

**INNOVATION IN CHINA:  
THE CONTRIBUTION OF SINO-WESTERN  
JOINT VENTURES**

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# Declaration

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# Abstract

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Thesis title: Innovation in China: the contribution of Sino-Western joint ventures

Since China embraced the “Open Door” policy in 1978, innovation has been an increasingly important factor for the Chinese economy. China is now the third largest country in the world league table of patent applications. China has also received large amounts of foreign direct investment, much of it from major Western innovative companies. In the earlier years of the Open Door policy, much of the involvement of Western companies was through joint ventures. International joint ventures are still important, and it is believed have substantially enhanced China’s innovative capability. It is the contention of this research that there is a direct correlation between the arrivals of Sino-Western JVs and China’s increased innovation capabilities. This is an important area of study as China moves towards becoming a developed economy. The gap in research at present is in applying innovation theory to China and to JVs.

The thesis explores the contribution of Sino-Western JVs to the development of China’s innovative capabilities. A model of the innovation process is developed, and eight important factors that are considered to enhance a company’s innovative capacity, are derived from the model. The factors, expressed as propositions, are:

- 1: Becoming part of a wide innovative network in its industry
- 2: Taking part in an open innovation system in its industry
- 3: Relating closely to universities, and particularly their research laboratories
- 4: Relating closely to research institutions
- 5: Developing a social atmosphere conducive to innovation
- 6: Developing a strong strategic planning system with innovation as a focus
- 7: Having innovation as a primary objective of both partners at the outset of the joint venture
- 8: Focusing on developing intellectual property

To investigate whether these propositions were accepted by Sino-Western joint ventures, 40 semi-structured interviews were conducted in ten international (Sino-western) joint ventures in China. In general the interviews provided support for the propositions. However, some reservations were expressed. Executives were reluctant to engage in open (collaborative) innovation, preferring to seek patents for developed intellectual property. They also perceived the main objective of the Western partners to be commercial success rather than innovation, although the Chinese partners were very much innovation-orientated. The research contributes to our understanding of the contribution of Sino-western JVs to the innovative capability of Chinese companies, and provides support for most of the propositions identified in the literature. Respondents remarked that most of the propositions would apply also to self-standing companies in China, and suggested that joint ventures could stimulate innovation in indigenous Chinese companies. In addition to providing a historical overview of the development of innovation in China, developing an

innovation process model and testing it in the Chinese context, the thesis makes important policy and practical recommendations to Chinese organizations.

Key words: **International joint venture (IJV), innovation, China, innovation process, national innovation system, innovation process model.**

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# Abbreviations

2G	Second Generation Wireless Phone Technology
3G	Third Generation Mobile Telecommunications
4G	Fourth Generation of Cellular Wireless Standards
5G ICOT	Fifth Generation-Institute for New Generation Computer Technology
863 Programs	China National High Tech Research and Development Program
AM	After Market
AMPS	Advanced Mobile Phone System
ATM	Automated Teller Machine
AUV	Asian Utility Vehicle
BCG	Boston Consulting Group
BERD	Ratio of Business Expenditure on R&D
BLT	Block-Transfer Instruction
BP	Baseband Processor
BRIC	Brazil, Russia, India and China
CAS	Chinese Academy of Science
CD	Compact Disc
CDMA	Code Division Multiple Access
CEO	Chief Executive Officer
CMMI	Capability Maturity Model Integration
CPU	Central Processing Unit
CTL	Computation Tree Logic
DB	Database
DMB	Digital Multimedia Broadcasting
DRAM	Dynamic Random Access Memory
DSLAM	Digital Subscriber Line Access Multiplier

EBIT	Electron Beam Ion Trap
ESPRIT	European Strategic Programme on Research in Information Technology
ETACS	European Total Access Communication Systems
FD	Floppy Disc
FDI	Foreign Direct Investment
FIAS	Investment Climate Advisory Service
FM	Frequency Modulation
FTI	Flanders Technology International
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D to GDP
GPRS	General Packet Radio Service
GRI	Government Research Institutes
GSM	Global System for Mobile communications
HK	Hong Kong
HKMT	Hong Kong, Macau and Taiwan
HRM	Human Resources Management
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
IBM	International Business Machines
ICT	Information Communication Technology
IDRC	International Development Research Centre
IJV	International Joint Venture
IMF	International Monetary Fund
IMT-2000	International Mobile Telecommunications 2000
Inc	The Innovation Strategy Consulting Company
INNOFUND	Innovation Fund for Small, Technology-based Firms
IP	Intellectual Property
IPRs	Intellectual Property Rights
IT	Information Technology
ITRI	Industrial Technology Research Institute
ITU	International Telecommunications Union

KRW	South Korean won
L&M enterprise	Large and Medium Enterprise
L&M tech Industry	Low and Medium Tech Industry
LCD	Liquid Crystal Display
Ltd.	Limited company, or private company limited by shares
M&A	Merger and Acquisitions
MB/S	Megabits per second
MITs	Mobile Intelligent Terminals
MNCs	Multinational Corporations
MOST	Ministry of Science and Technology
MOU	Minutes of Use
MSN	Microsoft Network
MU	Motorola University
NATE	South Korean Web Portal
NBSC	National Bureau of Statistics of China
NIS	National Innovation System
NMT	Nordic Mobile Telephone
NTE	New Technology Enterprise
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturing
OLED	Organic Light Emitting Diode
PDA	Personal Digital Assistant
PE	Equipment Procurement
PHS	Personal Handy-phone System
PIERS	Port Import Export Reporting Service
PII	Process Innovation Initiative
R&D	Research and Development
RBV	Resource- Based View
RJV	Research Joint Venture
RMB	People's Republic of China Renminbi
S&T	Science and Technology
SAE	International Society of Automobile Engineers
SDRAM	Synchronous Dynamic Random Access Memory

SME	Small and Medium Enterprise
SMP	Sample Machine Procurement
SMS	Short Messaging Service
SOEs	State Owned Enterprise
SSTC	State Science and Technology Council
STP	International Strategic Technology Partnering
SUV	Sports Utility Vehicle
TDMA	Time Division Multiple Access
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
TEU	Twenty-foot Equivalent Unit
TI	Technology Licensing
TPA	Thailand-Japan Technology-Promoting Association
TRIPS	Trade Related Aspects of IPRs
TU Media Corp.	“TV for you” Media Corporation
UMPC	Ultra-mobile Personal Computer
UMTS	Universal Mobile Telecommunications System
USC	University of Southern California
VCR	Videocassette Recorder
W-CDMA	Wideband Code Division Multiple Access
WCO	World Customs Organisation
WiMAX	Worldwide interoperability for Microwave Access
WIPO	World International Property Organisation
WTO	World Trade Organisation



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# Chapter 1: Introduction

## 1.1. Background

In recent years China has become a world economic power. China's GDP has increased about 30 times in the last three decades according to the International Monetary Fund, World Economic Outlook Database (2010). This astonishing growth has been attributed to the opening up of China's economy to the rest of the world through the enlightened policies of Deng Xiaoping and his Open Door policy (1978), and its consequent ability to become the world's greatest manufacturing centre as a result of its low wages, and the ability and hard-working nature of its population. China's reputation in the twentieth century at least for innovation and economic creativity has however been less clear, and the technological development of the country has been attributed in no small part to the role played by Sino-Western Joint ventures.

Developing nations working towards mature development tend to follow similar paths (the discussion in this and the following paragraphs is a synthesis of arguments provided by Bruland, Mowery and Potter). Firstly they are normally producers of raw materials and commodities. They buy their manufactures by exporting these raw materials and commodities to the developed nations. The next stage of development is to become low cost manufacturers on an original equipment manufacturer (OEM) basis for developed nation companies attracted by the low wages in the developing nation. This then leads to the imitation phase whereby the developing nation reverse engineers the outsourced manufacture and endeavours to market its version of the product. The result is a similar product, much cheaper and without the attractive

brand name. This brings the developing economy to the final stage of development, namely the development of its own globally recognised brand names. It can achieve good profit margins, allow rising wages to increase living standards in the economy and ultimately like Japan or Korea take its place at the table of developed nations.

Achieving a globally recognised brand name involves substantial marketing skills, but in addition it requires innovation in the economy of the developing nation, so that the new brand name product can be accepted as being different and better, and so worthy of its brand name e.g. the Lexus car.

Innovation<sup>1</sup>, therefore, is the critical factor in moving from a manufacturing/imitating economy to a branded one. The capacity to innovate therefore has to be developed. The best way to do these then may be by encouraging the setting up of joint ventures (JV)<sup>2</sup> with Western companies, thereby to learn the processes and techniques required to achieve innovation.

Since the establishment of the Open Door policy in the nineteen seventies China has done this, but little research has been carried to establish the role of JVs in lifting China to the first rank of innovating countries. The Chinese government has, however actively encouraged the setting up of Sino-Western JVs and hence the importation of modern technology, as is shown by the law of the People's Republic of china on Chinese-Foreign Joint Ventures (1979):

*“Adopted by the Second Session of the fifth National People's Congress on July 1, 1979, first amended according to the Resolution on revising the law of the People's Republic of china on Chinese-foreign joint ventures adopted by the third session of*

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<sup>1</sup> Innovation is discussed in detail in Chapter 3.

<sup>2</sup> For the purpose of this thesis, a joint venture is an entity established jointly by a Chinese and a Western partner to undertake a business activity.

*the seventh National People's Congress on April 4, 1990 and amended for the second time according to the resolution on revising the law of the people's republic of china on Chinese-foreign joint ventures adapted by the fourth session of the ninth National People's Congress on March 15, 2001."*

Article 1 provides a statement of the Chinese government's aim in encouraging Sino-Western JVs:

*"with a view to expanding international economic cooperation and technical exchange, the People's Republic of China permits foreign companies, enterprises, other economic organizations or individuals (hereafter referred to as 'foreign partner in a joint ventures') to join with Chinese companies, enterprises or other economic organizations (hereafter referred to as 'Chinese partner in a joint ventures') to establish joint ventures in the People's Republic of China in accordance with the principle of equality and mutual benefit and subject to approval by the Chinese government."*

Article 5 elaborates on this, stating:

*"Each party to a joint venture may make its investment in cash, in kind or in industrial property rights, etc. The technology and the equipment that serve as the investment of the foreign partner in a joint venture must be advanced technology and equipment that actually suit our country's needs"*

This makes it clear that the Chinese government saw encouragement of international JVs as a means for obtaining advanced technology in the form of equipment and knowledge. This thesis therefore focuses on attempting to understand what these JVs have been doing, and need to continue to do if their role as stimulants for Chinese innovation is to continue.

The international joint venture is common for China market entry for western companies, which can benefit both partners. The western partner can easily access China's local market and gain Chinese government support. The biggest benefit for the Chinese partner is that it has easy access to foreign technology. The impact of

foreign technology is largely embodied in new machinery and other process equipment. In the past, China has had poor support for knowledge based growth because of its poor technology infrastructure (Nelson 2004, David 2003), although things have improved more recently (Child and Yan, 2003). Sino-Western joint ventures have been extremely important in making good this weakness by creating transferable innovation on Chinese soil.

## **1.2. Recent economic history in China**

Over the past 16 years (1992-2008) the real GDP growth of China grew on average at around 10% a year, and its macroeconomic performance remains strong. China is the world's second largest economy and GDP was \$5,878,257 million US 2010, just behind United States which GDP is \$14,657,800 million, and overtaking Japan ranking 3<sup>rd</sup> with GDP of \$5,458,872 million; Germany ranking 4<sup>th</sup> with GDP of \$3,315,643 million; France ranking 5<sup>th</sup> with GDP of \$2,582,527; United Kingdom ranking 6<sup>th</sup> with GDP of \$2,247,455 (International Monetary Fund, World Economic Outlook Database, 2010). Economic growth leads of course to the increase of income per capita. However, China has one-fifth of the world's population and according to the International Monetary Fund, World Economic Outlook Database (2010), China ranked only 94th with GDP per capita of \$4,382 which is still low. United States ranked 9th with GDP per capita of \$47,284; Japan ranked 16<sup>th</sup> with \$42,820 United Kingdom ranked 22th with \$36,120. (International Monetary Fund, World Economic Outlook Database, 2010) The leading per capita nations are generally small and well developed like Luxembourg and Norway. China's large population holds back its per capita income growth and means that despite its overall GDP size there are still large pockets of poverty in the population.

Since 1978, innovation has been an increasingly important factor for the Chinese economy. China is now the third largest country in the world league table of patent applications. China has also received large amounts of foreign direct investment, much of it from major Western innovative companies.

Potter (1993) describes China's Open Door policy to attract foreign investment to Chinese market three decades ago. This Open Door policy was intended to bring China back into the world economic mainstream. Joint ventures became the first vehicles to stimulate foreign investment in China and move economic reform forward (Potter, 1993). He explains the need for foreign investment as a catalyst for economic reform in China:

*"In the late 1970's, China embarked on a new program of economic reform designed to bolster the domestic economy, in large part, by stimulating foreign investment and trade. This program, the so-called 'open door' policy, was an invitation for foreign investors to see China in a new light and as the new international business venue. One aspect of this open door policy is the program known as the Four Modernizations, which focuses on the areas of agriculture, industry, science and technology, and defence. The goal of the Four Modernizations movement was to transform China into an industrialized nation by the year 2000."*

In the earlier years much of the involvement of Western companies was through joint ventures. International joint ventures are still important, and have substantially enhanced China's innovative capability, although less so than in the last two decades. Probably for cultural difficulties of management methods and attitudes the Sino-western joint venture is in decline and FDI in the ascendant. The JV is however by no means dead or even dying.



### 1.3. Research question

As noted above, there is a gap in the literature on JVs and innovation, particularly with regard to China, yet there is the general but untested belief that such JVs substantially enhance China's capacity for innovation. This leads to the research question that motivates this thesis: **What is the contribution of Sino-Western JVs to the development of China's innovative capabilities?** To address this research question, it is necessary not only to consider the existing literature on innovation and JVs, but to examine actual practice in Sino-Western JVs. Hence, the research required by this thesis includes fieldwork as well as the examination of secondary material as embodied in particular in official statistics. In answering the research question, it is helpful to identify five sub-questions:

- What was the historical trajectory of innovation in China since the 1970s?
- What particular qualities should these JVs possess to achieve good innovation?
- What are the key factors for success in a JV that will lead to a good innovation record?
- Do the factors stated in the literature as enhancing a firm's innovativeness hold in the Chinese context?
- Are there differences across industries?

In order to address these questions, I develop an innovation model and empirically examine eight propositions (see Section 4.5).

## **1.4. Research design**

As will be described in detail in Chapter 5 the research has been conducted as follows:

### **1.4.1. The research approach**

The researcher has adopted a qualitative multi-case approach (Eisenhardt, 1989; Yin, 2004). The research philosophy underlying the choice is a positive or pragmatic one. This implies that the researcher believes herself to be operating in a world, in which she is not an influencing participant to any extent, so far as the study is concerned, but merely a recorder and an analyst. The researcher believes also that the facts and opinions given by the interviewees are likely to be both reliable and credible when confirmed by four interviewees from a case.

A qualitative methodology has been selected, since this approach is most appropriate to investigating the detailed views of research subjects, and given the lack of previous research on innovations in Sino-Western JVs. Qualitative multiple case design is particularly suitable to study questions asking 'why' and 'how' with respect to social, complex phenomena (Yin, 2004). Such a question is not she believes best approached by means of the fragmented pieces of data provided by SPSS analysed surveys involving regression and t tests, i.e. by quantitative methods of research. A multi-case analysis was chosen in the search for as much generalisability as can reasonably be hoped for from qualitative research (Eisenhardt, 1989; Yin, 2004). A total of 10 JV cases were studied. .

Based on a literature review, a model and propositions are developed that are then used as the basis of the case studies.

### **1.4.2. The interviews**

After conducting and analysing a pilot study, and conducting secondary research from published data, the researcher went back to China to carry out the major interviewing process. On the basis of a target of 4 interviews per case and ten cases the researcher managed to access sufficient numbers of executives willing to be interviewed covering a wide range of functions from marketing to finance or research and development, and either within the JV or within one or other parent company.

Most interviews were conducted in Mandarin Chinese since that was generally the first language of both the researcher and the interviewees. The interviews were semi-structured and focused on the Propositions outlined in chapter 4, thereby enabling topics to be discussed more widely than in a tightly structured interview thereby adding additional substance to the interviews. The interviews generally took about 1 ½ hours and were recorded. Anonymity of both interviewees and companies was agreed. Although the company names were available to the PhD examiners, they are not present in the final version of the thesis lodged in the Library at Royal Holloway, University of London.

When the researcher returned to UK the interview tapes were transcribed word for word, and content analysed in relation in particular to the Propositions. Further research of a secondary nature was conducted where necessary to fill in any gaps in the cases.

### **1.4.3. The scope of the study**

The research focused on JVs run in China owned generally 50:50 by a Chinese and a Western partner. A wide range of industries was covered and these industries were categorised as high tech, traditional manufacturing industries and service

industries. Such a categorisation enable a comparison to be made between the results for the three categories, although it was found that there were in fact only very minor differences between these results. It is felt therefore that the overall results of the research could best be stated for the 10 cases rather than by industry category. At all events the cases were not so much selected for any detailed characteristics so much as being available for interview as a result of the researcher's network or 'guan chi'. No attempt was made to select JVs by industry, or by geographical region of China. As a result the conclusions of the research are necessarily somewhat coarse-grained and general, but it is believed not less valuable for that. The researcher felt that to have gained access to JVs involving such well known companies within such a traditionally cautious, even secretive culture was quite an achievement in itself.

## **1.5. Structure of the thesis**

Figure 1.1 shows a diagram illustrating the structure of the thesis. Chapter 1 presents an overview of the study. Chapter 2 discusses technology development and Innovation in China: 1978-2010; Chapter 3 reviews the literature on international joint ventures, innovation, innovation process models. Chapter 4 develops the research model and propositions. Chapter 5 presents the research method and process of this research. Chapters 6, 7 and 8 describe 10 cases, including the high technology cases, traditional manufacturing industry cases and service industry case. Further set out the main findings of 10 cases in this thesis, particularly in terms of the statements of interviewees. Chapter 9 present cross case analysis to discuss the findings in more depth, using content analysis and statistical analysis. Chapter 10 discusses the findings against existing literatures. Chapter 11 summarizes the

conclusions of this study. There is an appendix in the end, which sets out the interview outline used in the field work underlying this research.

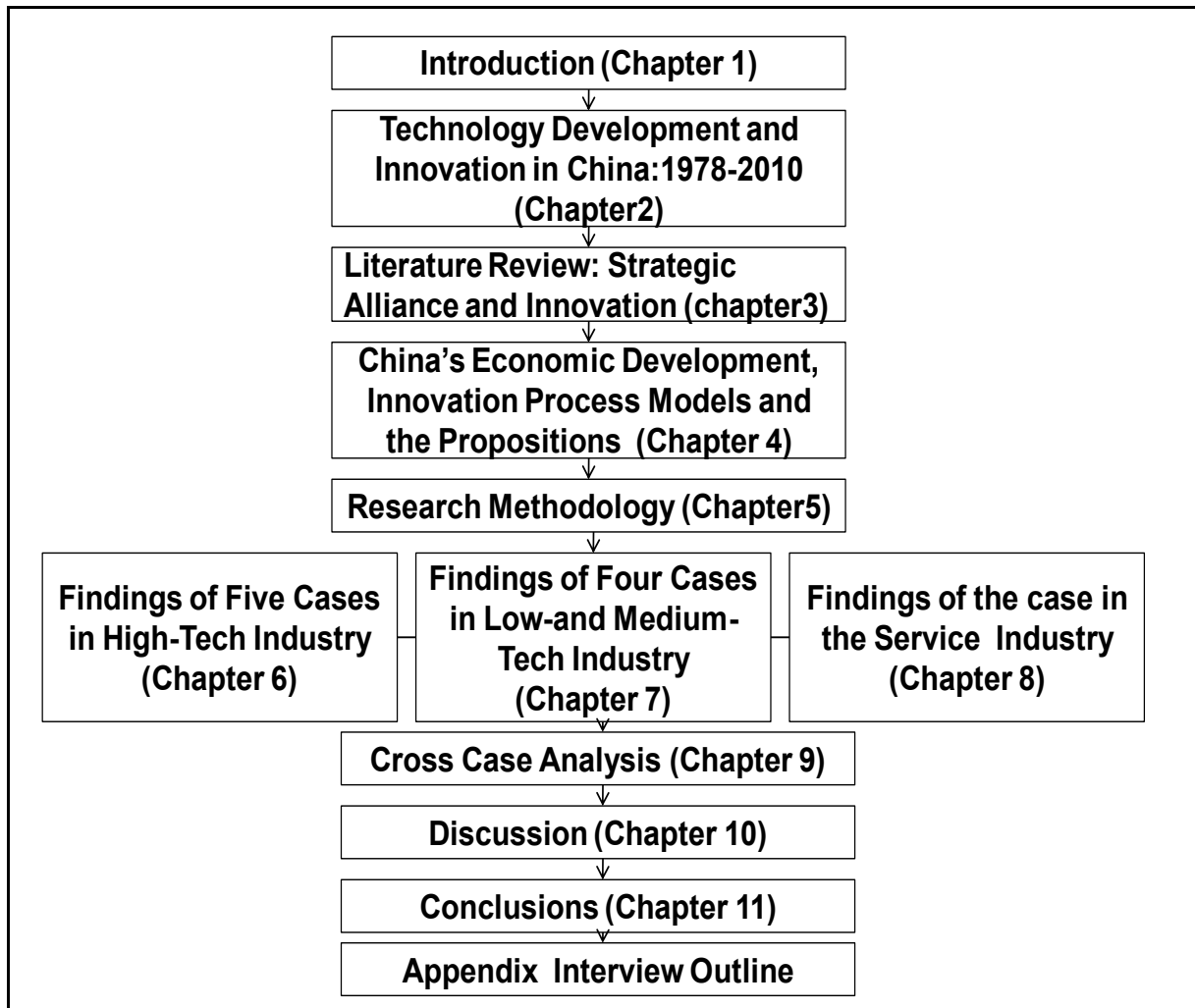


Figure 1.1 The Structure of thesis

# **Chapter 2: Technology development and Innovation in China: 1978-2010**

## **2.1. Introduction**

This chapter charts the emergence of China as a technology based economy and the development of innovation capabilities as a result of that growth of technology sophistication. China is nowadays often referred to as the workshop of the world, as was the UK in the nineteenth century. Most products whether they are local or from the West are in the 21st century manufactured in China (or India). However, if China is to become a fully developed economy it needs not only to manufacture products, but also to invent them, design them and ultimately label them with Chinese brand names that are acceptable as brands to the global economy. In these latter stages China still has some way to go. The development of Chinese brand names is a project for subsequent research and a later thesis no doubt. This one however concentrates on the major issue of Chinese innovation, it assesses how strong Chinese innovation capability is at present, and how it can be strengthened as a key characteristic of the Chinese economy, as currently is the case in say Japan or Korea. The thesis will focus on the role that the Sino-Western joint venture has played and can continue to play in Chinese innovation.

## **2.2. Background: 30 years of reform in China**

### **International factors impinging on China's reform process**

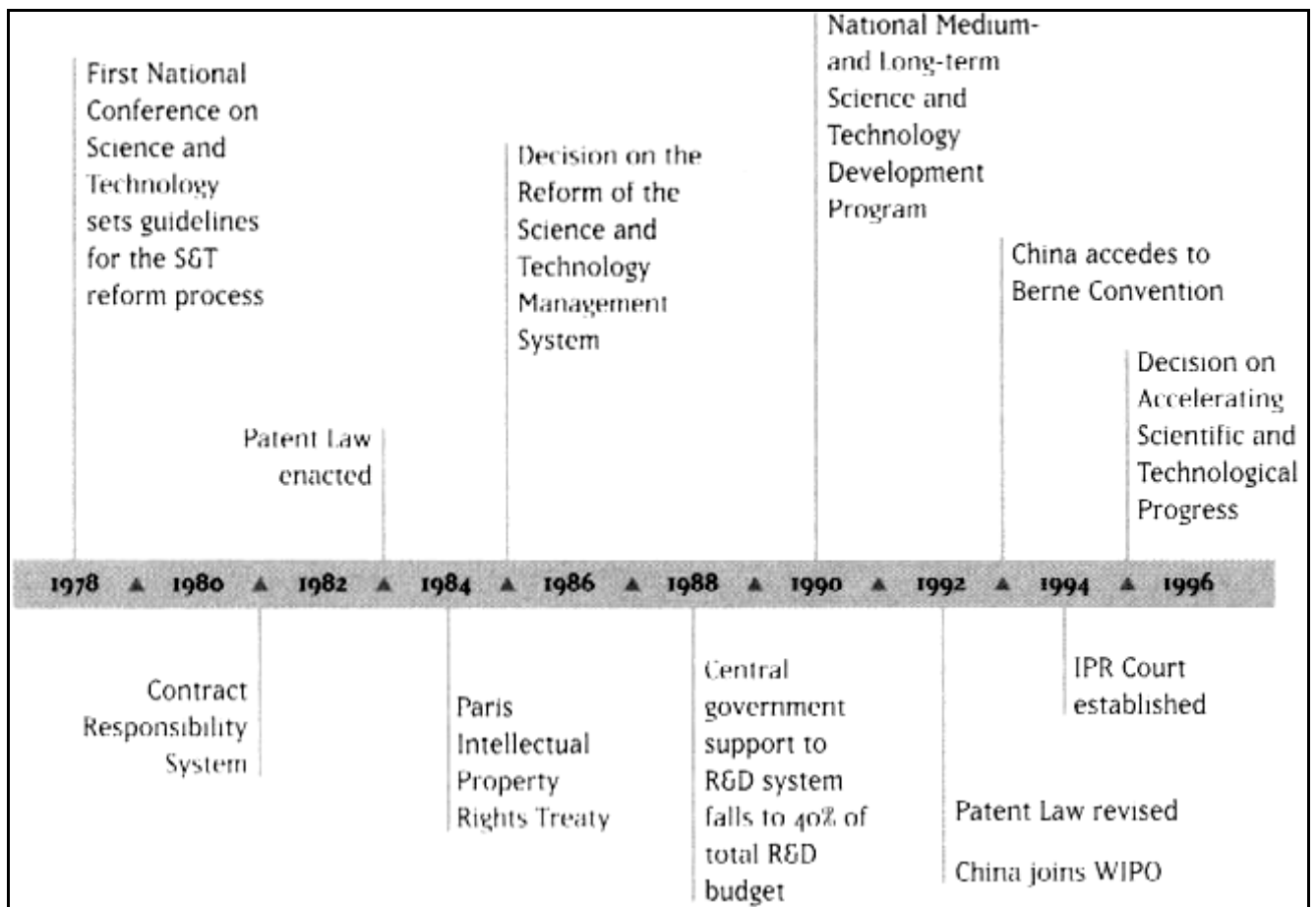
In the late 1970s China implemented the 'Open-door policy', a major purpose of which is to access foreign technology and foreign management methods. Other

purposes are promoting the Chinese economy, and improving living standards. Encouraging Chinese scientists to study and work abroad would bring foreign knowledge, technologies, organizational and management practices into China. China Ministry of Science and Technology (MOST,2009).

During China's 30-year reform programme, the world changed dramatically, in particular with increased globalization. International collaboration in science is increasingly the way in which science is practised. International collaboration means that the cost of research is shared. Technological collaboration within business cooperative arrangements has become global. The multinational corporations often do their research in their home country, their design in a second country, their development and production in a third, and their sales in a fourth.

### **Encouragement of science and technology**

Since 1978, China has encouraged experimentation in its science and technology (S&T). This was one of the important reforms decided by the State Council and the Central Committee of China. This decision also emphasised the reform of the Science and Technology Management system. In May 1995 it was decided to attempt to accelerate Scientific and Technological progress. The main decisions have established a sensible overall framework for S&T policy for a modernizing economy. Other reform initiatives during the reform period are shown in Figure 2.1 below.



Source: *Science & Technology Programmes: National High-tech R&D Program (863 Program)*, The Ministry of Science and Technology of the People's Republic of China (MOST), 2006

**Figure 2.1: Time line of significant policy events in the reform of China's science and technology system**

### Issues related to industrial technology

The introduction of a 'technology market' and of competitive sources for funding in China has turned the command economy of the past into a new technology market.

Under the command economy, research and development (R&D) institutions were important vehicles for technology innovation, and were funded by the Government. According to China Ministry of Science and Technology (MOST, 2009), more recently, the Government has been encouraging the development of a technology market by:



- Reducing the institutions' core-budget appropriation from government (in some provinces, the reduction is to zero);
- Allocating government-contract funds by competition to help technological development;
- Providing incentives for enterprises to invest in R&D at an increased rate.

These reforms have influenced many R&D institutions to transform themselves into enterprises to commercialize their own technologies. This also encourages the most successful provincial institutes to win support from some of the programmes offered by the State Science and Technology Commission (SSTC), for example, the 863 Program or the National Program for Tackling Key Technology Problems. National funds select research institutions by assessing the technical merit of proposals during processes of competition (China Ministry of Science and Technology, 2009).

### **Emergence of spin-off enterprises**

The common response of R&D institutions to the new market has been to create spin-off enterprises. These spin-offs attempt to commercialize technologies that the institutions have developed. Many such enterprises have been created. The Chinese Academy of Sciences (CAS) announced that the Academy and its 123 institutes had already created 900 spin-offs by the 1990s. This is a very successful rate of creation compared with other industrialized countries (China Ministry of Science and Technology, 2009).

### **Imported Technology**

According to China Ministry of Science and Technology (2009), China has imported substantial amounts of foreign technology during the last 30 years, particularly

through programmes of technological revitalization of enterprises. There are vigorous programmes in place to integrate those technologies into the production systems of enterprises. Companies spend as much as three times the purchase price of foreign technology on programmes to master, adapt, and develop their improved product systems built on the new technology (China Ministry of Science and Technology, 2009).

Facing increasing international competition and globalization, China has experienced two significant decades of economic development; increasing numbers of Chinese companies are becoming international. Nevertheless, the traditional technology innovation strategy characterized by imitation and secondary innovation has some strategic limitations, as innovation is regarded as proprietary and hence not shared through 'open innovation' systems (China Ministry of Science and Technology, 2009).

### **Globalization of R&D and China**

In recent years, the number of R&D centres of multinational enterprises in large cities, such as Beijing and Shanghai, has increased rapidly. The main purposes of these establishments are twofold: to take advantage of abundant and relatively cheap R&D human resources in China and to locate R&D units near to the manufacturing units of the multinational enterprises in the Chinese market. According to von Zedtwitz (2011), China-based R&D is increasingly value-adding rather than cost-oriented. By 2009, more than 1200 foreign R&D centres had been established in China, compared with 199 foreign R&D facilities in China at the beginning of 2004.

According to China Ministry of Science and Technology (2009), the globalization of innovation in China can also be observed from the co-operation between foreign enterprises and Chinese universities and research institutes. This new type of co-operation is in an initial and immature stage, and it is still very difficult for foreign enterprises to find original ideas and sufficiently innovative projects through this kind of co-operation. Currently, foreign enterprises do not buy ready-made projects or research, rather they utilize the existing R&D research capacity and facilities (which were often purchased with the support of governmental funding and are of very high standard) to carry out research projects, which are defined by the foreign enterprises themselves and modified during the working process to adapt to the local conditions (China Ministry of Science and Technology, 2009).

Nevertheless, according to China Ministry of Science and Technology (2009), the mutual benefits generated through such co-operative efforts should not be underestimated. These efforts will not only provide local universities and research institutes with additional funding and more advanced equipment, but, more importantly, they will also generate positive demonstration- and spill-over effects to the universities and allow them to get more informed about the international research frontier. Finally, co-operation can be an efficient way for foreign firms to identify research units and personnel with high research capacity (China Ministry of Science and Technology, 2009).

In recent years, according to China Ministry of Science and Technology (2009), a few Chinese enterprises, in particular in the electronics and ICT sectors, have initiated international R&D activities, either by acquisition of foreign enterprise/units or through setting up R&D organisations in OECD countries. High profile Merger

and Acquisition (M&A) deals involving Chinese enterprises in the high-tech sectors have attracted huge attention worldwide. In these M&A deals, the access to R&D centres of western sellers is one of the key elements. For example, the TCL and Thomson deal in November 2003 included Thomson's R&D centres in Germany, Singapore and the U.S. Similarly, in the Lenovo-IBM deal in 2005, Lenovo took over IBM's R&D centres in Japan and the U.S (China Ministry of Science and Technology, 2009).

In addition to the acquisition of R&D centres, some Chinese firms have made green-field investments in the form of R&D units in foreign countries. China has a total of 37 R&D operations abroad, which are concentrated in the ICT sectors and 24 of them are in developed OECD countries (FIAS, 2005).

A recent report from Boston Consulting Group (BCG, 2006) shows that the top 100 emerging global companies from developing economies include 44 Chinese firms, 18 of which are in the ICT sector. Even though the number of such Chinese firms is low and the scale of their international R&D activities is still small, a new generation of Chinese firms seems to be emerging as important players in S&T-intensive (instead of labour-intensive) segments of the global market. The innovation capacities of these Chinese firms and their ability to tap into the global network have therefore generated large interest, from both research- and policy-making perspectives.

The present research has looked for evidence of improvements in the innovative capabilities of Chinese firms; these improvements are the result of transfers of technology, assets, management systems and know-how in local alliances and partnerships. Joint venture companies collaborate with the western parent company,

the Chinese parent companies, suppliers, customers, or other companies in the industry to create different kinds of innovation outputs.

### **From a research institute-dominated to an enterprise-centred system**

According to China Ministry of Science and Technology (2009), since the beginning of the economic reforms, the Chinese innovation system has undergone significant changes, in terms of the relative importance of key actors and the mechanisms that drive the development of the innovation system.

Table 2.1, shows that the share of R&D expenditure by research institutes in the total R&D expenditure nationwide has gradually decreased from 50 % in 1990 to 21% in 2005, while the corresponding share for enterprises has increased from 27% to 68% in the same period. In this section of the thesis, from a historical perspective, a brief description of the transformation process is provided.

### **A plan-based innovation system**

In the socialist planned regime, the innovation system of China was dominated by a linear model of innovation with a clear-cut division of labour. The government functioned as the key coordinator in the system and the government research institutes played a dominant role in performing innovation activities (China Ministry of Science and Technology, 2009).

From the 1950s to the 1980s, Government Research Institutes (GRIs) were established at different administrative levels with various goals and orientations. The most important of them were at the national level, such as the Chinese Academy of Science (CAS). Most basic/scientific research was done by the CAS and some large research universities such as Beijing University and Tsinghua University (China Ministry of Science and Technology, 2009). There were also hundreds of industrial

research institutes under a wide range of industrial ministries, focusing on applied research and developmental tasks. Regional GRIs conducted R&D tasks, which were defined as relevant for regional development.

In addition, according to China Ministry of Science and Technology, 2009), the higher education sector played a complementary role for the GRIs. Most universities at that time were not involved in research, except those large research universities mentioned above. Many specialized universities focused on industry-specific technology and education (China Ministry of Science and Technology, 2009) For example, there were universities specializing in light industries, metallurgy and printing, etc

In general, according to China Ministry of Science and Technology (2009), the role played by industrial enterprises in the innovation system was limited and they functioned as manufacturing and/or sales units. Most of them did not do any R&D, while only some large SOEs (State Owned Enterprises) had their own R&D laboratories and their work focused mainly on experimental issues. Hence, the innovation system was constructed and driven largely according to a linear and hierarchical model (China Ministry of Science and Technology, 2009).

Following this clear-cut division of labour in knowledge creation and product manufacturing, a key question was how to introduce the new technologies and products into the market? This was decided to be the task of the government. The main policy tools of the government were the annual and the five-year Economic and Science & Technology (S&T) plans. Even at the government level, there was a sophisticated division of labour in policy making. For example, the State Planning Committee (the current State Development and Reform Commission) was the

central body for allocating production targets for enterprises. It was also responsible for introducing new technologies to the economic system. The Ministry of Science and Technology (MOST) was in charge of the annual and the five-year plans in the field of science and technology.

For a long time, S&T was considered to be of strategic importance to overcome shortages of supply of goods and services as well as to strengthen China's military position. High priority was given to a few large national projects, which involved thousands of scientists and engineers from a large number of government research institutes, universities, enterprises and hospitals across the country with a well planned division of labour (China Ministry of Science and Technology, 2009). The successes of artificial insulin and other major discoveries were results of this planning regime and they reinforced the impression that great success in S&T could be achieved, albeit with huge costs (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), despite the success in a few prioritized fields, the innovation system as a whole was less efficient. The enterprises were output-oriented, with little if any incentive to improve efficiency and enhance profitability and no attention was paid to intellectual property rights (IPR). The research institutes and universities were funded by the government and produced project reports with limited industrial uses (China Ministry of Science and Technology, 2009).

From the 1950s through the 1960s to the 1970s, China imported foreign technologies on a large scale from the former Soviet Union, Germany and Japan. Those technologies laid the foundation for the Chinese chemical, automobile, steel,

textile and many other industries (China Ministry of Science and Technology, 2009). For many industrial GRIs, from 1949 to the early 1980s, their main tasks were to assimilate those imported technologies. In order to replace the imported technology and to save foreign currency, incremental innovations based on imported technology were also implemented (China Ministry of Science and Technology, 2009). According to China Ministry of Science and Technology (2009), many new industrial sectors were established in China in the 1970s around the same time when South Korea initiated its new growth path to target automobile, ICT- and steel industry. However, the Chinese enterprises in these sectors have been lagging behind Korean enterprises for many years because of both the high degree of foreign technology dependency and the low level of absorptive capacity (China Ministry of Science and Technology, 2009). Many Chinese enterprises have got stuck in the pattern of “Import, lag behind, import again, lag behind again”.

### **The transition to an enterprise- centred system**

According to China Ministry of Science and Technology (2009), in the previous plan-based innovation system, there was little space for curiosity-driven research. The share for basic research had been low and remained at a level around 5% of the total R&D expenditure during the period 1995-2005 (China Statistical Yearbook on Science and Technology, 2006). After the economic reform was initiated in 1978, the S&T system of China soon became exposed to market competition. The objectives of the reform were twofold: to introduce a competition-based funding system and to establish new governance system of S&T institutions in order to more efficiently commercialize R&D results (China Ministry of Science and Technology, 2009).



One of the key initial changes was to reform the funding system and make the governance of the S&T institutions more flexible. It meant that the government reduced the direct funding for GRIs, the intention being that the funding of GRIs should be increasingly diversified and come from other sources than the government (China Ministry of Science and Technology, 2009). While this change aimed to enhance incentives for innovation and to accelerate commercialization, it also imposed increased pressure on scientists and led to short-term research projects for pursuing more immediate economic returns (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), in order to speed up the process from research to commercial products, the government also encouraged GRIs and universities to set up their own spin-offs and encouraged scientists to leave their research positions and engage in commercial activities.

Furthermore, according to China Ministry of Science and Technology (2009), a new institution called the technical market was introduced. This new specialized market was supposed to facilitate technology transactions between suppliers and users of technology. Moreover, special economic zones were established across China to support the development of high-tech enterprises (China Ministry of Science and Technology, 2009).

In the 1990s, after more than ten years of reform, there was still a great gap between the research activities of GRIs and the needs of industrial sectors. In the meanwhile, the government system underwent a significant change as most of the industry-specific ministries were abolished. The new structural challenge was how to deal with the industrial GRIs, which were previously affiliated to those ministries.

According to China Ministry of Science and Technology (2009), toward the end of 1998, the State Council decided to transform 242 GRIs at the national level into technology-based enterprises or technology service agencies. This important structural change implied that the dominance of GRIs in the Chinese innovation system was changed and instead, the industrial enterprises were on the way to become the core of the innovation system. Since 2000, the enterprises have undertaken more than 60% of total R&D in China (see **Table 2-1**) (China Ministry of Science and Technology, 2009). However, GRIs and universities are still the key players in frontier science and technological research. They still attract a larger number of talented scientists than enterprises do.

### **The enterprise system**

For a long time, enterprises have typically operated as manufacturing units with few if any R&D activities or formal R&D centres. Their production capability was maintained and upgraded mainly through technology imports, and enterprises spent more money on technology imports than on their own R&D during the period before 1998 (China Ministry of Science and Technology, 2009). According to China Ministry of Science and Technology (2009), since the 1980s, SOEs were given more autonomy to invest and innovate based on their own strategic decisions. Also, enterprises with different ownerships, such as private and foreign enterprises, have also to a larger extent engaged in innovation activities.

This wave of privatization and competition gave enterprises stronger incentives to invest in product development and innovation on top of exploiting cost advantages or diversification. **Table 2-6** and **Table 2-7** show that large and medium-sized

enterprises gradually increased their R&D inputs and R&D intensity. Nevertheless the R&D intensity is still quite low, comparing to that of developed countries.

In terms of output, the innovation capability of Chinese enterprises is still relatively low. Their innovation capability is mostly focused on incremental innovation with little radical innovation. This is why Chinese enterprises have relatively high patenting activity in utility model and design, which account for the largest increase in the total number of patents, but are low in invention patents (See Table 2-8). Furthermore, the patenting activities differ significantly between domestic and foreign firms and the difference is discussed in more detail in a later section (World Intellectual property Organisation, 2010)

Comparing international patents, such as invention patents granted in the U.S., the wide gap between Chinese enterprises and those of Korea and Japan becomes evident. In 2004, Korea's patents in the U.S. were about 11 times those of China, although more recently China is catching up (World Intellectual property Organisation, 2010).

The growth of small firms is a relatively new phenomenon. The market was opened for non-state owned small firms only after the 1980s. Most of them started their business by taking market opportunities and in general, their innovation capability is still low. But compared to large- and medium sized enterprises, as shown in Table 2.10, small S&T-based enterprises, which are defined as firms with S&T and/or R&D activities, have higher R&D intensities, but are less internationally oriented in terms of export of new products and import of foreign technology. Furthermore, there are also substantial differences of ownership between small enterprises and large- and

medium sized enterprises in their inputs and outputs of innovation activities (Lundin et al, 2006).

In 2005 China recorded over \$72 billion of FDI inflows (compared to less than \$3 billion for Japan which always attracted low amounts of direct investment). China's total stock of FDI is more than three-times that for Japan. The scale, scope and speed of growth in China show that Chinese firms are 'learning' faster than 'latecomer firms' in emerging markets. Foreign multinational firms promote Chinese firms to be 'imitation' and 'learning' enterprises in China's growing economy.

### **2.3. Scientific and technological activities in China**

China has considerable scientific research achievements; the high-tech industry has been developed and international competitiveness has been raised. China aims to become an innovative country. China focuses on accelerating economic development and transformation and nurturing industries of strategic importance.

The focus of this thesis is innovation. However 'innovation' is an extremely difficult concept to define. It is one of those things where you can say you know it when you see it, and it can of course vary in its essence from being a new product to being a novel way of doing things. There are however various surrogates for innovation all of which lead to the view that innovation is taking place but none of which is positive proof of the fact by itself.

Smith (2006) describes some of these surrogates for innovation below:

- Expenditure on Research and Development, but there is a very variable direct link between the amount spent and innovation – some expenditure may be a waste, and some may be less effective than others.

- The number of people working on innovation, but this may be misleading in organisations where innovation is not seen as a separate activity but part of core activities of all workers, or in organisations that are creative in part but where people tend to work in what in *The Economist* has called 'skunk works'. (*The Economist*, 2008).
- The number of patents applied for or granted. Although patent applications cannot measure the 'significance' of innovation – some new products or processes may require several patents while others may require only one patent – also, granting of a patent does not mean that it is exploited or developed, and in China many patent applications are made by individuals who are not part of a company. Such innovation is not the focus of this thesis, particularly as patent applications from individuals may not be exploited due to lack of funds..
- The number of awards for innovation, but these cannot generally really reflect significance. Only time will tell in this regard.
- Relative measures such as percentage of costs, or revenues represented by R&D or proportion of workforce involved in innovation.
- A useful measure may also be the number of new products produced by a company in the last five years, also measurable as a percentage of products sold.

Innovation can, therefore, be measured in various ways, although no single measure captures all aspects of innovation, and every measure has shortcomings. Among other measures that could be derived from the information published by the China Statistical Bureau are:

- Expenditure on (or funding of) Scientific and technical activities
- Expenditure on research and development
- Number of people working on innovation
- Number of patents applied for or granted
- Number of new products introduced
- Number of awards for innovation
- Number of scientific papers published

So whilst it will certainly not be possible to measure the level of innovation in the Chinese economy in any absolute sense, the combination of the above factors and their comparison with similar measures in other economies will give a pretty good picture of how well the Chinese are doing in developing their innovation capacity. In fact in the absence of many of the measures, the figures for patents applied for and granted, which are readily available in international publications, give us a pretty good start.

Where data are available, these measures of innovation can be assessed according to different types of organization, such as research institutions, higher education, and industrial enterprises. Within the last category, some data are available that allow for analysis according to type of enterprise, and this makes it possible to identify the significance of foreign joint ventures for innovation in China.

The most important source of data for this research is provided by the National Bureau of Statistics of China (NBSC). This is an agency directly under the control of

the Chinese State Council, and has primary responsibility for the collection and analysis of statistics and for national economic accounting. The latest data that could be obtained from the NBSC when data was being collected in 2010 was the data relating to 2008 and previous years. So the following data analysis is based mainly on the data covering the period between 2004 and 2008.

Funding for scientific and technical (S&T) activities (defined as “organized activities which are closely related with the creation, development, dissemination and application of the scientific and technical knowledge in the fields of natural sciences, agricultural science, medical science, engineering and technological science, humanities and social sciences”-NBSC) has risen from 432.8 billion RMB in 2004 to 912.4 billion RMB in 2008, an increase of 110%.

Table 2.1 below shows the main sources of funding. Government funding represents around 20% of the total in both years, though its importance is less in 2008 than in 2004. On the other hand, self-raised funds by enterprises represent nearly 70% of the total in 2008, against 64% in 2004.

**Table 2.1: Main sources of funding for scientific and technical activities (2004-2008)**

Sources	2004		2008		Growth% (2004-2008)
	billion RMB	%	billion RMB	%	
Government Funds	98.6	22.8	190.2	20.8	93.0
Self-raised Funds by Enterprises	277.1	64.0	637.1	69.8	129.9
Loans from Finance institutions	26.5	6.1	40.5	4.4	52.9
Other	30.7	7.1	44.6	4.9	45.5
Total Funding for S&T	432.8	100.0	912.4	100.0	110.8

Source: National Bureau of statistics of China 2010

**Table2.2: Expenditure on R&D from funding of scientific and technical activities (2004-2008)**

	2004		2008		Growth% (2004-2008)
	billion RMB	%	billion RMB	%	
Expenditure on R&D from Funding for S&T	196.6	45.4	461.6	50.6	134.8
Total Funding for S&T	432.8	100.0	912.4	100.0	110.8

Source: National Bureau of statistics of China 2010

Research and development (R&D) expenditure represents about half of total S&T activities. This has increased from 196.6 billion in 2004 to 461.6 billion RMB in 2008, a growth of about 135%. Table show that R&D expenditure represented about 0.6% of China's Gross Domestic Product in 1996, R&D expenditure represented about 1.5% of China's Gross Domestic Product In 2008. The total growth during 1996 to 2008 is 156.7%.

**Table2.3 Proportion of expenditure on R&D to GDP (1996-2008)**

	1996	2000	2004	2008	Total growth% (1996-2008)
Proportion of Expenditure on R&D to GDP (%)	0.60	1.00	1.23	1.54	156.7%

Source: National Bureau of statistics of China 2010

In 2004, about 3.5 million people were classified as *Personnel Engaged in S&T Activities* (defined as “personnel directly engaged in S&T activities, in the management of S&T activities, and in providing direct service to S&T activities”-NBSC), of whom about 2.2 million were classified as *scientists and engineers*. By 2008, the number of personnel engaged in S&T activities had risen to nearly 5 million, of whom about 3.4 million were classified as *scientists and engineers*.



## 2.3.1. Research and development classified by type of organizations

### (1) R&D expenditure

As noted above, total R&D expenditure in China increased from just less than 200 billion RMB in 2004 to 461.6 billion RMB in 2008. The table below shows the R&D expenditure made by different types of organization.

**Table 2.4 R&D expenditure by type of organization (2004-2008)**

Organization	2004		2008		Total growth% (2004-2008)
	billion RMB	%	billion RMB	%	
Research institutions	43.2	22.0	81.1	17.6	87.7
High Education	20.1	10.2	39.0	8.4	94.0
Industrial Enterprises: Large and Medium	95.4	48.5	268.1	58.1	181.0
Industrial Enterprises: Small	15.1	7.7	39.2	8.5	159.6
Other	22.8	11.6	34.2	7.4	50.0
Total Expenditure on R&D	196.6	100.0	461.6	100.0	134.8

Source: National Bureau of statistics of China 2010

The major development between 2004 and 2008 is that large and medium industrial enterprises represent a significantly greater proportion of total R&D expenditure in 2008 in comparison with 2004. Research institutions and higher education are less important in relative terms, even though total expenditure for all sectors has risen substantially.

### (2) Number of people working on innovation classified by type of organization

*“Full-time Equivalent of R&D Personnel refers to the sum of the full-time persons and the full-time equivalent of part-time persons converted by workload.” (National Bureau of statistics of China 2010)*

**Table 2.5** shows that there are slightly less than 40% of total full-time equivalent of R&D personnel in large and medium enterprises in 2004; and slightly less than 20% of total full-time equivalent of R&D personnel in research institution; and slightly less

than 20% of total in high education. There are 35% of total scientists and engineers in large and medium enterprises in 2004, and more than 20% of total scientists and engineers in higher education, slightly less than 20% of total in research institutions. The above figures describe that large and medium enterprises have the most full-time equivalent of R&D personnel in 2004; research institutions and high education have similar R&D personnel number in 2004.

**Table 2.5: R&D personnel (full-time equivalent) by types of organisation (2004)**

Organization	Full-time Equivalent of R&D Personnel (thousands)	%	Scientists and Engineers (thousands)	%
Research Institutions	203	17.6	158	17.1
Higher Education	212	18.4	206	22.2
Industrial Enterprises: Large and Medium	438	38.0	327	35.3
Industrial Enterprises: Small	104	9.0	74	8.0
Other	196	17.0	161	17.4
Total	1,153	100.0	926	100.0

*Source: National Bureau of statistics of China 2010*

**Table 2-5** shows that among total R&D personnel in 2008, more than 50% in large and medium enterprises; about 13% in research institutions and 13% in high education. Among total scientists and engineers in 2008, nearly 50% in large and medium enterprises; slight more than 15% in high education and about 12% in research institutions. Large and medium enterprises have half of total R&D personnel in 2008; research institutions and high education have the nearly same portion in total R&D personnel. The total growth of R&D personnel of large and medium enterprises between 2004 and 2008 is about 130%.

**Table 2.6 R&D personnel (full-time equivalent) by types of organisation (2008)**

Organization	Full-time equivalent of R&D Personnel (thousand)	%	Total Growth% (2004-2008)	Scientists and Engineers (thousand)	%	Total Growth % (2004-2008)
Research Institutions	260	13.2	28.1	204	12.8	29.1
Higher Education	266	13.5	25.5	261	16.4	26.7
Industrial Enterprises: Large and Medium	1,014	51.7	131.5	790	49.6	141.6
Industrial Enterprises: Small	216	11.0	107.7	160	10.1	116.2
Other	209	10.6	6.6	177	11.1	9.9
Total	1,965	100.0	70.4	1,592	100.0	71.9

Source: National Bureau of statistics of China 2010

### (3) Patent Applications classified by type of organization

**Table 2.7 Patent Applications by types of organization (2005-2008)**

Organization	Patent Applications (Pieces)	
	2005	2008
Research institutions	9,746	18,612
Higher Education	19,921	45,145
Industrial Enterprises: Large and Medium	55,271	122,076

Source: National Bureau of statistics of China 2010 (Note: 2004 data not available at a sufficient level of detail to enable accurate comparison)

### (4) Number of scientific papers issued classified by type of Organizations

**Table 2.8** shows that in 2004, there are more than 100,000 pieces of scientific paper of research institutions, and more than 660,000 pieces of scientific paper of high educations. The number of scientific paper of high education was the six times of that of research institution. In 2008, there are more than 130, 000 pieces of scientific paper of research institutions, and more than 960,000 pieces of scientific paper of high education. The number of scientific paper of high education was the 7.3 times of that of research institution.

**Table 2.8: Scientific papers issued classified by type of organizations (2004-2008)**

Organization	2004	2008	Total Growth% (2004-2008)
	Pieces	pieces	
Research institutions	104,699	132,072	26.1
High Education	668,520	964,877	44.3

Source: *National Bureau of statistics of China 2010*

## **2.3.2. Research and development of large and medium enterprises**

### **(1) New products of large and medium-sized industrial enterprises by registration status**

The National Bureau of Statistics of China defines New Products as:

*“Brand new products produced with new technology and new design, or products that represent noticeable improvement in terms of structure, material, or production process for improving significantly the character or function of the older versions. They include new products certified by relevant government agencies within the period of certification, as well as new products designed and produced by enterprises within a year without certification by government agencies. This indicator reflects the direct contribution of S&T output to economic growth.”*

And the large and medium enterprises are divided into eight kinds of enterprises relating to new products development:

*Category 1:* Foreign Joint Venture Enterprises;

*Category 2:* Foreign Enterprises with Sole Fund;

*Category 3:* Foreign Share-holding Corporations Ltd;

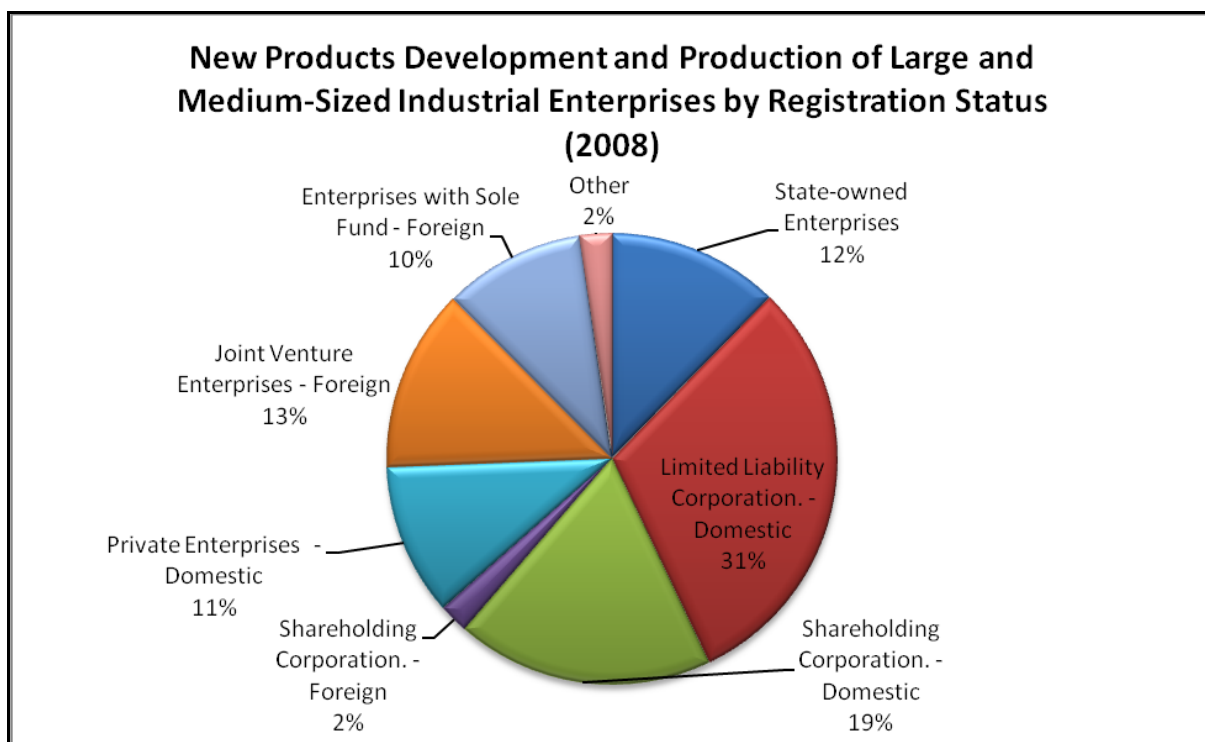
*Category 4:* State-owned Enterprises,

*Category 5:* Domestic Limited Liability Corporations;

*Category 6:* Domestic Share-holding Corporations Ltd;

*Category 7:* Domestic Private Enterprises;

*Category 8:* Other Enterprises



Source: China Statistical Yearbook 2009

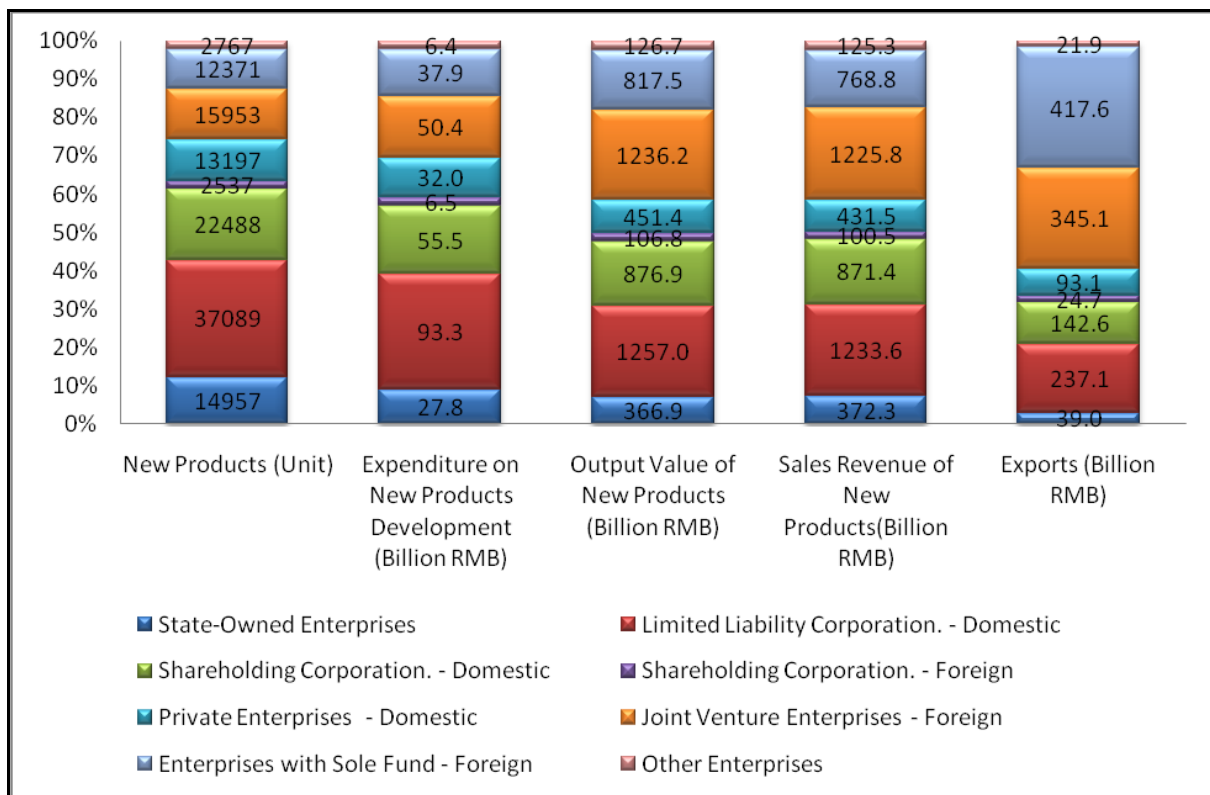
**Figure 2.2: New products of large- and medium-sized industrial enterprises by registration status (2008)**

Figure 2.2 shows that there foreign joint venture enterprises have the third largest percentage of total new product in 2008, which is 13%. Domestic liability Corporation and domestic shareholding corporation separately have 31% and 19% of total new product.

**(2) New products development and production of large and medium-sized industrial enterprises by registration status**

In 2008, Domestic Limited Liability Corporation has largest new products, nearly 38,000 units; foreign joint venture enterprise has the third largest new products, nearly 16,000 units, which is about half of that of Domestic Limited Liability Corporation. Expenditure on new products development of Domestic Limited Liability Corporation is more than 90 billion RMB; expenditure on new products development

of foreign joint venture enterprise is about 50 billion RMB, which is more than half of that of Domestic Limited Liability Corporation.



Source: China Statistical Yearbook 2009

**Figure 2.3: New products development and production of large- and medium-sized industrial enterprises by registration status (2008)**

However, the output value of new products of foreign joint venture enterprises is second largest, which is about 1236.2 billion RMB, similar with that of Domestic Limited Liability Corporation, which is 1257 billion RMB. Sales revenue of new products of foreign joint venture is second largest, which is about 1225 billion RMB and slightly less than that of Domestic Limited Liability Corporation. The largest export is foreign enterprises with sole fund, which is about 400 billion RMB, the second largest export is foreign joint venture enterprises, which is slightly less than 50 billion RMB; Domestic Limited Liability Corporation is the third largest export, which is about 230 billion RMB.

## 2.4. China patent applications

### 2.4.1. Comparison of world patent filings

According to the Organisation for Economic Co-operation and Development (OECD, *Compendium of Patent Statistics*, 2008, p. 8), “alongside other science and technology (S&T) indicators such as research and development (R&D) expenditures and personnel, innovation surveys, etc., patents provide a uniquely detailed source of information on inventive activity. Patent statistics are frequently viewed as an indicator of R&D output. . . . The more a country spends on R&D, the higher the propensity to patent.”

However, there also are problems with using Patents as an indicator of Innovation.

*It is widely accepted that patent statistics are a reliable (although not perfect) indicator of innovative activity. Therefore, it has become standard practice to use patent statistics for monitoring innovative activities and the development of new technologies. However, when using patent statistics as an indicator of inventive activity, the following points should be taken into consideration:*

- *Not all inventions are patented. There are other alternatives such as trade secrecy or technical know-how available to inventors for protecting their inventions.*
- *Use of the patent system for protecting inventions varies across countries and industries. Applicants' different filing strategies or filing preferences may render direct comparison of patent statistics difficult.*
- *Differences in patent systems may influence the applicant's patent filing decisions in different countries.*
- *Due to the increase in the internationalization of research and development (R&D) activity, R&D may be conducted in one location but the protection for the invention might be sought in a different one.*
- *Cross-border patent filings depend on various factors, such as trade flows, foreign direct investment, market size of a country, etc.*

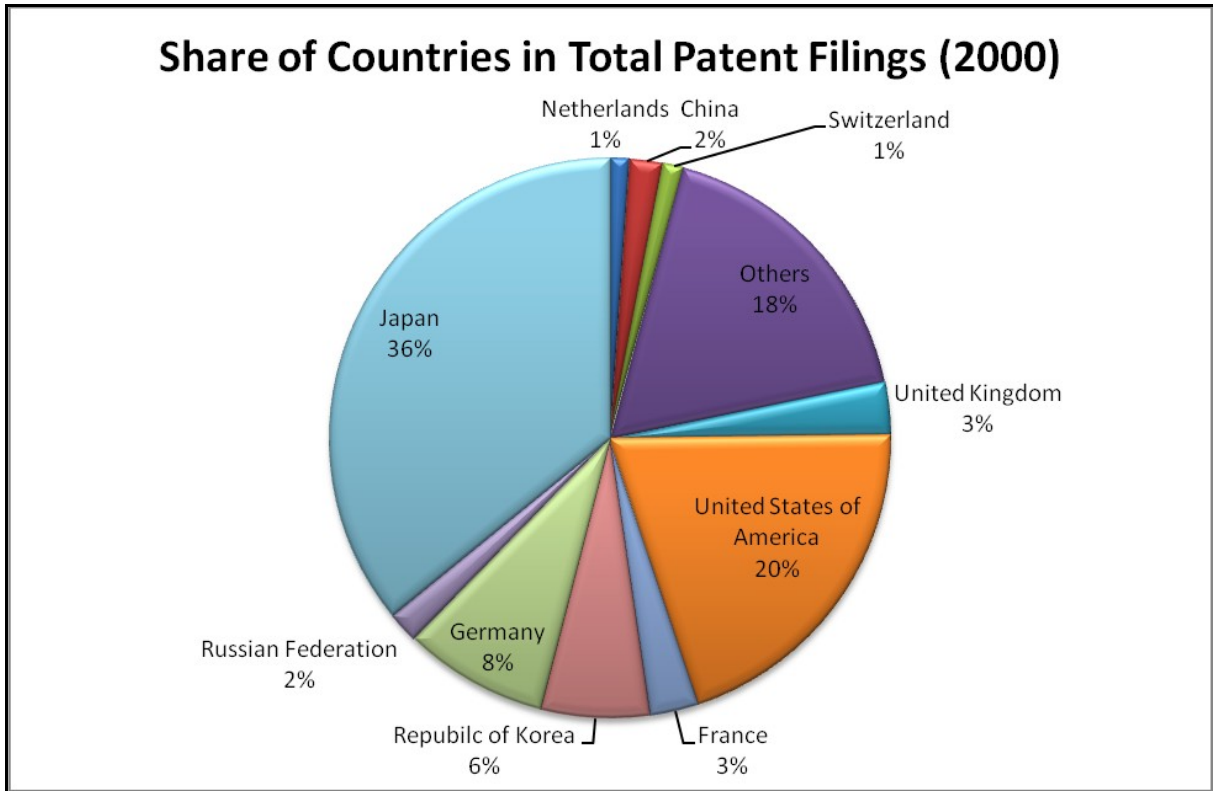
*Notwithstanding the points mentioned above, patent statistics do provide valuable information about innovative activity.*

Source: *World Patent Report: A Statistical Review 2008*

The World Intellectual Property Organization (WIPO), a United Nations agency, collates statistics on patents from countries around the world. WIPO publishes various statistical reports, including the *World Patent Report - A Statistical Review (2008)*. The Chinese position as an innovator can in part be assessed by comparing its recent position in the global league table of patent applications. In 1995 it was 12<sup>th</sup> with 18,699 applications. By 2006 its position had improved to 5<sup>th</sup> ranking with a total of 210,501 Patent application filings. Of these, approximately 80,000 filings were by foreign individuals and entities, so there were 128,850 filings by Chinese individuals and entities in 2006.

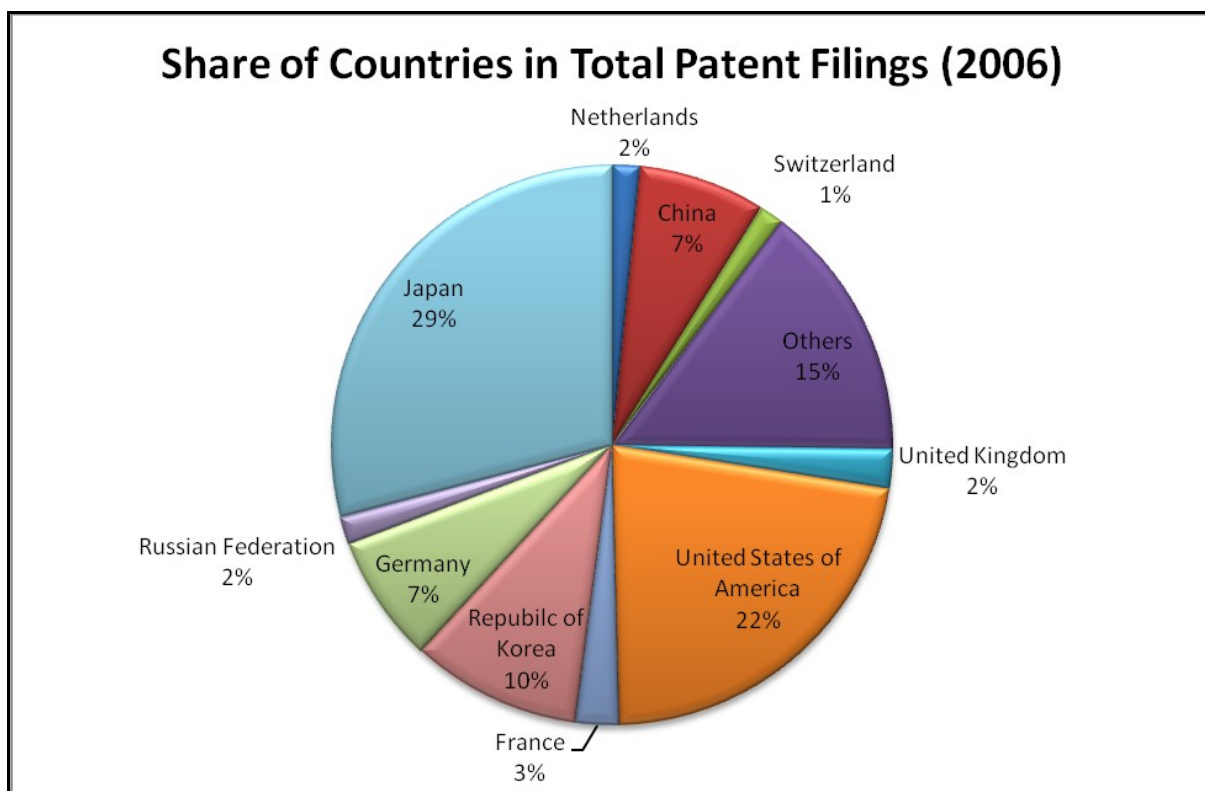
According to *World Patent Report - A statistical Review (2008)*, the total number of applications filed across the world in 2006 is estimated to be 1.76 million, representing a 4.9% increase from 2005. Patent applications from Japan, the United States of America, the Republic of Korea, Germany and China accounted for 76% of total patent filings in 2006. By 2006 China's position had improved to 5<sup>th</sup> ranking in the world with a total of 128,850 patent filings by Chinese individuals and entities, after Japan (1<sup>st</sup>, 514,047 patent filings), United States of America (2<sup>nd</sup>, 390,815 patent filings), the Republic of Korea (3<sup>rd</sup>, 172,709 patent filings), Germany (4<sup>th</sup>, 130,806 patent filings).





Source: WIPO Statistics Database (Note: The data includes patent filings in the office of the country of residence as well as patent filings abroad.)

**Figure 2.4: Share of countries in Total Patent Filings (2000)**



Source: WIPO Statistics Database (Note: The data includes patent filings in the office of the country of residence as well as patent filings abroad.)

**Figure 2.5: Share of countries in Total Patent Filings (2006)**

Between 2000 and 2006, China patent filings and Korea patent filings increased by 26.3% and 8.5% a year (average annual growth rate), respectively. In contrast, Japan patent filings decreased by 0.4% a year. Chinese residents increased their share of total worldwide patent filings from 1.8% to 7.3% between 2000 and 2006, mostly because of increasing of domestic patent filings.

Between 2000 and 2006, there was a significant increase in the number of filings originating from China, the Republic of Korea, India and Australia. The average annual growth rate for these countries was far above that of European and North American countries. Japan, the United Kingdom and Sweden experienced a modest growth in filings (less than 1% a year). The share of the top 10 countries of origin

increased from 82.4% (2000) to 85.2% (2006), reflecting an increasing level of concentration.

In 2006, approximately 727,000 patents were granted across the world. Similar to patent filings, patent grants are concentrated in a small number of countries. Applicants from Japan, the United States of America, the Republic of Korea and Germany received 73% of total patent grants worldwide. Between 2000 and 2006, the number of patents granted to applicants from China and the Republic of Korea grew by 26.5% and 23.2% a year, respectively (average annual growth rate). (According to Patent applications by country of origin in 2008, China had improved its position still further with 203,481 patent applications and a position of 3<sup>rd</sup> in the world league table behind only USA and Japan, surpassing Korea and Germany (World Patent Report - A statistical Review, 2008)

Countries with a high level of R&D investment tend to have a high resident patent filing to R&D expenditure ratio (patent intensity). (World Patent Report - A statistical Review, 2008) The five countries with the highest patent intensity are the Republic of Korea, Russian Federation, Japan, China and New Zealand. From 2000 to 2006, the patent intensity ratio of China and India has increased slightly (World Patent Report - A statistical Review, 2008), which is mostly due to the higher growth rate of resident filings relative to that of R&D expenditure.

The patent intensity ratio of Germany, Japan and the United Kingdom, on the other hand, has declined, especially for the most recent years. The decrease in patent intensity ratio of Germany, Japan and the United Kingdom is mostly due to the fall in resident filings.

The Republic of Korea, Japan, Russian Federation, New Zealand and China were the five top ranked countries in terms of resident patent filings-to-GDP (measured in billion US dollars) ratio. In 2008, residents of the Republic of Korea and Japan filed, respectively, 122 and 87 patents per billion US dollars GDP, while residents of China filed 24 patents per billion US dollars GDP. The Republic of Korea was the only country with more than 100 patents per billion US dollars GDP. For the majority of reported countries, the 2006 resident filings to GDP ratio are lower than the 2000 ratio, which is mainly due to the fact that GDP increased at a faster rate than resident patent filings. China and the Republic of Korea are two notable exceptions, whose 2006 resident filings to GDP ratio are higher than the 2000 ratio. However it is still the case that Chinese 'efficiency' in terms of the number of filing per unit of R&D expenditure is still low by comparison with Korea and Japan.

The World Intellectual Property Organization has pointed out there is no necessary clear relationship at the level of firms between R&D expenditure and patent filing activity or innovation (WIPO, *World Intellectual Property Indicators 2010*, p. 21). Not all R&D leads to new products or processes. In some situations there is a positive and significant relation between R&D expenditure and patent applications; however, an investigation of the factors influencing the number of patent applications by the largest innovative firms showed that R&D expenditure explains less than 10% of the variation in patent applications. For instance, a certain number of firms with relatively low R&D expenditure still file a large number of patents. "Patent filing intensity is influenced by a large number of factors, including the level of R&D (in particular business R&D), the number of researchers, their scientific publications, the design of the patent system, institutional incentives to patent, and education and science and

technology policies more broadly” (WIPO, *World Intellectual Property Indicators 2010*, p. 21).

**Table 2.9: Patent application growth rate by patent office (%): selected offices**

Patent Office	Total Patent Application growth Rate (%)				
	2005	2006	2007	2008	2009
China	32.9	21.4	16.5	18.2	8.5
European Patent Office	4.1	5.1	4.1	3.8	-7.9
France	-0.1	-0.2	-0.8	-2.4	-3.6
Germany	1.7	0.6	0.7	2.3	-4.5
Japan	0.9	-4.3	-3.0	-1.3	-10.8
Republic of Korea	14.8	3.3	3.8	-1.1	-5.0
United Kingdom	-6.6	-8.0	-2.9	-6.5	-3.9
United States of America	9.5	9.0	7.1	0.0	0.0

Source: *WIPO Statistics Database, June 2010*

These top eight offices account for 80% of global patent applications. The Table shows China had nearly 33% growth rate of total patent application in 2005, which is the highest growth rate in the world, Korea had nearly 15% growth rate. China had 8.5% growth rate of total patent application in 2008 whereas the other top 7 patent office had either zero growth rate or minus growth rate.

#### **2.4.2. Patent Applications in China**

Since 1978, Chinese companies, which had suffered from inefficiency and excessive inventories, were expected to introduce foreign technology through joint ventures, in exchange for their huge domestic market and cheap labour, in order to increase up their competitiveness.

China has made outstanding achievements in its patent law system, patent creation and application capability, intellectual Property protection and patent information communication and utilization after 30 years of unremitting efforts. Meanwhile, the personnel team dealing with examining patent applications is increasingly professional, which creates a favourable social and law environment for China’s

economic development and S&T innovation. The increased volume of patent applications in recent years provides evidence that innovation has been growing dramatically.

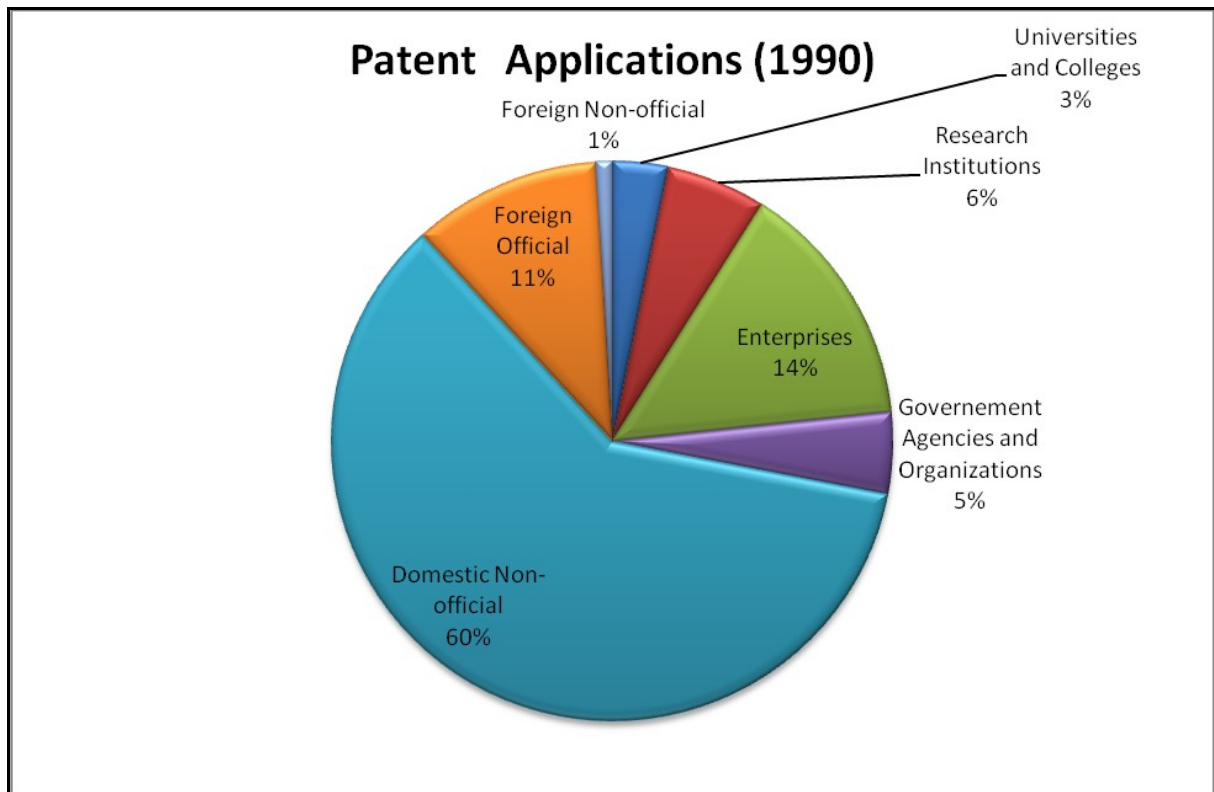
Based on the official Chinese statistics for patent applications, the researcher has identified eight categories of entity applying for patents, as follows:

1. Government Agencies and Organizations;
2. Research Institutions;
3. Universities and Colleges;
4. Large and Medium Enterprises;
5. Small Enterprises;
6. Domestic non-official;
7. Foreign Official; and
8. Foreign Non-official.

Categories 6,7 and 8, *Domestic non-official, Foreign Official and Foreign Non-official* are not included in this thesis, the following chapter will *only* focuses on three categories of patent applications (categories 2,3,and 4): the *Research Institutions; Universities and Colleges* and *Large and Medium Enterprises*, which impact and stimulate the innovation climate in China. This latter category includes Sino-western joint ventures.

Among total China patent applications in 1990, there are 60% patent applications of Domestic non-official (category 6 private individuals not part of companies), All enterprises (in 1990, the China National Bureau of Statistics did not provide separate information for Large and Medium Enterprises and for Small Enterprises) account for less than 15% of total patent applications. 3% of patent applications originated in Universities and Colleges, and 6% of patent applications came from Research

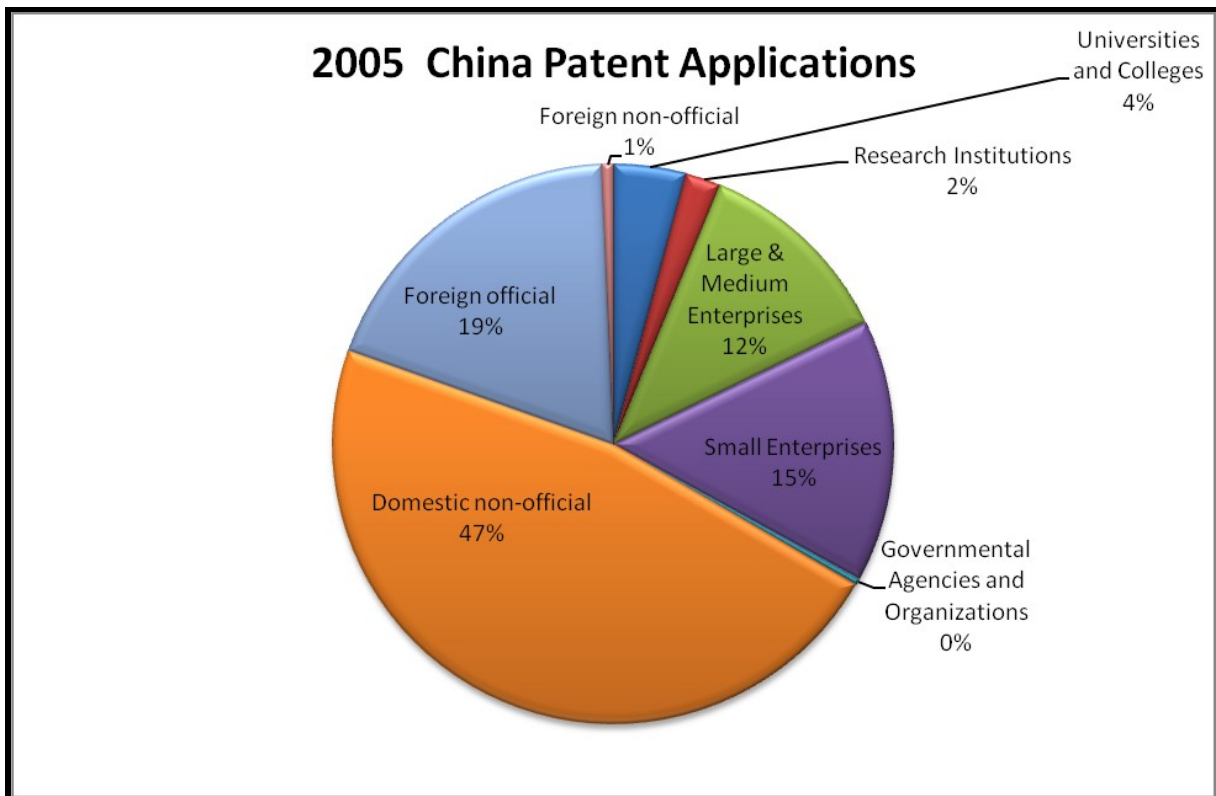
Institutions.



Source: China Statistical Yearbook 2009

**Figure 2.6: Patent Applications (1990)**

In 2005, slightly less than 50% patent applications come from category 6 Domestic non-official (private individuals not part of companies), All enterprises (categories 4 and 5 together) account for 27% of total patent applications: 12% patent applications of Large and medium Enterprises, 15% patent application of small enterprises. There were less than 5% patent applications of Universities and college, and 2% patent applications of Research institution. The above figures show that both L&M enterprises and small enterprises together are becoming the main force of patent applications in China. Research institutions and universities and colleges make comparatively small contributions to patent applications in China.

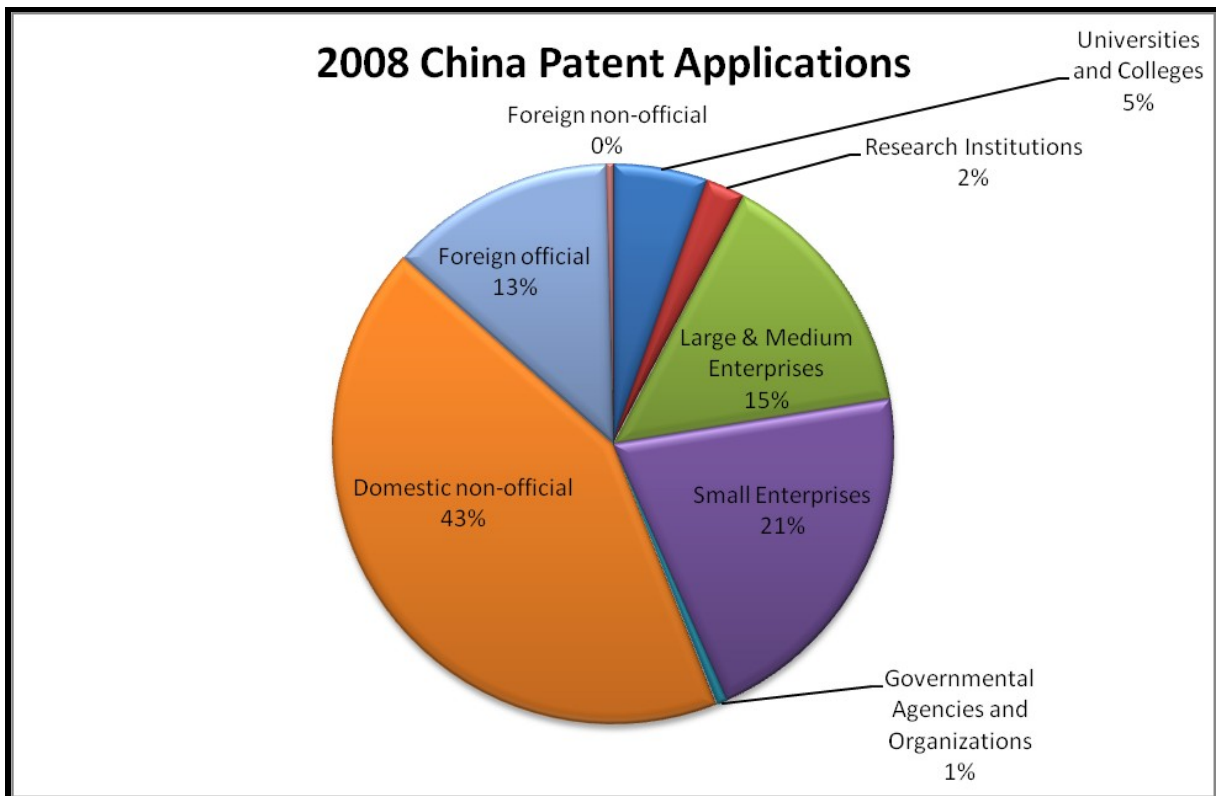


Source: China Statistical Yearbook 2009

**Figure 2.7: China Patent Applications (2005)**

The trend towards dominance by enterprises continues: recently among total China patent applications in 2008, patent applications of Domestic non-official (category 6 private individuals not part of companies) had fallen to 43%, while all enterprises (category 4&5) account for 36% of total patent applications: patent applications of Large and medium Enterprises increased to 15% and patent applications of small enterprises increased to 21%. Patent applications of Universities and Colleges were approximately the same at 5%, and patent applications of Research Institutions stayed at 2%.

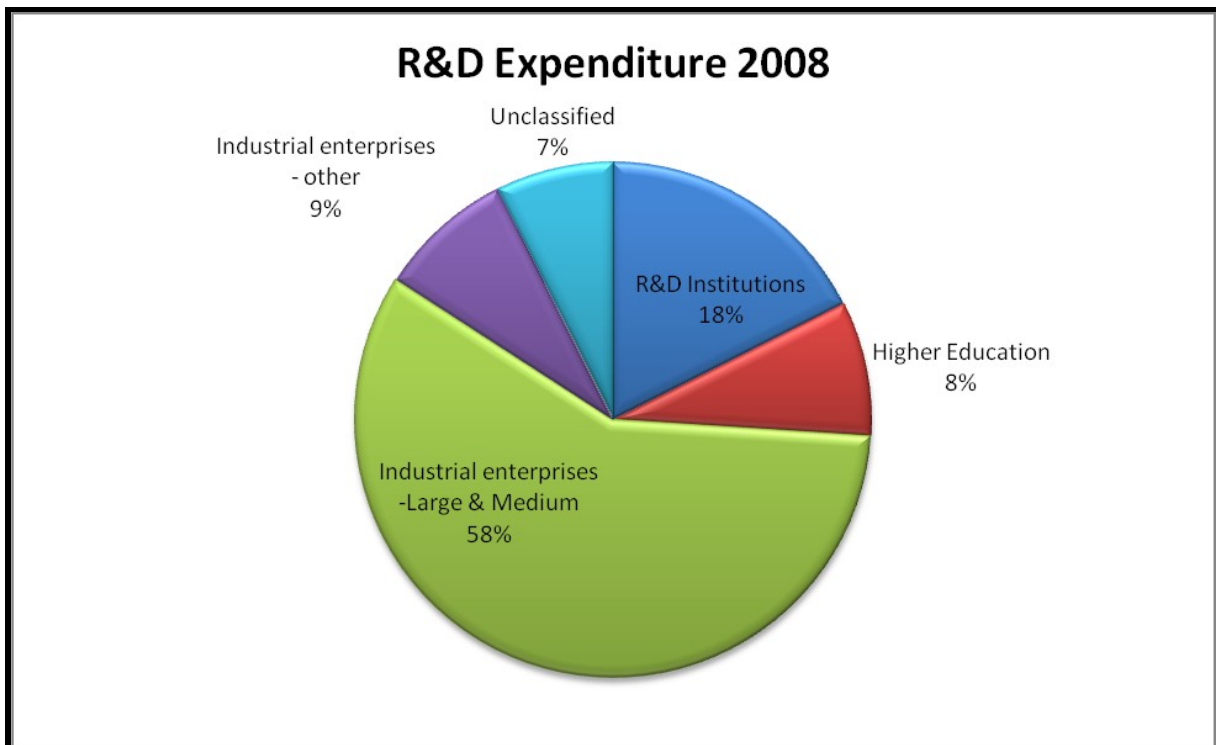




Source: *China Statistical Yearbook 2009*

**Figure 2.8: China Patent Applications (2008)**

So on the face of it, Chinese industry's record in innovation seems to be dramatically improving. However the more detailed analysis above shows that less than 50% of current applications are from Domestic non-official sources (category 6 private individuals not part of companies), which are therefore unlikely to be adopted by MNCs and to become major new products in the world economy. Furthermore although the Chinese government has been pouring very large amounts of RMB into R&D in Universities and Research Institutions but the record of these establishments in producing patent applications is less than might have been expected.



Source: China Statistical Yearbook 2009

**Figure 2.9: R&D Expenditure (2008)**

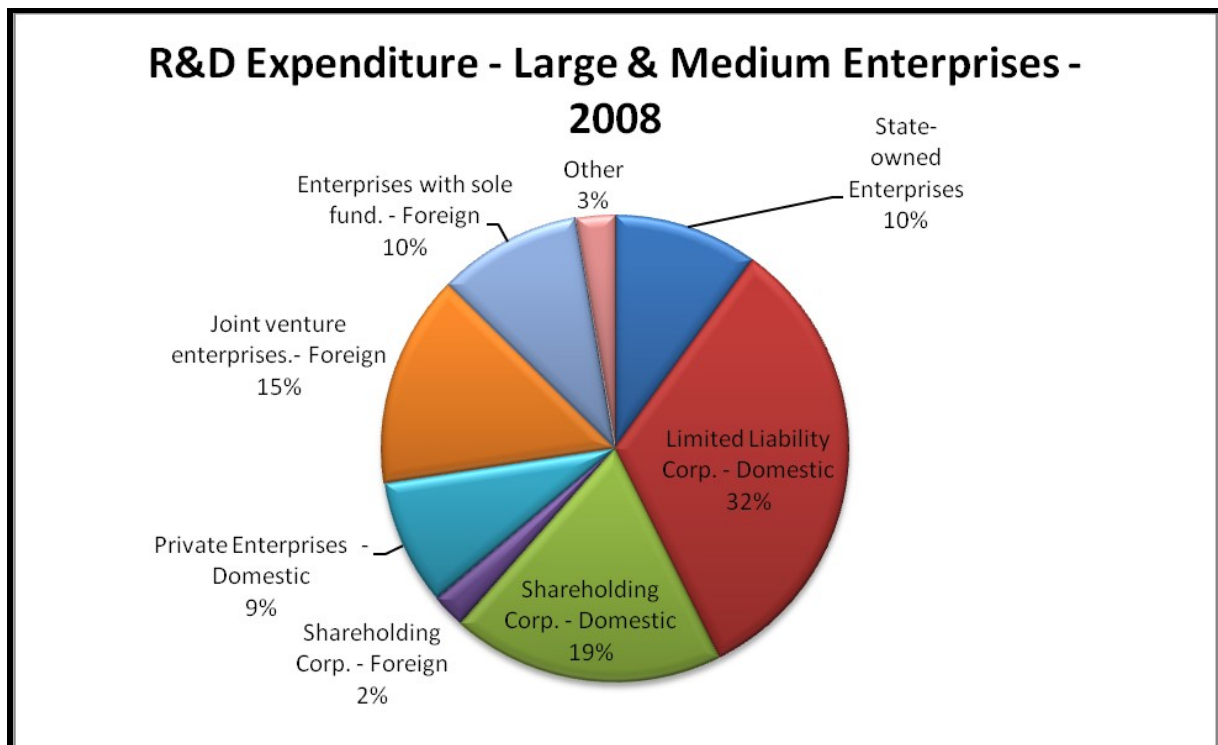
In 2008, Large and medium enterprises accounted for slightly less than 60% of total R&D expenditure, Research institutions for less than 20% of the total, and higher education for less than 10% of the total. These figures show Large and medium enterprises spend most on R&D.

The large and medium enterprises are composed of eight categories:

- Category 1:* Foreign Joint Venture Enterprises;
- Category 2:* Foreign Enterprises with Sole Fund;
- Category 3:* Foreign Share-holding Corporations Ltd;
- Category 4:* State-owned Enterprises,
- Category 5:* Domestic Limited Liability Corporations;
- Category 6:* Domestic Share-holding Corporations Ltd;
- Category 7:* Domestic Private Enterprises;

Category 8: Other Enterprises (combine collective and other, same as the new products, and change the pie)

The following pie shows that R&D expenditure of joint venture enterprises was 15% of total R&D expenditure of large and medium enterprises in 2008, while R&D expenditure of foreign enterprises with sole fund was 10% of the total.



Source: China Statistical Yearbook 2009

**Figure 2.10: R&D Expenditure – Large & Medium Enterprises – (2008)**

International comparisons of R&D intensity may be undertaken by calculating R&D expenditure in a given period as a proportion or percentage of GDP for that period (Smith, 2006, p. 155). A similar comparison of patent application intensity may be determined by calculating the number of applications as a proportion of R&D expenditure. China's proportion of Expenditure on R&D to GDP was about 1.3% in 2005 and about 1.5% in 2008 (see **Table 2-10** below). The following table measures

patent application intensity. The table shows that in 2005, higher education made about 800 patent applications for every billion RMB spent on R&D, Large and medium enterprises made about 440 patent applications per billion R&D expenditure; and Research institutions made less than 200 patent applications per billion R&D expenditure. It is interesting to note that higher education expenditure on R&D was less than half of research institution expenditure, but higher education organisations applied for over twice as many patents as research institutions.

In 2008, higher education made about 1100 patent applications, Large and medium enterprises made about 450 patent applications, and Research institutions made about 230 patent applications per billion RMB of R&D expenditure. It would seem therefore that the contribution of Universities to innovation is substantial in relation to its limited R&D expenditure and is growing, although research institutions are not doing so well, as measured by patent application intensity.

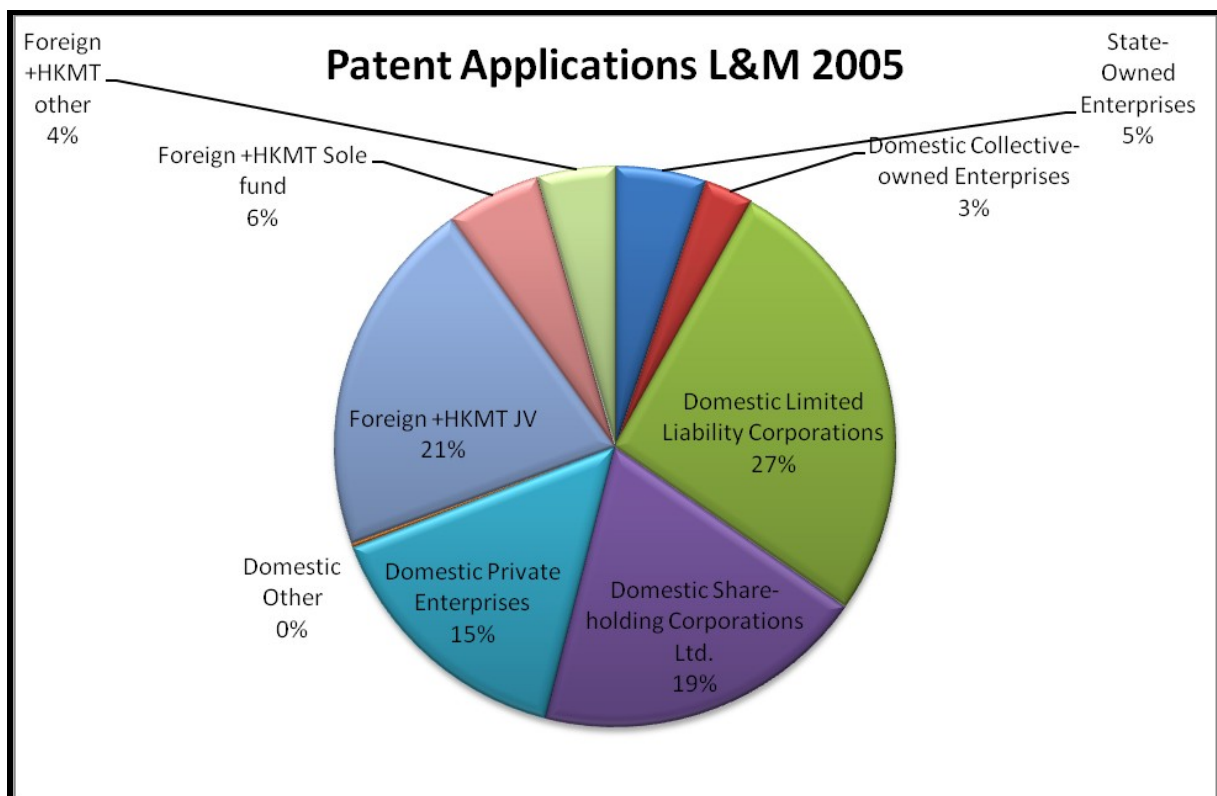
**Table 2.10: Comparison of Patent application intensity by organization (2005-2008)**

Organization	R&D Expenditure (Billion RMB)		Patent Applications (Pieces)		Patent application intensity (Patent Numbers per 1 Billion RMB)	
	2005	2008	2005	2008	2005	2008
Research Institutions	51.3	81.1	9,746	18,612	189.9	229.5
Higher Education	24.2	39.0	19,921	45,145	823.2	1157.6
L&M Industrial Enterprises	125.0	268.1	55,271	122,076	442.2	455.3

Source: *China Statistical Yearbook 2009*

How important therefore is the role of the Sino Western joint venture in innovation? The record here is interesting. When China first opened itself up to the global economy after 1978, the normal form of Sino-Western collaboration was the joint

venture. It is true that the Western and Chinese partners generally had different objectives in setting up a joint venture. Generally the Western partner sought access to a low cost labour force to manufacture its products and furthermore the ability to sell in the 1.3 billion person market. The Chinese partner on the other hand was more likely to be looking for technology transfer as a shortcut to innovation. Although the Western partner was more intent on protecting its technology, this still proved a good route from the Chinese viewpoint and Chinese patent applications from joint ventures are assessed to have reached around 21% of the total by 2005. (Figures showed in the following patent application pie in 2005)

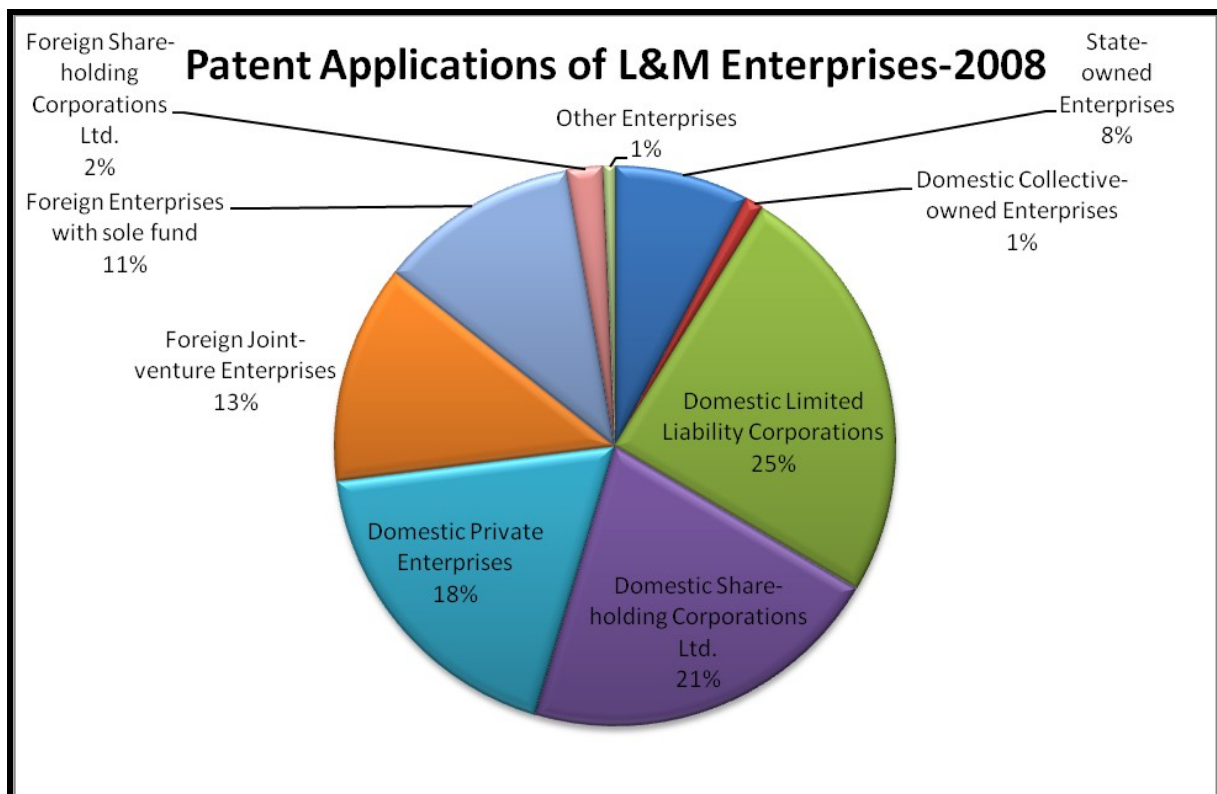


Source: China Statistical Yearbook 2009

**Figure 2.11: Patent Applications L&M (2005)**

However, largely because of culture clash, joint ventures between Western and Chinese partners developed a rather indifferent record of achievement in the eyes of

the Westerners. Chinese companies had not been used to seeking profit as a prime objective, and were more concerned with keeping up employment levels. Also Chinese staffs were often seen by Western investors to be reluctant to show initiative and willingness to think for themselves. As a result the enthusiasm of the West for joint ventures began to decline.



Source: China Statistical Yearbook 2009

**Figure 2.12: Patent Applications of L&M Enterprises (2008)**

The Chinese government became aware of this, and became concerned that Western investment was on the decline. They therefore relaxed the law on inward investment and allowed Western companies to enter China without a Chinese partner. That had the desired result of increasing Western investment in China but not of increasing innovation. Western companies tended to restrict R&D in China and ensured that their patent applications were made at home for their Western

shareholders (China Statistics Bureau 2009). So the share of total Western investment in the Chinese economy through joint ventures went into severe decline, and that of wholly owned FDI investment took over as the key investment vehicle, often reflecting inward investment for the Chinese Diasporas from Taiwan, Hong Kong and Singapore.

Nonetheless the amount of patent applications from China continued to rise dramatically over the years. Although patent applications from the Domestic non-official and joint venture categories are decreasing, patent applications of small enterprises, foreign enterprises of solo fund, Domestic Limited Liability Corporations; Domestic Share-holding Corporations Ltd; Domestic Private Enterprises are increasing, which contributes to the recent sharp increase in Chinese total patent applications. In addition the role of Sino-Western joint ventures continued to be important from the viewpoint of the development of Chinese innovation capability. By 2008 joint ventures still accounted for 13% of total patent applications of large and medium enterprises and 15% of total R&D expenditure of large and medium enterprises. (They accounted for a 21% share of total patent applications of large and medium enterprises in 2005).

A closer examination of how Sino Western joint ventures can help in developing Chinese innovation capacity remains a valuable and interesting research question and this thesis focuses on this issue. The thesis explores a number of propositions whereby innovation can be enhanced in China often through JVs but not exclusively so. It then reports on interviews with executives in Sino Western JVs in which these propositions are tested for their validity.

## **2.5. Conclusion**

China has come a long way in terms of industrial development, improved living standards and innovation achievement since the early days of the post-Deng reforms. This Chapter has shown how the growth of technology in China has led in turn to the growth of a capacity for innovation. In the development phase of this emergence the role of Sino-western JVs has been significant as they have been the major engine for the introduction of western style technology. This has since 1979 been strongly supported by the Chinese government as was explained in Chapter 1. Innovation, measured in various ways, has grown in China over the last 30 years.

The Chapter also demonstrates the increasing significance of large and medium enterprises to innovation. Sino-Western joint ventures continue to be an important contributor to innovation, but with the opening up of China to foreign direct investment, their role has been declining somewhat in recent years.

This thesis will explore how, through joint ventures and through the adoption of similar innovatory policies, domestic Chinese companies can also make their positive contribution to turning China into a more creative and ultimately brand name economy. In the next chapter, the literature on innovation in strategic alliances, in particular joint ventures, is reviewed.



# **Chapter 3: Literature Review:**

## **Strategic alliances and innovation**

### **3.1. Introduction**

In order to achieve a good understanding of how a JV between Chinese and Western companies creates and maintains technological innovation in China, this chapter reviews a number of literatures on strategy alliances and international joint ventures, and reviews current literatures on innovation. The overall aim of this chapter is to identify gaps in the literature on JVs and innovation, and to provide a review of the literature in the area of innovation so as to identify shortcomings in existing models. This chapter then provides a basis for developing a more sophisticated model and identifying key propositions on innovation in international JVs in Chapter 4.

Section 3.2 of this Chapter discusses international joint ventures in China; section 3.3 present innovations in China; section 3.4 is culture in IJVs; section 3.5 is literature on innovation; section 3.6 is literature on innovation process.

Some of the existing literature deals with “alliances”, which include any form of association between two or more enterprises. Examples of alliances are consortium arrangements, specific collaborations and joint ventures. The latter are normally set up as a separate corporate entity whose owners are a Chinese and a Western company. In some JVs, the partners are equal shareholders while in others there

may be a majority and a minority investor. The managers of JVs usually come from the partners who have set the JV up.

### **3.2. International joint ventures in China**

International Joint Ventures (IJVs) have become increasingly common vehicles for companies to access resources or to reduce the risk of entering new markets. There is a conventional view of IJVs between Chinese and Western companies that the Western company's motivation is generally to access a vast 1.3 billion person market, and to gain from the low labour costs existing in China, some ten times less than typical Western labour costs. On the Chinese side gaining access to Western technology and Western management methods is seen as the normal motivation. Innovation is the competitive advantage for a firm and the joint venture may be an effective vehicle for its development. This thesis will explore how JVs between Chinese and Western companies can create innovation, and ultimately build brand name companies which they currently lack.

China is currently an OEM country that supplies the whole world with a mass of products. This earns it an average of 5% on costs. However if it is to transform itself into a brand name country its margin would average 40% (Gu, 2005). However it cannot do this without a much higher level of innovation. Although its record is improving fast China only registered 3,900 patents on the latest figures compared with more than 26,000 for Japan and nearly 50,000 for the USA in 2007 (World Intellectual property organisation 2007). The key purpose of this research is to discover how IJVs can help Chinese companies to create more innovation and brand names.

China has been the subject of a large amount of media and academic interest particularly over the last ten years or so, since it has become apparent in the West that China is rapidly becoming a world economic power. Indeed in the area of manufacturing it seems to provide a large percentage of the world's traded and manufactured products, although many of them appear under well known Western brand names. (Gu, 2005)

One would have expected a wide and varied academic literature to have emerged analysing the nature of the joint ventures and charting the path to genuine brand name companies and industries, similar to those that developed in the 1970s in Japan, but this seems not to have been the case. The great outpouring of academic literature on joint ventures and other forms of cooperation belongs to the 1990s. Since the turn of the twenty first century, there has been comparatively little written on the subject. There is, however, a wealth of scholarly research on various aspects of IJVs, which provides a good literature base. Inkpen (2004) has been active writing about learning and knowledge management in alliances, and with Currall (2004) on trust, control and learning in JVs. Child and Yan (2003) has written on performance in IJVs and with Mollering (2003) on trust in the Chinese context; On the subject of human resource management Farley et al (2004) address the issue of HRM policies used strategically in IJVs, and Warner (2003) considers the subject in the context of China. Pothukuchi et al (2002) analyse culture of both national and organisation types in IJVs and Child and Tsai (2005) describe China's transition as an emerging economy. All of these contributions to the theory of IJVs are valuable, but they do not address the key issue of how Chinese companies through cooperation with Western companies in JVs are to evolve from pure low cost manufacturing units to genuine brand name companies comparable to those in Korea or Japan. Little has been

written on how Chinese firms can develop brand name companies out of pure OEM ones, and it is this gap that the current research aims to fill.

In China in particular good relations with governments both central and local, and good sensitive human resource policies are critical. The researcher will briefly review below some of the main findings in these streams of literature.

### **3.3. Innovation in China**

In order to achieve a good understanding of how a JV between Chinese and Western companies creates and maintains technological innovation in China, we will look at a number of theories that have been identified from a preliminary literature review.

Ring and Van der Ven (1994) develop an interesting cycle of evolution or innovation in a JV or other form of alliance. In this cycle, negotiation is followed by commitment and execution, which in turn lead to further negotiation, commitment and execution and so on for the life of the JV or other alliance form. Doz (1996) has a somewhat similar cycle. For him initial conditions lead to learning and hence to re-evaluation. This leads to adjustment, and to revised conditions as new external conditions are encountered. This leads back to further learning and so forth.

Many alliances are created for the primary purpose of learning, with the nature of the learning often uncertain at the outset, (Child, Faulkner and Tallman 2005). However as Powell, Koput and Smith-Doerr (1996) point out:

*“The canonical formal organisation with its bureaucratic rigidities is a poor vehicle for learning. Sources of innovation do not reside exclusively inside firms, instead they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers.”*

It might be expected therefore that the very existence of a new JV will give rise to some innovation as it establishes its place in the organisational framework of the partner companies, and in all probability some will be unexpected innovation. Thus in investigating this subject, we must look for change in the partner companies subsequent to the establishment of the JV and for innovation in the partner companies and the JV itself.

China has traditionally had a very weak innovation research structure, unlike Japan which became an established developed nation in the 1970s, largely because it was capable of 'playing catch-up' with the Western nations through a strong innovation tradition. China, however, through its Confucian heritage accorded more social status to the humanities than to science and technology. As a result after thirty years of an open door policy and after becoming the manufacturing hub of the world, China is still dominated by low value added manufacturing with margins of 5% or less. (Gu, 2005) Over 80% of exported manufactures from China come from foreign owned Chinese factories or joint ventures, and the dominant sources of Chinese Foreign direct investment (FDI) come from Chinese living abroad, to be found particularly in Singapore, Taiwan and Hong Kong.

Unfortunately, as in many planned economies, production facilities and R&D institutes operate separately, and therefore do not interact synergistically. The recent Chinese policy reform document entitled "Endogenous growth through harmonious development" recognises this, and attempts to stimulate innovation by bringing production companies and R&D together. It is already together of course in the Sino-Western joint ventures and strategic alliances, and it is there that we may perhaps most profitably look for current innovation.

Gu (2005) noted that separation of R&D and production was no longer appropriate and set up NTE's (New Technology Enterprises) starting from 1985. More recently under the reform package the modern Chinese innovation system has the following key characteristics (Gu, 2005):

- Research and development institutes are being merged into capital goods industries where innovation is important to competitive success in global markets.
- Inflow of technology is being encouraged through
  - a. technology licensing (TI)
  - b. sample machine procurement (SMP)
  - c. equipment procurement (PE)
  - d. FDI
  - e. OEMs
- Interactive relationships between joint venture partners.

China has easy access to foreign technology therefore, but is weak in its development of domestic technology infrastructure. The import of foreign technology is largely embodied in new machinery and other process equipment. Thus although China still has poor support for knowledge based growth because of its poor technology infrastructure (Nelson, 2004) Sino-Western joint ventures are extremely important in making good this weakness by creating transferable innovation on Chinese soil.

### **Eight key factors for creating innovative capabilities through a JV Company**

China needs an innovation system if it is to develop new products and services that are worthy of developing into major global brands. The key aspects of an innovative JV company are the following characteristics:

(1) A dense networks of strategic alliances especially those with the West. This contrasts with an atomistic company structure in which companies are weakly networked. (Powell & Grodal, 2005)

(2). A philosophy of Open Innovation in which innovations are capable of being easily accessed by companies other than the originator. This contrasts with the closed innovation system in which companies jealously guard their proprietary knowledge. (Chesborough, 2004)

(3) A system of spin-out Companies, especially technology ones, at the major Universities, capable of being developed into new entrepreneurial companies. This ensures that the research done at Universities and their allied research centres reaches the commercial sector. (Link & Siegel, 2007)

(4) Relating closely to Research Institutions helps to create more innovation (Link and Siegel, 2007).

(5) A social atmosphere that encourages a 'passion' for new thinking, supported strongly in companies by human resource management policies. Such social mindsets encourage company executives to forever strive towards better ways of doing things, rather than merely accepting the traditional ones. (Fagerberg, Mowery & Nelson, 2005)

(6) Developing a strong strategic planning system with innovation as a focus encourages innovation (Taylor, 1984)

(7) Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)

(8) A developing Intellectual Property (IP) record especially in patents. Currently China is improving fast, and to some extent it operates againly the open system described above. However a strong patent record is evidence of high R&D success. (Granstrand, 2005)

If a Chinese JV Company is able to score highly on these eight key factors it can be said to have developed strong innovative capabilities. This will be explored with particular focus on the Sino-foreign IJVs in the research.

Some of the key literature in relation to these factors is set out below.

### **3.4. Culture in IJVs**

Gomez-Mejia and Palich (1997) test the hypothesis that culturally related international diversification will have a positive impact on firm performance and that the opposite will be true for culturally unrelated globalization. Cultural diversity for Fortune 500 firms was used to predict performance over a ten-year period (1985-1994), controlling for several organizational and industry characteristics.

#### **3.4.1. Culture and the Selection of Entry Modes**

Kogut and Singh (1988) analyzing data on 228 entries into the United States market by acquisition, wholly owned greenfield, and joint venture. They find out characteristics of national cultures have frequently been claimed to influence the selection of entry modes. They investigate this claim by developing a theoretical argument for why culture should influence the choice of entry. Two hypotheses are derived which relate culture to entry mode choice, one focussing on the cultural distance between countries, the other on attitudes towards uncertainty avoidance.



### **3.4.2. Culture and the Survival of IJVs**

Meschia and Ricciob (2008) identify the main and interaction effects of two country-level variables, namely national distance and country risk, on the survival of IJVs in emerging markets. Their research examined in a sample of 234 IJVs formed in Brazil between 1973 and 2004. These IJV were subjected to an event history analysis over a period of time ranging from 1973 to 2006. The results show that large national cultural differences between local and foreign partners increase the instability of IJVs, whereas the survival of these alliances does not seem to be affected either by the economic and political uncertainty of Brazil. Furthermore, the national distance between local and foreign partners has effects on survival that are variable according to the life cycle of IJVs.

### **3.4.3. Culture and the IJVs Performance**

Pothukuchi, Damanpour, Choi, Chen, Park (2002) examine the effect of dimensions of national and organizational culture differences on IJV performance. Based on data from a survey of executives from joint ventures between Indian partners and found that the presumed negative effect from culture distance on IJV performance originates more from differences in organizational culture than from differences in national culture.

According to Li, Lam, Qian (2001), their study applies a resource-based view of the firm to analyze data from a sample of 898 joint-venture firms in China, including both joint ventures established by overseas Chinese and by firms from Western cultures. They find out culture could influence the timing of entry of joint ventures, their investment preferences, and performance. ANOVAs and regressions were

conducted, and the results suggest the impact of cultural as well as technological resources.

Sirmon and Lane (2004) propose a model of cultural differences and international alliance performance to explain the ambiguous findings regarding the influence of national culture differences on alliance performance. Building on research on national, organizational, and professional cultures, they argue that the closer the domain of a social group is to the value-creating activities of an alliance, the more disruptive cultural differences between the partners' members of that social group will be. "Organizational culture differences will tend to be more disruptive than national culture differences, and differences in the professional culture most relevant to alliance value creation typically will be the most disruptive. Implications for research and managerial practice are discussed, and the model's relevance for international R&D alliances is highlighted."

Hennart and Zeng (2002) test whether national cross cultural differences between joint venture (JV) parents affect JV longevity by comparing that of two categories of JVs placed in the same environment, those between two or more Japanese parents on one hand, and those between Japanese and American parents, on the other. Carefully controlling for other factors that may affect JV longevity; they find that the longevity of Japanese-American JVs is lower than that of Japanese-Japanese JVs. Such effects, however, appear only for dissolutions that result from the sale of the venture to one of the partners, not for those due to liquidation or sale to a third party.

#### **3.4.4. Effects of Partner and Location Cultural Differences**

Hanvanich, Stewart R, Richards, Cavusgil (2003) focuses on one of the most important aspects of domestic joint venture and IJV formation: culture difference.

They adapt ownership-structure classification of IJVs and empirically examine the effects of JV partner and JV location cultural differences. Using an event-study methodology, the results reveal the impact of cultural difference on shareholder value creation. The article discusses the implications of using cultural difference measures in international research.

#### **3.4.5. Chinese Culture**

According to Leung (2008), China has been characterized by rapid economic growth and drastic institutional reforms in the last two decades. The convergence argument suggests that Chinese should be become more individualistic, but there is also compelling evidence for the continued influence of traditional culture. Current in China, materialistic achievement is being emphasized. Many Chinese are enterprising, diligent, and focused on their goals because of their desire to achieve. To understand the behaviour of Chinese people, it is important to examine the interplay between the contemporary social forces and traditional values and beliefs. Materialistic achievement may be more relevant for economic behaviour, whereas the social behaviour of Chinese is still guided by traditional values and beliefs.

### **3.5. Literature on Innovation**

In order to achieve a good understanding of how a JV between Chinese and Western companies creates and maintains technological innovation in China, we will look at a number of theories that have arisen from a literature review.

The great outpouring of academic literature on joint ventures and other forms of cooperation belongs to the 1990s. All of these contributions to the theory of IJVs are valuable, but they do not address the key issue of how Chinese companies through

cooperation with Western companies in JVs are to evolve from pure low cost manufacturing units to create innovation and in the end genuine brand name companies comparable to those in Korea or Japan. Little has been written on how Chinese firms can create innovation out of pure OEM ones, and it is this gap that the current research has filled.

Obtaining western advanced technology and management knowledge is one of the primary motives of the IJV Chinese partners. Since 1979, China has implemented open door policy and encourages “Market exchange for technology” policy. China has the largest numbers of joint venture activities among the developing countries in 1990s.

There is a literature on alliance and innovation, Cheung and Lin (2003, P.25) shows how “foreign direct investment (FDI include) can benefit innovation activity in the host country via spillover channels such as reverse engineering, skilled labour turnovers, demonstration effects, and supplier-customer relations.”. They also state the positive effects of FDI on the number of domestic patent applications in China. The spillover effect is the strongest for minor innovation such as external design patent, which is effected by the demonstration effect of FDI.

“Imitate” is the first step for China; in this stage Chinese firms try to learn, to imitate and to copy the technology and knowledge from western firms. In this step, western-Chinese joint ventures benefit innovation activity of Chinese firms through the followings approaches: firstly, Chinese firms learn advanced technologies and products brought in by western firms; secondly, Chinese firm can “steal” skilled labour worked for joint venture firms, which cause technological spillover because this labour represents technological know-how. Third, western-Chinese joint

ventures have a demonstration effect on local R&D activity. By their mere presence in the domestic markets, foreign products/technologies can inspire and stimulate Chinese innovators to develop new products and processes. This helps shorten the trial-and-error process of Chinese firms in their search for inventions. Finally, spillovers may take place vertically from western firms to their Chinese suppliers by means of technological staff training, and so on. These spillovers can enhance the innovation capability of Chinese suppliers.

Whereas this thesis focuses on the fact that that China is moving to the second step that “Chinese firms have innovation capability and develop sustainable and ongoing R&D activity, which is based on western-Chinese joint ventures”, it is time for China to develop its own innovative capability after 30-years simply importing technologies or imitating technology. What are Chinese innovative capabilities? It means Chinese joint venture firms utilize resources to carry on independent R&D activity, and develop core competitive advantages and foster sustainable innovative capabilities.

Many alliances are created for the primary purpose of learning, with the nature of the learning often uncertain at the outset, (Child, Faulkner and Tallman 2005). However as Powell, Koput and Smith-Doerr (1996) point out:

*“The canonical formal organisation with its bureaucratic rigidities is a poor vehicle for learning. Sources of innovation do not reside exclusively inside firms, instead they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers.”*

It might be expected therefore that the very existence of a new JV will give rise to some innovation as it establishes its place in the organisational framework of the partner companies, and in all probability some will be unexpected innovation. Thus in investigating this subject, we must look for change in the partner companies

subsequent to the establishment of the JV and for innovation in the partner companies and the JV itself.

### **3.5.1. Innovation Definitions**

A number of definitions of innovation have been provided in the literature. One useful definition is that of Bozeman and Link (1983), who attempt a definition thus: “Innovation is the creation of something new. An invention becomes an innovation when it is put to use.” Innovation comes in many guises and is not merely up to date technology, although this is an important part of it. Tidd, Bessant, and Pavitt (2005) argue that there are four distinct types of technology.

- **Product innovation** – this is perhaps the most common form of innovation and is seen in the development of a product that previously did not exist eg the I-Pod, or the development of an existing one in an altogether different way eg the innovation of the radio from a valve-based product to a transistor-based one.
- **Process innovation** – this involves manufacturing in a new way. The most obvious examples here have been in the motor industries. Cars were first made one by one in craft-based fashion. Then we had the assembly line. This was sophisticated by just-in-time manufacturing or inventory control, and then ultimately by the installation of robots for many routine processes. At the same time the ‘lean machine’ approach became popular to replace the assembly line altogether.
- **Positioning innovation** – Tidd et al (2005) give the example of the repositioning of Lucozade from a medicinal drink to a sports drink.

- **Paradigm innovation** – This may be most aptly illustrated by the paradigm shift of the desktop computer from the domain of the technical specialist to that of the everyday manager, used by now as part of his every day life to clicking on icons and sending e-mails.

Doblin Inc (2007), the Innovation Strategy Consulting Company, extend the typology of innovation to as many as ten varieties, as described below:

- Innovative ways of making money – Doblin illustrate with Dell who have managed to collect their money before delivering the orders for their computers.
- Innovation through networks and alliances – here the best innovations are where companies outsource things they are not good at and concentrate on those that they are good at. There are value chain innovations.
- How you support the company's core processes; Doblin illustrate with Starbucks who use young attractive professionals to serve coffee, and pay them well; the opposite of McDonalds.
- Innovation in the core processes themselves, e.g. inventory management.
- Improved product performance; an example here might be the VW Beetle or many years ago the original Morris Mini.
- An improved product system – MSN make software products like other software companies, but they package them so that people buy them as a package e.g. Microsoft Office.
- Service – it is said that the service of Singapore Airlines or Malaysian Airlines is so good that it beats the market.

- Innovative ways of getting your product to market e.g. the internet rather than through salesmen or agents.
- Brand – Doblin give the example of Absolute Vodka and what it stands for as a brand.
- Customer experience – Harley Davidson is the example here. It is said to be a life experience, not just a motor bike to ride on.

Moore (2004) gives us a further taxonomy of innovation:

- **Disruptive innovation.** E.g. Motorola's first generation of mobile phones. This is like Tushman and Anderson's (1986) competence destroying technology that creates new ways of meeting needs.
- **Application innovation.** In this form existing technologies are taken into new markets. Tandem's development of the banking ATM comes to mind here, as does Apple's I-Pod.
- **Product innovation.** This is the most clearly understood form of innovation e.g. when for example Toyota develops the Prius hybrid car.
- **Process innovation:** Dell's streamlining of its supply chain is an example of process innovation that improves efficiency and therefore saves costs.
- **Experiential innovation** finds ways of giving improved service that improves the experience of the consumer.



- **Marketing innovation.** These are common nowadays with the growing use of the internet for marketing by companies.
- **Business model innovation** is another form. An example of this would be in Moore's (2004) description IBM's move from producing computers to providing technologically orientated consulting services.
- **Structural innovation** happens where as a result often of regulation or deregulation companies see new ways of serving a market place as after 'big bang' in the banking industry in the 1970s.

Of course the taxonomies of innovation by the various authors have a large degree of overlap. However all are new and different ways of doing things and many would probably not all be regarded as innovations by the Chinese, where technology through product and process innovations is probably the dominant innovation sought.

The evolution of a developed nation economically is said to be in stages:

- Manufacturing
- R&D(Innovation)
- Branding

China is making some progress eventually on R&D having initially concentrated on manufacturing. The third stage is still largely for the future so innovations in this area in JVs are as important as in the other two.

### **3.5.2. An innovative network**

#### **(1) The Role of Networks in Innovation**

Over ten years the interorganizational networks are becoming very crucial. Networks can build up innovative capabilities, including collecting a large number and different kinds of ideas, accessing resources easily, and enhancing the transfer of knowledge. In formal collaborations, when the firms can not achieve the goals by themselves, the collaborations could help the division of innovative labour so that all the firms can accomplish the goal together. The investments in mutual learning and the diverse collaborations are associated with increased patenting. Patenting is very important to the innovation process.

According to Powell & Grodal (2005), the number of members of a network effectively that share their information and skills depends on the nature of knowledge, conceptualized in term of tacitness or explicitness which are the very crucial factors. It is easier for the networks rooted in a division of innovative labour to transfer tacit knowledge in the form of finished inputs. However, the networks involved in the co-creation of novel ideas may succeed or the networks fail due to the capability to convey and transfer ideas in firms, and the ideas are not easily codified.

Developing the capacity to simultaneously enhance the flow of information among the current member of networks and the new members is another important factor in the networks of innovators. Most research focuses on high technological industries, and patents are used as a proxy for innovation.

## **Formal Ties**

Powell & Grodal (2005), argue that most empirical studies of the relationship between networks and innovation focus on formal ties established among firms. There are also some vital themes including *Tie Characteristics, Technological Uncertainty, Network Evolution and Entrepreneurial Firms*.

*Tie characteristics.* Different types of ties influence the benefits derived from alliances. According to Vinding (2002), the impact of collaboration on innovation is associated with both the type of partner and the pattern of previous collaborative relationships. Prior interaction with partners is very important because the factors such as trust and cognitive understanding need time to build up. Domestic partners have more positive impact on innovative performance than foreign partners because of the higher psychological cost and higher financial cost. Vinding's research emphasizes benefits derived from strong local ties.

Powell et al. (1999) argue that network experience has a positive influence on patenting; the rate of increase diminishes with additional experience. This is the "cycles of learning" process in which R&D collaborations generate attention that attracts other partners, who collaborate in developing ideas. The diversity of affiliations will increase the firm's experience at managing collaborations and transferring knowledge and the firms' centrality in the industry will also be increased. Greater centrality is related to the higher rate of patenting. The R&D partnership will work because of centrality and patenting. And the cycle for centrally placed firm will restart.

Many researchers focus on the presence of a formal collaboration and the absence of a formal collaboration. Ahuja (2000a) analyses the difference between direct ties

and indirect ties, and the level of indirectness. He uses the number of patents to measure the innovation output. Collaboration was measured through formal ties. He finds out that the innovation depends on both direct and indirect ties. The impact of direct is bigger than the impact of indirect.

Ahuja (2000a) also argues that innovation output can be measured by the rates of patenting. Collaboration is shown by more remote network. Close-knit networks are good at transferring tacit knowledge. (Van Wijk, Van den Bosch and Volberda, 2003) Hansen (1999) also claims that tightly knit networks transfer the complicated skills and knowledge.

*Entrepreneurial firms* The survival of a start-up firm will depend on the strength of its networks. The relationship can be built up. It can support the new firm to grow. Larson (1992) suggested that the external resources and key business functions is vital for the firm to grow and prosper. The most important role of the network is to help the firm to gain resources and make the start up company succeed. Shan, Walker and Kogut (1994) claim collaborative relationships increase innovation. Formal cooperative relationships explain innovative output, but innovative output does not account for the pattern of alliances. Stuart (2000) argues that the partners which have technologically sophisticated alliances have higher patenting rates than those that have not enough ties. Firms building strategic alliances with larger partners also grew at a higher rate than firms without partners. The network can help the small and start up firm to get the most patenting.

Baum, Calabrese and Silverman (2000) find a positive effect of alliance formation on innovation. And:

*'Network efficiency, defined as the diversity of information and capabilities per alliance, showed a large positive effect on the number of technological patents.'*

They also claim that alliances with direct competitors had a negative effect on innovation. Overall rates of alliance formation strongly influence the number of patents and the volume of R&D.

*Network Dynamics* Powell et al. (1996) point out that external collaboration can help firms to develop technological fields fast. They find out that the firms that develop experience at managing collaborative R & D relationships will become the centrally positioned firms. The more firm's experiences with collaboration and diversity of partners, the greater the innovation, also the more central the firm in the industry. In turn, the centrality leads will help the size of firm to become bigger and coordinate more alliances. This cycle of learning is a positive effect on financial performance. (Powell et al.1999). The more relationships with diverse partners will help firms stay in a leadership position in the industry. (Powell et al.2005).

Innovation and networks establish a positive cycle. External networks help to create the innovation. At the same time, the more alliance networks the greater the innovation outputs. Both of these two factors support the firm's growths and enhance further innovation. Ahuja (2000b) and Stuart (2000) describes: 'the firms with many prior patents are more likely to form alliances than firms lacking patents'. This suggests that collaborative ties are very vital in the process of innovation and growth.

*Technological Uncertainty* Two extra aspects of the innovation process are the relationship between strategy and alliance formation and the level of technological uncertainty in the field. Eisenhardt and Schoonhoven (1996) show how a firm gains credibility for innovation and hence obtain financial and other resources for

developing innovative technology through alliances. Sarkar, Echambadi and Harrison's (2001) find out that the alliances performance is measured by market share, sales growth, market development and the product innovation. And performance is strengthened by an active strategy of alliance formation. They also describe when the environment is uncertain; the managers are more likely to build alliances. Smaller firms and start-up firms obtained more benefits from the networks than larger firms. Because the smaller companies think the technological landscape is more uncertain.

Networks can provide different kinds of sources of information and capabilities than the firms without collaboration relationships. Both direct and indirect ties have positive influences on innovation.

### **Informal Ties**

The informal ties within organizations have the potential to make an important contribution to innovation. Powell et al (1996) argue that "Beneath most formal ties lie a sea of informal ties." The formal ties are strongly supported by informal connections. (Cross, Borgatti, and Parker 2002)

Von Hippel's (1987) research is the vital studies of informal networks among firms. He investigated US steel mini-mill producers. He finds out that the trading of proprietary knowledge with both cooperating and competitive companies was very normal. The engineers from different firms had strong norms of membership in a professional community. The information trading was an approach to secure reputation and status in the community. Much proprietary knowledge and information was shared in the community, such as production problems, matters of pollution control and so forth. They exchanged information on the issues covering industry-

wide concerns. Interesting when relationships among engineers in rival firms were especially close, more proprietary knowledge was exchanged. He claims that the productivity of mini-mills benefit from the exchange complex information by engineers. The information sharing is not under close managerial control.

Kreiner and Schultz (1993) emphasise that the importance of informal ties through in-depth interviews with university researchers and industry research directors. They claim that successful collaborative R&D alliances are usually based on informal ties.

There are many researches of informal ties that emphasize the importance of trust. Tsai and Ghoshal (1998) find out a strong trustworthiness among business units take place in social ties. The trust increases resource sharing and combination among business units. It contributes to the product innovation. Uzzi's (1997) analyze the "arm's-length" ties and embedded ties. "Arm's-length" ties mean "a deal in which costs are everything". Embedded ties mean "you become friends with these people-business friends. You trust them and their work. They are part of the family." Uzzi find the embedded ties to network partners increase the organizational performance. Embedded ties are good at transferring complex, context-dependent knowledge. The network including only "arm's-length" ties decreases the firms' performance.

Ruef (2002) suggests that the perfect networks structure combine both formal ties and informal ties, In other words, keeping both strong relationship and weak relationships is vital to the process of innovation.

### **Multi-Party Relationships**

Rosenkopf and Tushman (1998) note multi-party relationships connect technical professionals across organizations. Aker (2001) analyzes the IBM user group Share and finds out that the main innovation came out of Share provided the basis

for both system programming and operating systems. The most important advantage of Share network provides the technical standards. The other vital advantage is the diffusion of knowledge among computer companies and users.

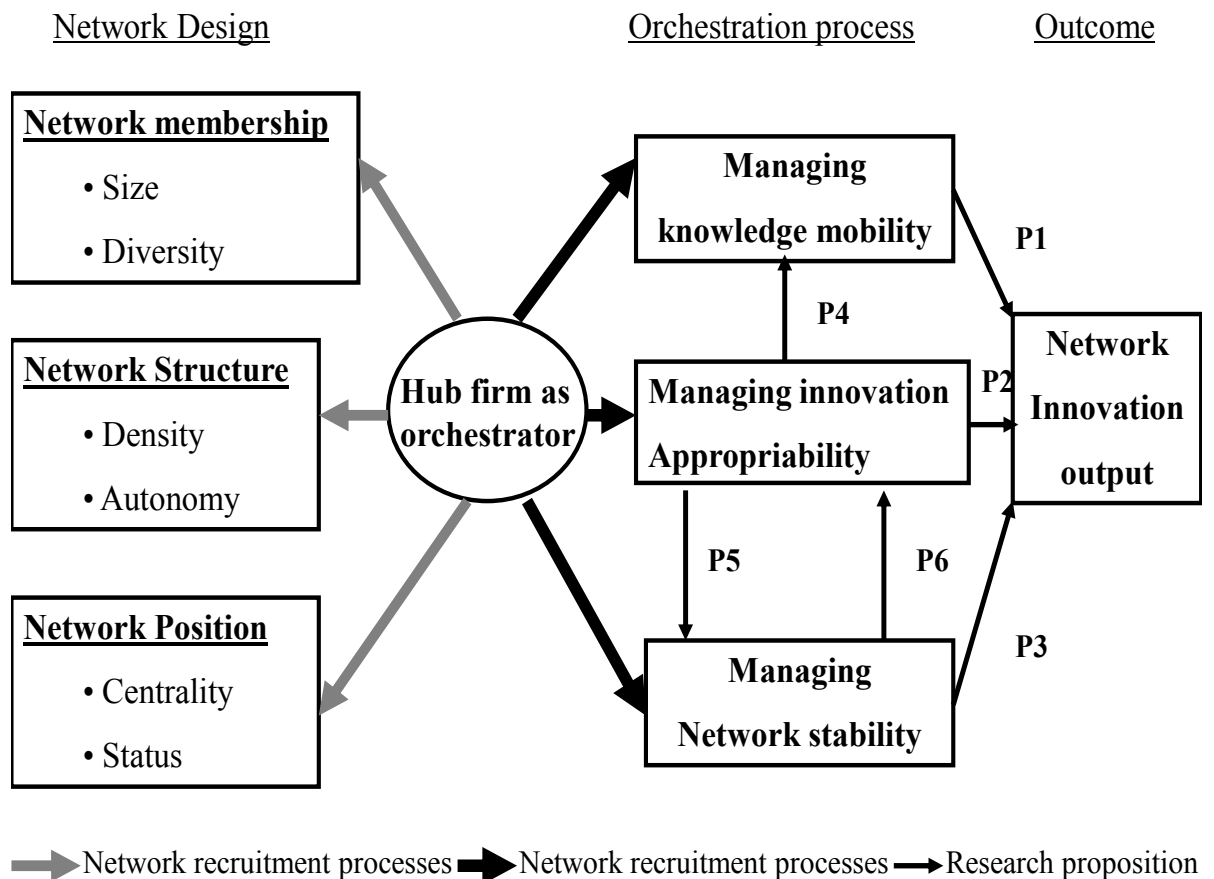
Another large network is the network of scientists. Crane (1972) claims how knowledge grows and how the structure of scientific communities affects the expansion of knowledge. The most important benefit of scientific communities is that the members of the relevant community openly share the research results and information. Powell and Owen-Smith 1998 and Owen-Smith 2003 argue that research commercialization by universities prevents the innovative benefits of scientific communities. And commercial interests stop the information sharing among the scientists.

## **(2) Orchestrating Innovation Networks Theory**

How companies innovate is profoundly impacted by the network form of organization. Dhanaral and Parkhe (2006) explored the process issue in network management which implicates network theory, strategy, knowledge management, alliances and international business. They developed the framework for orchestration in innovation networks. There are three orchestration processes that a hub firm must manage: knowledge mobility, innovation appropriability and network stability.

The orchestration framework has some implications for managers in firms that have large networks. According to Hagedoorn, (1995), the number of alliances per firm has gone up significantly. It is very easily to find large firms managing over 500 alliances simultaneously. This framework provides a way to manage such a large numbers of alliances.





**Figures 3.1: A framework for Orchestration in Innovation Networks**

### (3) Knowledge-Diffusion Networks

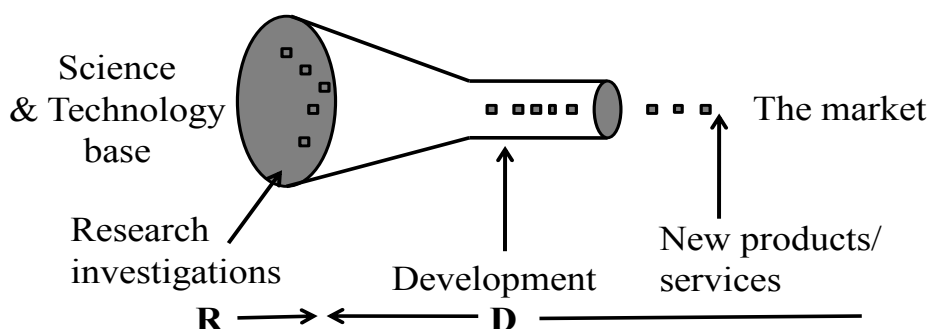
Spencer (2003) examines structural characteristics of knowledge diffusion networks, for example, density levels, centralization levels, and the presence of global knowledge brokers. These contribute to the emergence of dominant designs and the competitiveness of countries' firms and industries. He also finds out national institutional structures and firm-specific influence the development of knowledge-diffusion networks are impacted by national institutional structures and firm-specific attributes.

### 3.5.3. Open innovation system: a new paradigm for understanding industrial innovation

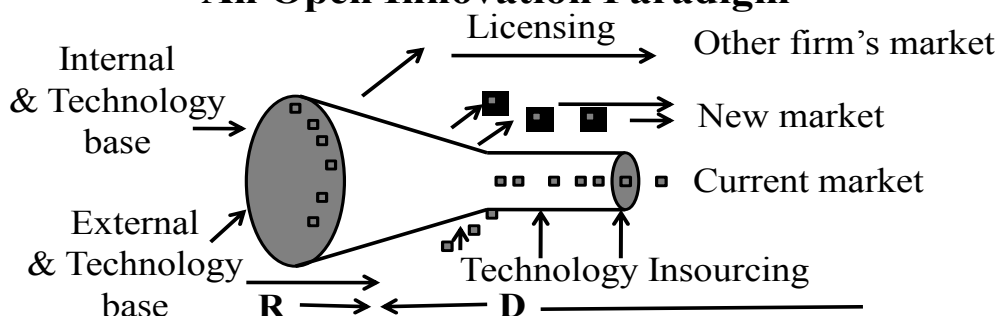
According to Chesborough (2006), the open Innovation paradigm can be described as internal research and development (R&D) activities which lead to internally developed products that are then distributed by the firm. So open innovation is the use of inflows and outflows of knowledge to speed internal innovation, and expand markets for external use of innovation. A firm should use both external and internal ideas, and internal and external paths to market in order to advance their technology.

The Open Innovation paradigm treats R&D as an open system. Open Innovation suggests that both inside and outside the company can bring valuable ideas, which can also go to market from inside or outside the company.

#### The current paradigm: a Closed innovation model



#### An Open Innovation Paradigm



Source: *Open Innovation: Researching a New Paradigm*. Chesbrough, H., Vanhaverbeke, W. & West J. Oxford University Press, 2006

Figure 3.2: The Closed and Open Innovation Paradigms

### **3.5.4. The relationship between firms and universities, particularly their research laboratories**

#### **(1) University Technology Transfer Theory**

At the regional level, universities are engines of regional economic growth, because they can commercialize their intellectual property through technology transfer (Link and Siegel, 2007). According to Link and Siegel (2007), the major university technology transfer commercialization mechanisms are the following:

- Licensing agreement between the university and private firms
- Research Joint Ventures(RJVs)
- University-based start-ups

In many countries, national governments have provided support through:

- Legislation to facilitate technological diffusion from universities to firms
- Collaborative research
- Subsidies for RJVs involving universities and firms
- Shared use of expertise and laboratory facilities

Along these lines, national, state, and regional government authorities have also supported science parks and incubators.

#### **(2) The institutional contexts of university technology transfer**

University technology transfer is usually done through licensing and new business formation. The institutional structure, organizational capability, and incentive systems to encourage participation by researchers are the key success factors of a

university's licensing program. Specifically, informational and cultural barriers existed between universities and firms, especially for small firms. Clarke (1998) found the importance of institutional norms, standards, and culture. He concluded that an entrepreneurial culture at those institutions was a critical factor in their success.

Franklin, Wright, and Lockett (2001) observed UK universities regarding entrepreneurial start-ups that emerge from university technology transfer. They distinguished between academic and surrogate (external) entrepreneurs and old and new universities in the United Kingdom. Old universities accept entrepreneurial start-ups because they have excellent and established research reputations, and world-class professors. New universities are not good at academic research and they do not accept entrepreneurial easily. The most significant barriers to the adoption of entrepreneurial –friendly policies are cultural and informational. The old universities have the most favourable policies according to external entrepreneurs. In China the link between Universities and manufacturers is not well developed at all.

### **(3) Industrial Linkages with universities**

The innovative activities in business firms have become more professionalized, and university research more specialized. Universities play an important role in providing trained researchers for a company's innovative activities. Firms also realize that universities can provide them very effective processes, and they also can benefit from long-term research programmes in universities which help their current and future activities.

Companies and universities carry out different functions in the innovation process (Pavitt, 2005). Firstly, university scientists make discoveries through fundamental research; then business companies turn the discovery into a marketable product or

service that can generate commercial profits. So the company may cooperate with the university scientists to exploit it. This exists extensively in the chemical industry, and in biotechnology and pharmaceutical industries.

Secondly, the trained researchers are familiar with the latest research techniques; they are also becoming part of worldwide research networks in their research field. These are very useful for the company. Martin and Salter (1996) state that many industrialists think the above are the greatest benefits provided by the universities. There have less direct applications in mechanical engineering than research in chemistry, but universities still can provide mechanical engineers trained in simulation and modelling techniques that are vital in design and development of automobiles and aero-engines.

Thirdly, there are some complementary interactions between companies and universities. The collaboration process links the university research with industrial innovation. It includes direct industrial funding of university research, university-based consultants, and the exchange of researchers between industry and academia.

As Pavitt (2005) emphasises, there are three features of university-firm links:

- *The importance of personal and often informal contacts.* Informal relationships provide the practitioners with entry points into the academic world. Through informal relationships, they can know the most important developments and the relevant people to interact with. The researcher can also know about the industry's current problems and become aware of the company's leading edge technology. As Hicks (1995) mentions, industrial publications in scientific

literature can be signals to the wider academic community of fields and problems of industrial interest that benefit from more intense personal exchanges.

- *Much university research that is useful to industrialists is also valued by the academics.* Some academics separate industrially relevant applied work and fundamental research. This is the reason why some universities make technology transfer into a Business Company. Mansfield (1995) and Narin et al (1997) suggest that most industrial research is publicly funded, researched in universities and published in top academic journals.
- *The University also indirectly contributes to the industry.* Because the researchers in the university train the graduates, the graduates learn research methods. When they are employed by the business company, they can bring their new theoretical insights, new techniques, and new skills to the industry, and all these skills cannot be obtained from industrial firms alone. The graduate will work either for an industrial company or for consultancies which provide the innovation-supporting services to industrial companies.

Some fields of university research, including many fields of biotechnology and some of software provide an increasing number of inventions with potential industrial applications. University licensing activity in university-founded spin-off firms and private funding of university research are increasingly common nowadays.

University-industry relationships are vitally important. Business managers always complain that universities extend the timeline by ignoring the urgent deadlines of industry. Companies argue that universities should not be nominated as the leader of many important projects as they are not generally time aware. However universities

feel that they are often treated as cheap performers in industry projects. The government and research councils encourage 'technology transfer' between universities and industry. As Salter et al (2000) mention in the worst situation, some industry programs only focus on the short-term requirement of industry, but should use the long-term quality of universities' basic research, graduate training, and experimentation more extensively. Technology transfer programmes are usually based on innovation in universities, in which the university does the science or basic research and generates innovation for industry to take up in its engineering, manufacturing, and marketing activities.

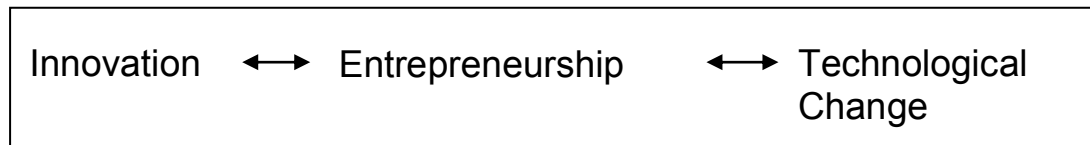
### **3.5.5. The relationship between firms and research institutes**

According to Link and Siegel (2007), research partnerships involve firms, research institutes, universities, nonprofits organizations, and government agencies. There are different types of research partnerships: Research joint ventures (RJVs); Strategic alliances and networks involving high-technology organizations, research institutes, Industry consortia; Cooperative research and development agreements involving federal laboratories and firms, engineering research centres; industry-university cooperative research centres; federally funded research and development centres; Science/research parks and high-technology incubators (many of which are located at universities); Licensing and sponsored research agreements involving universities, government laboratories, and firms, and university-based start-ups. The research partnerships can be attributed to three public policy initiatives:

- Promote technology transfer from research institutes to firms
- An increase in the incidence of public-private partnerships

- Relaxation of antitrust enforcement related to collaborative research

The research institutions and government agents are all involved in the innovation and entrepreneurship. Innovation, entrepreneurship and technological change, these three concepts are interrelated. One affects all others as shown:



**Figure 3.3: The interrelationship between Innovation, Entrepreneurship and Technological Change**

### **3.5.6. Strategic planning as a framework for innovation**

Taylor (1984) describes that strategic planning act as a central control system, a framework for innovation, an organizational change process, a political activity, and a way of exploring the future. Strategic planning should provide a framework for the generation of new products and new processes and the entry into new markets and new businesses (Taylor, 1984).

Taylor (1984) states that setting up a central steering mechanism for the direction and coordination of large, diverse, multi-national operations is needed by the growth of business planning. Corporate needs encourage creativity and innovation to decrease centralization and bureaucracy. The process of innovation is vital to survival for a competitive business, which is an investment for the future of business. Company need to keep the leading position in their industry by re-investment in employees training; market development, new products, and new advanced equipments (Taylor, 1984).



According to Taylor (1984), the process of entrepreneurship is a central function of the businessman, it involves:

- Identifying an opportunity in the market
- Developing a product to match the opportunity
- Raising the enough finance and matching the risk to the opportunity
- organizing the staff and the other resources necessary to provide the required service
- produce and sell the new product to the market to gain the profits

Strategic planning is regarded as a form of ‘organized entrepreneurship’ in many corporations (Taylor, 1984).

**Table 3.1: Strategic planning: basic approach as framework for innovation**

	<b>Framework for innovation</b>
<b>The focus</b>	Developing new business
<b>Important ideas</b>	A vehicle for commercializing innovation
<b>The elements</b>	(1) Commitment to innovation (2) Funds for new development (3) Strategies for corporate development (4) Organizing project teams and action programmes
<b>The techniques</b>	Programmes for: (1) Divestment (2) Diversification (3) Acquisition (4) New product development (5) Market penetration and development

*Adopted from “Strategic planning five basic approaches”*

### **3.5.7. Developing Intellectual Property Rights (IPRs)**

Studies of the economic theory of the patent system have emerged since the 1960s.

Arrow (1962) describes a model of invention, R&D innovation and imitation. Patent

can benefit innovation through controlling the rate of imitation. In Arrow's model, imitation can decrease innovator's profit completely. And innovator become the monopolistic patent holder and sell over-pricing products, and they can carry on invest in R&D during patent protection. And the imitation is delayed by patent protection (Granstrand, 2003). Nordhaus (1969) researches on the economic theory of patents and theoretical analysis of the cost and benefits to the firm and the patent system. The length of patent protection increase, incentives for generating innovations is increased.

Fisher (2001) describe that any firm could use if for free once the innovators show their breakthrough to the whole industry. The pace of technological innovation will decrease if new products can be replicated easily. Helpman (1992) express the similar view that competitors always try to imitate successful innovations and use them in their own products. And the innovators cannot be repaid the costs of their innovations, including the costs of the innovators' education and training for preparing innovations, costs of research and development, etc (Fisher, 2001).

An empirical study on intellectual property rights and innovation in developing countries, Chen and Puttitanum (2002) studies the relationships between intellectual property rights and innovation in developing countries. Through analyzing data of 64 developing countries over the 1975-1995 periods, they state that the imitation of foreign technologies when IPRs is not strong, domestic innovative activities can be stimulated by strong IPRs. Innovations in a developing country increase in its IPRs (Chen and Puttitanum, 2002).

## **The Role of IPRs in Innovation Systems**

Old types of rights include patents for inventions (judged as sufficiently novel, non-obvious and useful), trade secrets, copyrights, trademarks, and design right, and database right. Until recently, IPRs had the central position in economic policy, national competitiveness and social welfare. (Granstrand, 2005)

'Trade related aspects of IPRs' (TRIPS) are only the latest links between trade and intellectual property protection. Us-originated pro-patent or pro-IP era appeared since the 1980s. In 21 century, knowledge (and information), innovation and intellectual capital become the strongest basic of the new capitalist economy. And different kinds of forms of IP show extensions of old and creation of new types of rights.

Levin et al (1987) argue that innovation could happen in the absence of patent protection. The patents are not sufficient to obtain all the benefits from innovation. Yale study revealed 'nation- and sector-specific differences in the use of patents, secrecy, lead times and other means for appropriation of the returns from innovation. (Cohen et al.2003).

*Differences in IPRs across Sectors* Mansfield (1986) emphasizes there are inter-industry differences in IPRs rates caused by, such as

*'Industry and market structure (competitive conditions, size and diversification of firms, barriers to entry, market growth, R&D intensity etc.), the nature of the technology (technological opportunities, codifiability, capital intensity etc.) and the nature of IPRs (patents for technology, copyright for software and creative industries, trade markets in mass consumer markets, etc.)'.*

Patents support the growth of knowledge-intensive industries. Arora et al (2001) claim in the later stages of industry evolution, the R&D scale is high and barriers to

entry are against small company. Small firms license their new technologies to established firms specializing in the later stages of the innovation process, or they are acquired by the established companies.

*Differences in IPRs across Nations* Dutton (1984) mentions that many countries, including Japan, successfully industrialized in the presence of a patent system, other countries, such as German, Holland, and Switzerland did not. (Kaufer, 1989) Lerner (2000) examines 177 policy changes in 60 countries over the past 150 years. He find out the changes increasing patent protection had much stronger effect on inward patenting by foreigners than on patenting by domestic entities.

TRIPS may be regarded that the leading countries and firms obtain more economic returns of their R&D and make developing counties pay more to catch up. (Granstrand, 2005)

### **3.5.8. Innovation in “Low-Tech” industries**

#### **(1) Classification of Industries**

For a firm, the R&D/Sales ratio is used to classify a high-tech or Low- and medium-Tech (LMT). For an industry, the ratio of business expenditure on R&D (often known as BERD) to total production or value added is used for classify. For a country, it is gross expenditure on R&D (GERD) to GDP. OECD, using BERD/Production ratio, classify industries into a four-tier model:

High-tech industries	>5%		R&D/Production
Medium high-tech industries	>5%	>3%	R&D/Production
Low-tech industries	>3%	>1%	R&D/Production
Low-tech industries	>1%	>0%	R&D/Production

## **(2) Factor Intensity**

Innovation is rapid in high-tech industry and LMT industries, the high-tech industry shows rapid innovation. According to Tunzelmann and Acha(2005), The LMT industries are mostly related with the developing countries because there is labour-intensity in the developing countries. “Low-Tech” industries as food processing are highly capital-Intensive (e.g. tobacco and many beverages), and “Low-Tech” industries as building materials (e.g. cement). Labour- intensity or capital-intensity is decided by their economic environment. The same industry may be capital-intensive in the USA and labour-intensive in China.

## **(3) The key drivers**

Tunzelmann and Acha (2005) states the drivers of change in low, medium, and high-tech industry can be from the products or from the technologies.

Table 3.2: Classification of industries based on R&D intensity

	ISIC Rev 3	Direct R&D Intensity 2005	Acquired Intensity as % of direct R&D intensity, 2005
<b>High technology Industries</b>			
Aircraft and spacecraft	353	12.7	15
Pharmaceuticals	2423	11.3	8
Office, Accounting and Computing Machinery	30	10.5	25
Radio, Television and Communications Equipment	32	8.2	17
Medical, Precision and Optical Instruments	33	7.9	29
<b>Medium-high- technology Industries</b>			
Electrical Machinery and Apparatus	31	3.8	42
Motor Vehicles and Trailers	34	3.5	29
Chemicals	24 exc 2423	2.6	18
Railroad and transport eqpt. n. e.c.	352+359	2.8	88
Machinery and eqpt n.e.c	29	1.9	104
<b>Medium-Low- technology Industries</b>			
Coke, refined petroleum products and nuclear fuel	23	0.8	30
Rubber and Plastic products	25	0.9	127
Other non-metallic Mineral products	26	0.9	285
Building and repairing of ships and boats	351	0.7	200
Basic Metals	27	0.7	289
Fabricated metals Products	28	0.6	133
<b>Low-technology Industries</b>			
Manufacturing n.e.c and recycling	36-37	0.4	n.a.
Wood, pulp, paper, paper products, printing and publishing	20-22	0.3	167
Food Products, Beverages and tobacco	15-16	0.4	267
Textiles, Textile products, Leather and footwear	17-19	0.3	250

Sources: OECD, Science, Technology and Industry Scoreboard 2005: Benchmarking Knowledge-Based Economies (Paris: OECD 2006), Annex 1, P.106; OECD, Science, Technology and Industry Scoreboard 2001: Towards a Knowledge-Based Economy, Annex 1.1, pp. 13-139.

### **(a) Demand Differentiation**

*Quality innovation* According to Tunzelmann and Acha (2005), Producing for new market is an important way for the recovery of older industries. Producing the same type of goods for untouched regions work well for the brand name companies, for example, Coca-cola, and producing different types of the same categories of good (“product differentiation”) is crucial for resurgence. Within given market, income change of demand will also affect the product growth. For example, when the customers’ salaries are increased, the responsiveness of consumers will influence the products. Because many products are comparative “Necessities”, the low-tech industries have the inelastic demands. LMT industries need to find new products to attract the custom of higher earners. The availability of advanced technologies becomes one of the most important factors for innovation strategies in LMT firms.

*New Tastes* According to Tunzelmann and Acha (2005), except the quality upgrading, consumers may choose the products with new characteristics. High-tech industries have strong innovative capabilities to have product innovations. LMT industries also need to have innovation. For example, automobiles, energy generation and food get the pressures from communities and from the governments to produce safer and more environmentally friendly products. And the processes that produce these outputs also face all these pressures.

According to Grossman and Helpman (1991), both the potential for developing higher-quality products (“quality ladders”) and new products compensate the maturation of older industries and develop the new products and trade patterns. And the adding value in processing and in new products is very important. How and how

well firms in LMT industries can alter their products and services through developing better products or new products is the challenge for innovation strategies.

**(b) New Technological Paradigms: General purpose Technologies and learning in LMT Firms**

According to Freeman and Perez (1998), Freeman and Louca (2001), certain new technologies can spill out of their original industry and be used by older industries. Key technologies often have the property of being able to become “Pervasive” through their take-up in one industry after another. Helpman (1998) states industrial revolution is generally constituted of several of these “general purpose technologies”. The general-purpose technologies associated with the third Industrial Revolution provide the new chances for LMT industries to develop their innovative and economic performance through application of ICT, biotechnology and the smart materials. The properties of these technologies are the high-tech industries of their day and spread to adopting industries. It contributes the significance to LMT industries.

In LMT industries there is little formal learning by science and technology, at least at the firm level. The innovation-related learning and adopting- related learning activities operate in LMT industries. The downstream LMT industries need to use upstream developments productively by having “absorptive capacities”. According to Cohen and Levinthal (1989, 1990), absorptive capacities are best inculcated by doing some of the innovative activities oneself, even may replicate other firm’s innovation outcome. Nelson (1993) describes the national system innovation emphasise formal science is united in national or regional laboratories instead of being internalized within firms in LMT industries. The firms in LMT industries need to



have “absorptive capacities” to absorb and apply the science products of national and regional laboratories.

#### **(4) Firms and corporate change in LMT Industries**

*Strategy in LMT Industries* According to Porter (1985), there are three main types of corporate strategy, including cost leadership, differentiation, and focus. Cost leadership is usually in “mature” LMT industries which depend on the process innovation to decrease cost although the innovative sparks mostly disappear. Branding is the very important to the choice of a differentiation strategy, because customers mainly choose the products with high reputations.

*Functions and structures of the firms* LMT firms and industries have the similar tasks with any other science-based industry, whereas LMT industries more focus on product/marketing functions rather than technology functions. As mentioned Porter concept of corporate strategy, according to Tunzelmann and Acha (2005), the frame is the filter through which the strategies are developed and chosen. The filter is decided by individual and mediated at the organization level by senior management. According to Orlikowski and Gash (1994), Orlikowski (2000), managers understand the firm’s position and opportunities as well as their innovation system through this technology frame.

The frame concept is related with the innovation in LMT industries. Firms in LMT industries usually are not selling technology, they are using technology. These firms mainly adopt technology, whereas technology in the firms in high-tech industries is the most important selling points. Even in the LTM industries, firms are also different. The market characteristic of LMT industries promote different firm to have different interpretations about the role of technology for commercial success. The market is

segmented. Product differentiation, cost efficiency and control of complementary assets decide the competitive advantage.

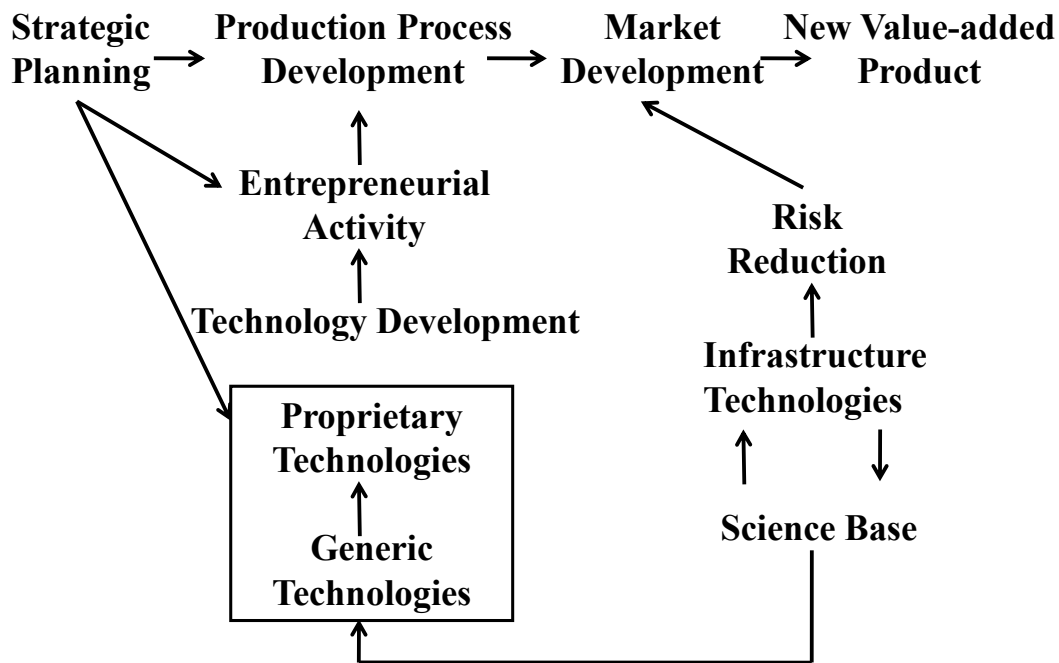
In high-tech industries, technology is the key to the commercial success. And the technology frame may consensus in these high-tech firms because (1) the market is only related with fewer products and technologies. (2) There is increasing appropriation of technology through IPR in high-tech industries. (3) Regulatory environments mainly play a structure role. (E.g. biotech) In summary, variation in technology frame in high-tech industries focus on how the technology should develop, on contrary, variation in technology frame in LMT industries emphasise more about what the role for technology should be.

#### **(5) Change at the industry Level**

Vertical Alignment and Networks According to Tunzelmann and Acha (2005), the structure of the industries can be affected by the changes in firms' size, integration and diversification. Firms usually develop the close relationship with upstream suppliers and downstream customers. It is very important in motor vehicle industry. Many firms operate as "system integrators", acting as the hub for operations immediately connected to their central activity. They outsource the related activities, they may just produce a minority of the value added by their "system". Every integrator needs the networks of suppliers and related activities.

#### **(6) Model of Innovation in Manufacturing Sector Firms**

Tassey (1997, 2005) created the model of innovation activity relevant to technology-based firms in the manufacturing sector. Gallaher, Link, and Petrusa (2006) and Link (2006) expanded this model. The figures illustrate different technology elements within the overall model of innovation.



Sources: NIST (2005) and Gallaher, Link & Petrusa (2006)

**Figure 3.4: Model of innovation relevant to the manufacturing sector**

According to Link and Siegel (2007), Science base is the root of the model. Science base is the accumulation of scientific and technological knowledge. The science base resides in the public domain. The investments in the science base come from basic research. The government mainly funds basic research. Universities, federal laboratories and some large companies globally perform the basic research.

Technology development, in the form of basic or applied research, begins within the firm's R&D laboratory. Technology development involves the process of application of the scientific knowledge from the science base and leads to a new technology. It will create a generic technology. If the generic technology has potential commercial value, then the next step is applied research. If successful a proprietary technology results (Link and Siegel, 2007)

Basic, applied, and development research are the result of the company's strategic planning. Strategic planning defines the environment for entrepreneurial activities. And entrepreneurial activity influences production process development. Technology infrastructure supports the processes that leads to both generic and proprietary technologies, and hence technology development.

Markets do not always accept new technology because of the transaction costs and interoperability. The transaction costs are compared with the contribution of the new technology. The interoperability is between the new technology and the existing technologies. Infrastructure technologies can both reduce the market risks and speed market development.

In China things are altogether different. Companies and research institutes still operate very distinctly from each other, and are often not part of the same network. As Gu (2005) points out "Another difficulty is that Chinese manufacturers don't have sufficient intellectual property and cutting edge technology. Instead they must pay high prices to buy technology from the outside world."

### **3.5.9. Innovation In services industries**

Services innovation is become the increasing interest fro innovation researchers and policy makers. In the last decade, services have become larger part of employment and output in most industrial counties. The services industries of these economies are important for their productivity, economic competitiveness, and the quality of life. But the innovation in services is very important except the economic importance. Innovation in services affect services activities extending beyond the service sectors in all sectors of the economy.

### **3.5.10. Innovation in Developing Countries**

In the nineteenth century, 'foreign' technology and its international diffusion are the most important factors that contributed to the industrialization both in Europe and the United States. It also impacted strongly the industrialization in Japan in the twentieth century. Nowadays, in the twentieth-first century, there is the rapid industrialization of the newly industrializing countries. Or it is called 'dynamic Asian economics', for instance, South Korea, Taiwan, Singapore, and more recently China, India and Indonesia. Developing countries had higher growth rates than those of the developed countries during the 1980s and 1990s. (Freeman and Soete, 1997)

Freeman and Soete (1997) analysed how technologies evolve and diffuse and under what conditions 'effective' technological catching up will happen. His research focused on in-depth historical studies of countries in the production and use of particular technologies (Ames and Rosenberg, 1963). He emphasises the historical institutional framework within which the process of imitation/technological catching up will happen.

Making development happen requires previous capital to produce new capital, previous knowledge to produce new knowledge, so it is with the technology. Technological 'locking out' of underdevelopment opposes the international diffusion of technology. (Associated with IP) In some of the neo-technology international trade, the further international diffusion of the technology to 'less developed' countries takes place. These countries acquire comparative industrialization advantage in low tech mature products and industries through the 'use' of imported technologies. The capability of creating and improving new technology rather than the simple 'use' of technology can make technological catching up happen. In

summary, these countries must become the imitators or innovators of the new products or processes. In the beginning of the new technologies and industries, small companies make the most important contribution.

In house process innovation is different from open market product innovation. Technical uncertainty needs to be solved in Product innovation. Whereas, both technical uncertainty and market uncertainty need to be solved in in-house process innovation.

According to Freeman and Soete (1997), the decision-makers decide to implement an innovation project in the company according to three parameters, as following:

- 'The probable costs of development, production, launch and use of marketing of the innovation and the approximate timing of these expenditures.'
- 'The probable future income stream arising from the sale or use of the innovation and its timing.'
- 'The probability of success, technically and commercially.'

### **National Innovation System (NIS) in India**

Joseph (2005) argues there was a rise in foreign collaboration for technology import, investment in R&D, industry academia interface, growth of GDP, foreign exchange reserves and FDI inflows. He also highlights:

- Indian enterprises are also making outward investments as a part of their internationalisation process.

- Some Indian enterprises are emerging as multinationals in knowledge based industries such as in pharmaceuticals, automotives, and IT software and Services.
- India is also emerging as an R&D Hub for MNCs

Joseph (2005) explains:

*“The main issue was the failure of the factor in the role of NIS (National Innovation System). A country that invests increasingly in R&D and having larger share of its imports from advanced countries with higher technological knowledge is likely to experience faster TFP growth. India’s investment in R&D as a proportion of GDP increased from about 0.35% in 1970-71 to 0.62 percent in 1980 and increased further to reach an all time high level of 0.96 per cent in 1989-90. The rate of growth in the number of engineering graduates increased from 0.61 per cent during 1968-79 to 4.64% during 1979-89.”*

However, he also addresses many challengers, such as, Declining R&D; Weak interface with academia at large; poor quality of manpower and new patent Regime and others. Although there has been a boom in sectors like IT and software as well as off shoring of R&D services by MNC’s, their research and work is not addressing India’s problems and issues but mainly global ones.

### **National Innovation System in Thailand**

Intarakumnerd (2005) claims private companies, government, universities, private bridging organisations, financial intermediaries and institutions are playing different role in the National Innovation System of Thailand. He analyses the role played by various actors such the government, universities, private firms, private bridging organizations, financial intermediaries and institutions.

“Thai firms regarded research institutions as less important sources of knowledge and information. On the contrary, 53 percent of Korean firms regard universities and research institutes as the sources of knowledge and information. Only 36 and 29 percent of Thai firms considered so respectively. ”

Intarakumnerd (2005) also highlights the fact that the proportion of innovating firms is low in Thailand. The share of product and process innovating companies in Thailand only added up to 2.9 percent compared to 21 percent in Korea. He also outlines the major characteristics of organisations in Thailand:

- Limited roles in diffusing innovation, unlike Japanese industry associations in R&D consortium in the 1960s.
- Limited roles in building trust among members
- Mostly represented vested interests (FTI, TCC), focus on political bargaining. A few like Thailand-Japan Technology Promotion Association (TPA) and Kenan Institute Asia performing knowledge brokers/diffusion roles, and assisting local firms to increase technological/managerial capabilities.”

### **National Innovation System in Vietnam**

Sinh (2005) highlights the needs why Vietnam’s transformation to NIS is he believes inevitable:

- “Vietnam is undergoing double rapid transitions: from centrally planned to market economy and Regional integration”
- “Implications on relationship between R&D institutions and enterprises including private ones”



- “First introduction of concept by IDRC mission to Vietnam in 1997 NIS provides theoretical framework in understanding the dynamic interaction between actors involved in innovation, not only public R&D institutions and enterprises.”

Sinh (2005) explains Weak interaction among actors on NIS arises because relationship between research and industries is still very weak. He argues that the enterprises do not rely on the support of the local R&D institutes for their technological innovation. Very few enterprises participate in large state research programmes and projects. And there is lack of information channels and intermediary agencies for facilitating the innovation process. Also, the structure of a centrally planned economy still dominates.

According to Sinh (2005):

*“Lack of motivation for innovation had four major reasons. There was limited technology learning among enterprises from foreign partners including FDI projects. Due to secret keeping tradition and inadequate protection of IPR, the innovation system is more static with limited flows of knowledge. There is lack of intermediary institutions and services. Finally, there is no venture capital.”*

He suggests transformation of industrial technology R&D institutes as the policy options for gradual restructuring of the existing NIS where: building R&D capabilities in enterprises through spin-in and spin-out transformation; a change on role and functions of R&D institutes knowledge producers, users and brokers.

## **3.6. Literature on the Innovation process**

### **3.6.1. Corporate innovation Processes**

Innovation processes vary in many aspects according to the industry, national economy and period of study. Innovation processes also are different according to

the size of the corporation, its corporate strategy, and its prior experience in innovation. Economists focus on the economic incentives for innovation and innovation effects. Organizational specialists are interested in the structural and procedural correlates of innovative activities and processes. Sociologists concentrate on the social determinants and consequences, whereas managers care more about how to develop innovatory products of services leading to competitive success and profit.

Pavitt (2005) explains the general framework for the innovation process.

*“Firstly, the innovation process includes the exploration and exploitation of opportunities for new or improved products, processes or services. It is based on an advanced technical practice (know-how), or a change in the market, or a combination of the two. Secondly, innovation is uncertain; it is very difficult to predict the cost and performance of a new product, and the reaction of users. It involves processes of learning through either experimentation (trial and error) or improved understanding (theory). The processes of competition in capitalist markets thus involve purposive experimentation through competition among alternative products, systems, processes, and services and the technical and organizational processes that deliver them.”*

Pavitt (2005) states the innovation process has evolved and has gone through major historical transformations. There are three key features of the innovation process.

- *The production of scientific and technological knowledge:* Since the industrial revolution, the production of scientific and technological knowledge becomes specialized by discipline, by function and by institution. History and social science, technology and business contribute to the understanding of this transformation.

- *The translation of knowledge into working artefacts:* nowadays scientific knowledge develops sharply, whereas the theory is not sufficient for guiding technological practice. There is the growing complexity of technological artefacts. Technological and business history contributes a lot to this transformation.
- *Responding to and influencing market demand:* This involves the process of matching working artefacts with users' requirements. The opportunities to transform technological knowledge into useful artefacts are influenced by the nature of products, users and the methods of production. In the competitive capitalist system, corporate, technological and organizational practices evolve together with the market. Social change, innovations in marketing and market research has been devoted to the challenge of matching technological opportunities with market needs and organizational practices.

### **3.6.2. The production of scientific and technological knowledge**

According to Pavitt (2005), there are three forms of corporate specialization: firstly, the development in large manufacturing firms of R&D laboratories specialized in the production of knowledge for commercial exploitation, secondly, the development of a myriad of small firms providing continuous improvements in specialized producers' goods and thirdly, the trend of specialization to change the division of labour between private knowledge developed and applied in business firms, and public knowledge developed and disseminated by universities and similar institutions.

#### **(1) Functional Specialization and Integration: Industrial R&D Laboratories**

The industrial R&D laboratory is a major source of innovation in the modern economy. It first happened in Germany in the chemical industry and in USA in the

electrical industry. It is the general process of functional specialization of large manufacturing firms. There are radical innovations in materials processing and forming. The industrial research laboratory also provides companies with lots of useful knowledge from fundamental advances in chemistry and physics. These new laboratories help companies to get new access to new technologies from other companies.

According to Rothwell (1992), the vital reason for successful innovation is the degree of collaboration and feedback between product design and other corporate functions during the innovation process, especially in manufacturing and marketing within the firm. Forrest (1991) explains that many product designs are technically difficult to manufacture, or do not cater adequately for user requirements.

Clark and Fujimoto (1992) state that Japanese automobile firms use senior project managers to control resources within the company, and these project managers can report directly to the senior management team at the same level as the departmental manager. But the department managers are reluctant to give up their control over their resources and object to the 'heavyweight' manager. A lot of large firms provide formal training in project management to their project managers. The training includes many issues, for example, management of fast-moving project teams responsible for integrating research outputs, conceptual and detailed design, and various engineering functions, and the ability to react efficiently to customers' requirement during production process.

According to Leonard-Barton (1995), in the automobile industry, the benefits from economies of scale and cost reduction from the use of common components can be substantially reduced by the use of 'heavy-weight' project managers.

## **(2) Characteristics of innovation process**

The varying characteristics of industry innovation contribute to inter-industry variety in the structure and management of the innovation processes. In the twentieth century large manufacturing firms exploit specialized knowledge, and in-house R&D laboratories for innovation purposes, and many small firms provide the specialized producer goods necessary to turn the innovations into marketable offerings.

According to Pavitt (2005), Innovation processes have many characteristics and much variety. Firstly, nowadays knowledge is increasingly specialized and professionalized, manufacturing companies are path-dependent. Path-dependency reflects the conservatism of professional and functional groups. For instance, it is very difficult to turn a textile company into a semiconductors company.

Secondly, firms that specialize in different products and related technological fields focus on different features of innovation processes. This demonstrates the nature of the knowledge and competences that they are based upon. For example, automobile firms concentrate on the useful feedback between product design and manufacture. Whereas pharmaceutical focus on the feedback between product design and university research. Small innovating firms largely depend on users as the main source of innovation, but when firms sell to a big market of users who do not have technological capabilities, for example, then users cannot be the main source of innovation.

Thirdly, the innovation process is different in large companies and small companies. In large firms, innovation involves a lot of employees in specialized functions. And the innovation process has obviously procedures, including the formal and informal. In small companies, there are not many resources involved. The capabilities of

executive managers influence the decision on the recognition of chance, resources allocation, and functional activities.

The above aspects reflect the variety and contingent nature of the innovation process.

### **3.6.3. Transformation of Knowledge into Working Artifacts**

Pavitt (2005) mentions that when managers transform knowledge into products, systems and services, they need to understand the industries; in particular government-funded R&D programmes and how to manage uncertainty.

Governments usually fund the technological activities in opening and exploiting innovative opportunities. For example, the success of government-funded programmes includes ICT in USA which is a military-related programme, the early development of computers, semiconductors, software and the Internet. Military programmes have also been widened to include civil aviation in the USA. In Japan and France the government has funded the development of high-speed trains.

According to Floyd (1997), since the 1980s there have been many government-funded programmes in developed countries; for example, 'pre-competitive' collaborative R&D in Europe (ESPRIT and Eureka), the USA (Sematech) and Japan (5G ICOT Program). A lot of major companies have had the opportunity to become involved in these programmes. The companies need to evaluate the potential benefits to achieve corporate goals. They also need to evaluate the financial and organizational cost of participating, and the risk and involved in not participating. The companies also need to consider how to make the government programme suit the corporate long term strategy plan.

It is not easy to summarise the recent history of how government supports industrial innovation. All government-funded programs involve the following factors: the technical lobbies successfully persuade government to financially support the programs; the program in fields related closely to military applications; large-scale infrastructure, for example, transportation, energy, housing and communications. This process can help not to be limited by the commercial constraints and to premature commitments to particular designs. Economists emphasize the potential cost of these programs, but government support can speed up the critical technological learning at a time when purely private markets are not ready to take the risk. The early development of ICT in the USA suggests the importance of variety and experimentation in government support for technological progress.

### **Managing Uncertainty**

Specialized R&D and related activities in business companies have become institutionalized and predictable sources of discoveries, inventions, and improvements. However, the process of innovation is complex. It includes many variables, and the properties and interactions of these variables are imperfectly understood. Companies cannot predict accurately either the technical performance of major innovations, or their acceptability to potential users. And they also cannot predict the technical and commercial outcomes of their innovative activities. Research scientists and engineers often are over-optimistic about the costs, benefits, time periods, and market demand for the products. According to Freeman (1982) and Mansfield (1995), there is a wide variation in the ratio of *ex post* outcomes to *ex ante* estimates of investment or profit within corporate portfolios of projects. As Guilloches (1990) points out a disproportionate share of corporate R&D spending leads to commercially unsuccessful projects.

Business companies can seldom predict all possible uses from their innovations, especially radical ones. There are a lot of special successful technologies and innovations where companies do not expect a high profit outcome at the beginning. For example, in the early twentieth-century the pioneers of radio communication designed it as a system of point-to-point communications, especially between naval vessels, later on they developed massive radio communications. According to Schnaars and Berenson (1986), the founder of IBM predicted the worldwide computer market as no more than five major computers. Recently, there has been a very inaccurate forecast of world market for mobile phones, and there are also other related functions, for example, text messages, the internet, and MP3 players.

Corporate managers have difficulty in dealing with innovative activities. The innovative activities have several elements, for instance, the investment market; continuous feedback from the market; experiences and experimentations. Top-down corporate vision is not good for the innovation strategies. For example, the reason for Ericsson's success in mobile phone is the middle-level technical managers' suggestions rather than the estimates of top managers. The failures of top-down visions are easily forgotten and the successes oversimplified. Another example, Prahalad and Hamel (1990) state Canon was very successful in diversifying from optics mechanics into electronics products, whereas Sandoz (1997) suggests that Canon failed in diversification into recording products and electronic calculators.

Managers need to match the products, systems, services, organizational practices and the actual and potential market demand in the successful companies (Pavitt, 2005) if the innovation is to succeed. The innovation will be based on the company's accumulated knowledge of product and process technologies, of organizational



practices, and users' requirements. It also needs to make adjustments according to the market demands, and new technological change.

Chandler (1997) states technologies and organizational practices co-evolve with market demand. This process involves the adaptation of company organizational practices to market needs and technological opportunities. Technical advances usually precede organizational and market advances. Firms tend to want to keep their competitive position and to refuse to use new technologies and knowledge in future product and process development. Thus leading companies in new technologies are rarely those that led with the old technology.

According to Aris (1998), in the long term because the market decides on the exploitation of advancing technological knowledge, companies cannot develop by carrying out traditional cost-benefit analysis and limited cost. At all events costs may be possible to estimate with some degree of accuracy but benefits rarely are, as they depend heavily on the level of market demand. Pavitt (2005) summaries the organizational and marketing practices that must be consistent with several key features of technologies:

- External linkages with potential customers, and with the important sources of knowledge and skills.
- Internal linkages in the key functional interfaces for experimentation and learning.
- The centralization of resource allocation and monitoring activities needs to be consonant with the costs of technological and marker experimentation.
- Criteria for resource allocation need to be consonant with levels of technological and market opportunity.

- Alignment of professional groups, who possess power and control, with fields of future opportunity.

### **3.7. Summary**

The researcher is interested particularly in what differentiating factors are necessary for success in an innovative JV Company. This has been largely unresearched to date and leads to the following three major areas on which focus will be directed in this research:

- the nature of innovation and the use of the JV as a tool achieving it in the Chinese economy
- necessary conditions for developing innovative companies in China, for which innovation is an important component
- key factors for success in international joint ventures motivated by innovation activity with particular reference to China.

The researcher believes from reading the literature that these are the areas that need more research if China is to move through IJVs, in part but also through foreign FDI and indigenous investment from the manufacturing low margin stage of development to the brand name stage comparable with Japan and others. This research will focus on IJVs.

Overall the link between alliances, networks and innovation is clear from many research projects. This thesis (a) develops a model of the innovation process that is specifically relevant to Sino-Western joint ventures, (b) uses this model to derive propositions about factors relevant to successful innovation, and (c) discovers the

degree to which such factors are currently supported by managers of international joint ventures in the developing Chinese economy. This chapter has discussed the existing literature on JVs in relation in particular to innovation in its various forms. The next chapter will develop a model of innovation to provide the framework for the propositions tested in the research.

# **Chapter 4: China's Economic development, Innovation Models and the Propositions**

In this chapter the model guiding the thesis, and the propositions underpinning the investigation, are developed. The chapter begins with a description of the innovation system developing in China at the present time. It then reviews some innovation models in the literature and develops an innovation model to be used in this research. Finally it describes the eight propositions to be researched.

## **4.1. The Chinese national innovation system**

### **4.1.1. Politics and the Economy**

Porter (2008) states China has averaged about 9.7 percent growth rates since the late 1970s. China has made a great achievement in developing its economy and improving 1.3 billion people's living standard. In 2007 China GDP is US\$3.3 trillion; China has become one of the largest economies in the world only the United States, Japan and Germany are above China.

In the global Competitiveness Report 2008-2009, China ranked 46<sup>th</sup> place in adopting new technologies when they are available, However China is behind the other BRIC (Brazil, Russia, India, and China) countries in the technological readiness pillar; it ranks at 77. China rank 83<sup>rd</sup> place in availability of the latest technology. Through the report China's competitiveness is very strong and is developing in the right direction. China is likely to keep its manufacturing

competitiveness but it will change the situation that relies on low-cost inputs to achieve economy growth and its creative spirit is still in some need of proof. Its position has significantly improved since 2008-9 however.

China has a closed, centrally planned system but an open, market-oriented economy. In the late 1970s, the reforms changed the collectivised agriculture to the gradual liberalisation of prices, fiscal decentralisation, increased autonomy for state enterprises, the foundation of a diversified banking system, the development of stock markets, and the rapid growth of the non-state sector, and the opening to foreign trade and investment.

#### **4.1.2. Policy instruments**

The industrial policy in China aims to promote collaboration opportunities with western countries. And the policy should continue to make the China an attractive location for investment.

According to China Ministry of Science and Technology (MOST) in 2006, the Chinese government set up a series of key policies to develop a national innovation system and to promote the commercialization of R&D achievements. Firstly, it sought to establish high-tech zones and incubators to develop high-tech industries in China since late 1980s. It learned from Silicon Valley in America. At the national level there are 53 high-tech development zones (China Ministry of Science and Technology, 2006).

According to China Ministry of Science and Technology (2009), Zhong Guan Cun high-tech zone was the first high-tech zone. It was established in Beijing in 1988. The policy of the high-tech zone is the following: Firstly, the high-tech zones are set up with a well-functioning infrastructure to act as the platform for innovation;

Secondly, the firms in the high-tech zone have tax incentives preferentially; Thirdly, the China government tries to reduce the procedure costs and provide more service for firms in the high-tech zone; Fourthly, the China government tries to create an innovative atmosphere in the high-tech zone and to help the companies in the high-tech zone to collaborate closely (China Ministry of Science and Technology, 2009).

Until now the high-tech zones have developed but the innovative activities vary greatly. A large number of high-tech firms and incubators have been set up in a high-tech zone. And these firms collaborate with universities and western firms. According to China Ministry of Science and Technology (MOST) in 2009, there are 550 billion RMB value-added created by the high-tech zones, it is 8.8% of the China GDP, and exports of high-tech zone is 82.4 billion US dollar, which is 12% of China exports. There are over 490 incubators established in Beijing, Shanghai, and Shenzhen, Wuhan incubator was the first business incubator in China (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), the current long-term Science and technology policy in China is the 'National Plan 2006-2020 for the Development of Science and Technology in medium and long term'. Independent innovation and indigenous innovation are key content in this new National Plan. The China government encourages Chinese firms to develop indigenous innovation. According to China Ministry of Science and Technology (2009), there are three reasons:

Firstly, foreign technology and foreign invested firms have a major contribution to the development of China economic growth. There are more than 85% of all high-tech exports from foreign-invested firms since 2000. (China Statistics Yearbook on high-

tech technology industry, 2004-2006). 'Market for technology' is another China government's new policy; the purpose of this policy is to encourage automatic knowledge and technology spillovers from foreign firms to Chinese firms (China Ministry of Science and Technology, 2009).

Secondly, there is an imitation and copying policy in product development and design, some in scientific research. The domestic knowledge base creates innovation and intellectual property rights which need to be focused on in the China National innovation system.

Thirdly, China needs to change its current development strategy to an energy-efficient and environment-friendly technology, plus new management skills (China Ministry of Science and Technology, 2009).

According to the China Statistics Yearbook on high-tech technology industry (2004-2006), there are three policies to support the indigenous innovation strategy. Firstly, although the Chinese government predicts that GDP growth will increase at a similar rate as in past 30 years, the government is increasing R&D by 2020 to 2.5% of GDP (China Statistics Yearbook on high-tech technology industry, 2004-2006). According to OECD (2006), nowadays in purchasing power parity, China is the second-largest country in R&D expenditure, U.S ranks the first, and China has overtaken Japan.

Secondly, fiscal policy supports indigenous innovation. The new tax policy makes R&D expenditure 150% tax deductible (China Ministry of Science and Technology, 2009). Thirdly, the public procurement of technology will promote indigenous innovation activities. The current public procurement practice is to cut costs instead of developing indigenous innovation. The new procurement will put development of indigenous innovation as a priority.

According to China Ministry of Science and Technology (2009), there are several policies to help the commercialization of R&D results because of the ownership of IPR. Firstly, the Chinese government permits IPR results of government-funded R&D projects to be commercialized. Secondly, the ownership of IPR resulting from government-funded R&D projects will not be government-owned assets; instead it can transfer to the university who conduct the projects. Thirdly, if private inventors collaborate with government-funded R&D projects, the private investors can get a maximum 35% of the licence fee after research results transfer (China Ministry of Science and Technology, 2009).

#### **4.1.3. Chinese Government Permissions and Support**

Because of the huge consumer market and cost-effective source of input and cheap labour, China attracts many western multinational companies to invest there. The rapid economic growth and the country's increasing purchasing power is channelling investment into transportation, energy, utilities, communication systems and other infrastructure. These aspects also become attractions for western multinational firms (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), government industrial policy encourages growing Chinese overseas direct investment under the 'Going Global' policy. The objective of this policy is to develop national industry champions and the procurement of natural resources abroad. Both underpin a broader agenda of economic nationalism including energy security, geopolitical positioning and national competitiveness (China Ministry of Science and Technology, 2009).



According to Cao, Suttmeier and Simon (2006), the China government also encourages developing high technology industry sectors. It is led by the National Development and Reform Commission as part of country's 11<sup>th</sup> Five-year Plan, launched in June 2006. The most important industries including information technology, biotechnology, new materials, high-tech services, new energies, and technology are the focus of this initiative.

Chinese support both local technology-based start-ups companies and high-tech FDI by upgrading the R&D infrastructure to develop innovative, patentable technologies. Researchers in these areas have increased sharply since 1999 (China Ministry of Science and Technology, 2009). Now there are more researchers in China than in Japan. And the numbers of researchers in China will catch up the numbers in Europe. According to the advanced technology exports, China is second to USA. And China will also overtake Japan to become the second largest investor in R&D. It spent about half of the UK budget on R&D in 1994 and now spends more than three times as much as the UK each year (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), recently after the financial crisis, China plans to reduce its external imbalances; encourage domestic demand; specially consumer demand, and rebalance investment and consumption; promote balanced external sector development; speed up financial reform; and improve the exchange regime 'in a gradual and controllable manner' (China Ministry of Science and Technology, 2009).

### **(1) National High-tech R&D Program (863 Programme)**

Four Chinese scientists proposed to accelerate China's high-tech development in 1986 because of the challenges of the new technology revolution and competition during globalization. Mr Deng Xiaoping had strategic vision and resolution, and approved the National High-tech R&D Program and named it the 863 Program (China Ministry of Science and Technology, 2009). Implemented during three successive Five-year Plans, the programme has boosted China's overall high-tech development, R&D capacity, socio-economic development. According to Cao, Suttmeier and Simon (2006), in April 2001, the Chinese State Council approved continued implementation of the programme in the 10th Five-year Plan. As one of the national S&T program trilogy in the 10th Five-year Plan, the 863 Programme continues to play an important role.

#### **Orientation and Objectives**

According to China Ministry of Science and Technology (2009), objectives of this program during the 10th Five-year Plan period are to build up innovation capacity in the high-tech sectors, particularly in strategic high-tech fields, in order to gain a foothold in the world and achieve breakthroughs in key technical fields. And these fields are in the national economic lifeline. It can help China to achieve radical development in key high-tech fields and take strategic positions in order to provide high-tech support to fulfil strategic objectives in the implementation of the third step of the modernization process (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), during the 10th Five-year Plan period, the 863 Program will carry on to aim at the advanced world technology development and focus on innovation efforts and realize strategic

transitions. It plays the most important role in China catching up period. In 5 years efforts, the programmes will sharply enhance China's high-tech innovation capabilities in selected fields and improve the international competitiveness of major industries. According to China Ministry of Science and Technology (2009), it will master a number of technologies with industrial potential and proprietary IPR. It will nurture high-tech industrial growth sources. It will promote the development of China's industrial structure which will help nurture both individual and overall strength of high tech industries. It will also build up innovative and enterprising capabilities for high-tech R&D and industrialization (China Ministry of Science and Technology, 2009).

### **Major Tasks**

According to China Ministry of Science and Technology (2009), the 863 Programme focuses on cutting-edge high-tech issues of strategic importance and foresight during the 10th Five-year Plan period, according to national goals and the market requirements.

- ***Develop key technologies for the construction of China's information infrastructure.*** The 863 Programme will focus on developing a number of key technologies in the next five to ten years and establish systems of significant value for application. It aims to accelerate the national socio-economic development, drive industrialization through informatization, and enable China to catch up with international pioneers in selected fields (China Ministry of Science and Technology, 2009).
- ***Develop key biological, agricultural and pharmaceutical technologies to improve the welfare of the Chinese people.*** The 863 Programme will concentrate on

developing key technologies in agriculture, pharmaceuticals, and other related areas. It will enhance the overall bio-technological R&D level and capacity by a significant margin (China Ministry of Science and Technology, 2009).

- ***Master key new materials and advanced manufacturing technologies to boost industrial competitiveness.*** According to China Ministry of Science and Technology (2009), the 863 Programme concentrates on developing Nano-material and other new material, along with related technologies for the development of aviation, the Maglev train, information storage and access. It helps China to develop national economy by utilizing China's characteristic resources, environment, and technical strength. China tries to learn advanced manufacturing technologies to catch up with the globalized manufacturing in 21st century (China Ministry of Science and Technology, 2009). The 863 Programme will help China to develop advanced integrated manufacturing systems and key technologies leading to the development and upgrading of China's manufacturing industry.
- Achieve breakthroughs in key technologies for environmental protection, resources and energy development to serve the sustainable development of society.

### **Development Priorities**

According to China Ministry of Science and Technology (2009), in accordance with major tasks, development priorities are categorized into Priority Projects and Key Projects. Priority Projects are guided by encouraging innovation, obtaining IPR proprietorship and addressing key technological issues. Priority Projects conduct R&D in 19 subjects which impose the most significant impact on enhancing China's

overall national strengths (China Ministry of Science and Technology, 2009). According to China Ministry of Science and Technology (2009), these subjects range over 6 high-tech priority fields in the civil sector, including IT, bio-technology and advanced agricultural technology, advanced materials technology, advanced manufacturing and automation technology, energy technology as well as resource and environment technology.

According to China Ministry of Science and Technology (2009), key Projects are centred on major systems and projects and guided by pooling resource. It focuses on significant high-tech issues according to demands of major national strategies, the market and application. These issues relate with strategic significance on China's high-tech development and participation in international competition. They will facilitate the formation of new economic growth sources and industrial clusters with international competitiveness, and serve as demonstration (China Ministry of Science and Technology, 2009). They are also crucial elements in enhancing the competitive edge of major industries, facilitating industrial upgrading, developing China's own features of high technologies, and realizing catching up progress in the high-tech field.

### **Organization and Management**

- ***Expert Responsibility System.*** According to China Ministry of Science and Technology (2009), during the 10<sup>th</sup> Five-year Plan period, there is an expert responsibility system in the Program. All experts in different areas are responsible for the technical decision-making and judgements of high-tech development trend. It promotes the decision-making role of government. The system is tiered with expert committees (priorities) and expert panels (subjects).

The expert committees supervise and assess project implementation in relevant priority fields. The expert panels are responsible for technical decision-making on relevant subjects and their project process management.

- **Project Management.** There is a Program management system and a project leader responsibility system. The Program adopts a management system to include calculation of the full budget, total cost accounting. According to China Ministry of Science and Technology (2009), the general expert panel are responsible for pooling resource, focusing on key issues, key projects. Normally government funds the R&D budget management and priority projects and adopts a project budget system. And local government, industries, Enterprises and the whole society are encouraged to increase their involvement in high-tech R&D (China Ministry of Science and Technology, 2009).
- **Relevant Measures.** According to China Ministry of Science and Technology (2009), a series of measures have been adopted for the implementation of the program in the 10th Five-year Plan period. Firstly, encourage innovation. In project award and evaluation, proprietary intellectual property right (IPR) acquisition is adopted as an indicator to encourage innovation. Secondly, enhance the innovation capacity of enterprises and push them to become technical innovation entities. For application-oriented research, it adopted measures in project application, assessment and evaluation (China Ministry of Science and Technology, 2009). Thirdly, strengthen IPR management and protection. It increases the study and analysis of IPR before and during project implementation and clearly defines the rights and interests of the State, project stakeholders, and concerned parties in the application, development and

utilization of IPR. Fourthly, it strengthens the integration of the Program with local high-tech development. It initiates guidance projects to guide local high-tech development and associated industries to nurture economic growth sources. Fifthly, it encourages international cooperation. Special funds are earmarked to facilitate the integration of the 863 Program with the “Program on Major International Cooperation Projects”, and support and encourage the implementation of international cooperative projects within the framework of the 863 Program (China Ministry of Science and Technology, 2009).

## **(2) National R&D programs**

- According to China Ministry of Science and Technology (MOST) (2006), Government support is one the most important factor in China’s National Innovation System. Market forces are also a very key factor in the National Innovation System. The Government usually controls the land; large investment projects; infrastructure construction and market accesses to strategic industrial and service sectors, for example, automobile industry, financial services. China government policy decides the S&T development in China and implements national R&D programs, long-term and short-term plans. According to China Ministry of Science and Technology (2009), China implements a lot of National R&D programs to develop National Innovation Systems. China Ministry of Science and Technology (MOST) Except National R&D programs, there is a National Innovation Fund (INNOFUND) for S&T based SMEs, the fund is average 0.5 billion RMB a year. And the National Science of Foundation is mainly for basic research. Government projects are mainly produced in Universities and GRIs. Important scientists play a vital role in government programs. The regional

and industrial funds also choose the research field according to the national programs (China Ministry of Science and Technology, 2009).

#### **4.1.4. Environment, Culture, Tradition, National Character**

China is a big country and has many resources. And different regions in China have different cultures. The variety will also influence innovation. Northern cities in China have the heavy industries in the past. Xian, Guizhou and some other western cities have important heavy industries. Nowadays Chongqing, Xian and Chengdu are the three examples of innovative cities in western provinces.

According to China Ministry of Science and Technology (2009), Fujian, Zhejiang and Guangdong provinces in the South coast and east coast have developed better than other provinces even though the China government did not invest much in the coastal provinces in the China planned economy. These provinces are the commercial centres in China and they have become the market economy faster than other provinces. There are many private SMEs with great entrepreneurship in these three provinces, and till now they are the most developed provinces in China.

Every region decides their resource allocation and operational decisions because of decentralization since the 1980s. This causes the diversity of innovation capacity in different regions because of regional disparity. There is a big difference in the eastern region, middle region and western regions in China. Liu et.al (2006) claims the Eastern region has stronger innovation capabilities because of an unbalanced growth approach and uneven FDI inflows according to the Scoreboard of Regional Innovation Capacity. Shanghai, Beijing, Guangdong, Jiangsu, Zhejiang and Shandong are the top 6 most innovative regions according to knowledge creation, diffusion, company innovation, infrastructure and performance 5 indicators (Liu,



2006). These 6 cities are either in the east region or coast region. According to Liu (2006), there also are big different innovation capability in the indicators of human resource, high-tech industries and openness of the regional economies in general. In 2000 the China government implemented a 'Go West' policy to try to balance the region divergence and gap. The 'Go west' policy together with fiscal, region, FDI and S&T policy is intended to help the less developed regions to catch up with innovative regions (China Ministry of Science and Technology, 2009).

#### **4.1.5. Knowledge Base Level**

In addition to the challenge of China's development is the "revolution" in the production and dissemination of knowledge. Both the process of economic development and the difference in countries' levels of development are decided by the effective use of policy and technical knowledge. According to Dahlman and Aubert (2001), nowadays knowledge is very important:

- The information and communication technology revolution, the engineering of materials at the molecular level, and even the development of new life forms through biotechnology depend on the advanced scientific and technical knowledge.
- The integration of precious disparate economies through trade and other international exchanges benefit from the decreasing costs of transportation and telecommunications.
- Digitization and informatization reduce the transaction costs and increase the productivity.

Dahlman and Aubert (2001) also state that China's future will be characterized by:

- Development of a service-based economy as activities with high intellectual content becoming decisive.
- High education and life-long learning make effective use of the rapidly expanding knowledge base.
- More investment in R&D, training, education, software, branding, marketing, logistics and similar services.

Knowledge and information are the most important elements of international competitiveness as in the global economy, it is also very crucial to respond rapidly and efficiently to change. In China's tenth five-year plan, China will carry on experiencing the restructure affecting all sectors because of the high growth rate and the knowledge revolution.

#### **4.1.6. Industry Level**

Freeman (1987), Nelson et al (1993) and Lundvall (1992) all give the concept of National Innovation System (NIS) a different explanation. National Innovation System can be used to analyze innovative capabilities. It can be used as the instrument for policy making in the developing countries. Liu and White (2001) state China innovation System is a more plan-based system in the past. And the government research institutes have the crucial role from idea creation to a user of the new products both annually in the National Science and Technology Plans and the National Science and Technology every five years. Industrial enterprises have had little influence in the national innovation system in the past.

China started its economic reform and Open-door policy in the late seventies. The Market-oriented economy began to dominate since the 1980s. Industrial enterprises

gradually play the important role during the reform process. According to China Ministry of Science and Technology (2009), State Owned Enterprises (SOEs) change into equity share or privately owned enterprises. SMEs have also become more important players in the Chinese economy and in the national innovation system; it is driven by competition and entrepreneurships. Foreign investment enterprises grow rapidly. In China National Innovation system market-oriented mechanism become the main force instead of government plan. Nowadays both plan-mechanism and market-mechanism exist in the Chinese economy. The National Innovation System is a market-based open innovation system. It shows a change from the Government Research Institutes (GRIs) dominated to an enterprise-centred innovation system (China Ministry of Science and Technology, 2009).

According to China Ministry of Science and Technology (2009), the innovation-oriented enterprise system still needs to develop a greater innovation capacity. Their innovation activities mainly concentrate on incremental innovations. During China's reform process, Chinese characteristics, innovation gap across ownerships and regional disparities need to be made more efforts for China national innovation system. According to China Ministry of Science and Technology (2009), there are two key forces helping to develop the national innovation system, firstly, a national strategy of indigenous innovation to encourage Chinese firms to build up their innovative capabilities. Secondly, knowledge creation and technology learning through global networks and alliances can help to develop an Open Innovation System.

## **China Industrial Experience**

According to Luo (1997), the efficiency of IJVs and growth of IJVs need strong market structure, a solid supply relationship, comprehensive buyer networks and an efficient organizational image. The local partner's market experience and industrial knowledge are very important to achieve these requirements. The Chinese partner's established history and strong background in the industry often results in a good reputation or high credibility in the market. The Chinese partner's extensive marketing and distribution network is very crucial capability needed by IJVs (Luo, 1997)

### **4.1.7. Company Level**

#### **Western Firms**

Foreign direct investment into China in the first six months of 2007 was \$31.89 billion, an increase of 12.2 percent from a year earlier (National Bureau of statistics of China, 2010). According to National Bureau of statistics of China (2010), China has attracted the dominant share of FDI into any single country, with over \$60 billion per year in recent years. Most investments are in the form of equity joint ventures or wholly-owned foreign enterprises. About 70 percent of FDI each year is in manufacturing industries, but service-related FDI is growing (National Bureau of statistics of China, 2010).

China is an increasingly attractive market for foreign direct investment. Alliances, joint ventures, partnerships and mergers and acquisitions increase every year. The Western multinational firms and Chinese local firms involve a lot of major complementary assets, resources and capabilities. They both engage in a reciprocal give-and-take in the process of market entry.

The international joint ventures involve British-Chinese joint ventures, US-Chinese joint ventures and European-Chinese joint ventures. All these multinational firms overcome the challenges to set up successful businesses producing and selling in the world's fastest-growing market. These experiences also help them to establish their businesses in other countries.

On the other hand, western managers also know by now, that in the long term Chinese firms will be their competitors. They have to know how to deal with it. Cooperation and competition both exist. Chinese companies will not just manufacture and imitate the Western brand name products; they also transfer the western advanced technology legally or illegally. Chinese firms are learning how to develop their innovative capabilities and how to continuously create new products and services. When Western company try to learn about China, China at the same time learns from the western how to be innovative (Luo, 1997).

According China Ministry of Science and Technology (2009), both Western multinational firms and local Chinese firms are benefiting from joint ventures alliances and partnerships. Firstly, International Joint ventures bring the capital, advanced technology and managerial capabilities into the China economy. Secondly, the scale, scope and speed of economic growth in China overall and specific improvements in the innovation capabilities and competitive advantages of particular Chinese firms have largely benefited from joint ventures alliances and partnerships. Thirdly, Both Western multinational firms and local Chinese firms have benefited from joint ventures, alliance and partnerships. Each side is learning, and accessing complementary assets, capabilities and knowledge. Fourthly, Different forms of partnership, complementarities and learning exist depending on the firm, industry

and operational management. And the strategies and successful management practices also different. Fifthly, these opportunities, and related threats, are evolving for Western firms currently invested in China or looking to invest (as well as firms elsewhere, as Chinese firms increase exports and expand outward FDI). Sixthly, the most successful firms are the most dynamic. They know collaborators are learning, changing and adapting. They identify the future business and reposition themselves within global value chains in response to the future competitive advantages of Chinese firms. Seventhly, Chinese Government's National Development Plan is to improve domestic scientific and technological capabilities and enforce China's competitiveness in high-technology based industries (China Ministry of Science and Technology, 2009).

The most dynamic western firms benefit from the cheap labour and growing disposable profits; they establish their company in China and learn about the future threats and opportunities from Chinese firms. They are of course also motivated to access the very large Chinese market. According to Luo (1997), Major reasons for Western Firms to form a joint-venture with local Chinese firms are:

- Accessing local business knowledge, including customer and supplier connections
- Assistance with local officials and regulations
- Financial input from partner
- To limit investment risk
- Access to local management skills

- Access to local material of sources of inputs
- Access to distribution channels

### **Chinese Firms**

FDI firms have played a crucial role both in production and R&D in China since China started to reform 30 years ago. The FDI firms are increasing during these 30 years. According to National Bureau of statistics of China, (2010), the shares of value-added and exports of FDI firms in the Chinese industrial sector separately account for 40% and 70% in 2004, it is very high level. Whereas the shares of R&D expenditure and employment are 29% and 34%, this is not so high (National Bureau of statistics of China, 2010). These figures show that FDI firms' production is more capital-intensive than R&D-intensive manufacturing in Chinese industrial sector.

There are manufacturing industries, high-tech industries and service industries. The internationalisation in the high-tech industries is very important; there are some discussions on the characteristics of high-tech industries. On the one hand, there is the high international competitiveness of high-tech industries of China because of increased trade. On the other hand, China's high-tech industries relies on FDI firms, imported materials, foreign advanced technology, and foreign brand logo and brands. Information and communication Technologies (ICT) sectors are the most internationalized high-tech industries, FDI firms control value-added, technology imports and exports.

According to Von Zedtwitz (2011), during 1998-2010 R&D intensity across different ownerships has increased. Chinese firms including Stated-owned and private have higher R&D intensity than FDI firms. More R&D investment help Chinese firms build

up their innovative capabilities. Both State Owned Enterprises (SOEs) and entrepreneurial and S&T-based private firms increase R&D investments. There are two type of lower R&D-intensities FDI firms, one type is the capital intensive or labour intensive manufacturing in the high-tech industries. The other type is that FDI firms which have R&D activities in China, but most R&D is still carrying on in the OECD counties (Von Zedtwitz, 2011).

R&D intensity in the high-tech industries in China has achieved great progress, but it still needs to make a greater effort to catch up with high-tech industries in the OECD countries. China encourages indigenou innovation and there are competitions between Chinese firms and FDI firms, it will help Chinese firms to create more innovative capabilities and close the technology gaps between Chinese firms and FDI firms. Once there is less technology gap, it will also promote more strategic alliances and R&D investments between Chinese firms and FDI firms.

According to Shenkar (1990), Chinese firm's previous foreign experience is very important to the success of intercultural and cross-border ventures. Both in the beginning of the joint venture and during the period time of IJV's contract, foreign experience affects the organizational fit between partners. The business atmosphere and commercial practices in China is quite different from those in Western countries. According to Luo (1997), The Chinese firms can improve its knowledge, skills and values from its foreign (Western) experience in import business, export business, and strategic alliances with foreign investors. In the international market, the employees can develop their competitive sensitivity through working with foreign firms and employees. The Chinese firm can improve their receptivity toward maintaining quality standards, customer responsiveness, and product innovation



through long-term cooperation with western firms. As foreign experience is accompanied by exposure to foreign (Western) values, it also increases a Chinese business's ability to effectively communicate with its foreign partner. The successful cooperation needs the trust and collaboration between Chinese and western partners. Beamish (1987), Luo (1997), and Shenkar (1990) state the IJV's financial return, risk reduction, and sales growth in the domestic as well as export markets can be benefited from a Chinese partner with more international experiences. There are many success stories about Western joint ventures in China; they prove the importance of local partners' international experience for IJVs' success.

### **Joint Venture Companies**

Child, Faulkner and Tallman (2005) state the investors of Joint Venture Company are its partners. If it is capitalized through the issuing of equity, its partners are also its alliance shareholders. Similar as other investors, partners can accept a certain risk if they could get profit as return. Partners are concerned with how best to govern their alliances, which minimize the risk and maximize the good return.

Beamish (1987) notes Chinese partners are learning technological, innovative and managerial skill from western partners through IJVs. The Chinese partner's learning ability, its ability to acquire, assimilate, integrate and exploit knowledge and skills are very crucial to the success of IJV's local operation and development in the local market. According to Luo (1997), IJV's profitability and sales growth depends on a Chinese partner's learning ability and absorptive capacity.

Section 4.1 has discussed the transformation process of the NIS in China. As China's political and economic systems are unique, the innovation system and policy making needs to be grounded in this uniqueness. Therefore, the researcher aims to

give the research emphases on key elements of the NIS in terms of actors and linkages as well as on country-specific factors, which are important

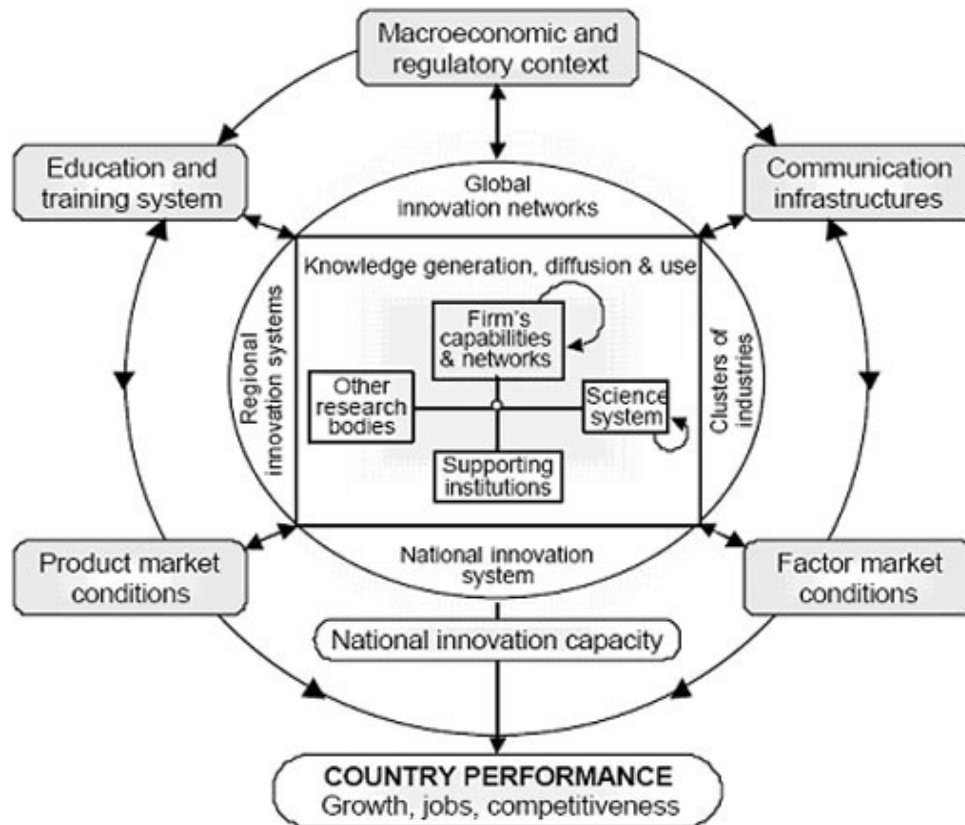
## **4.2. Models of innovation systems from the current literature**

### **4.2.1. Model 1: Actors and linkages in the innovation system**

For this research a model or framework needs to be developed relevant to the Chinese system, to the role of JVs in innovation development. Firstly the researcher considered innovation models in the literature before developing her own

He also mentions that innovation 'is a ubiquitous phenomenon in the modern economy. In all parts of the economy, the on-going processes of learning, searching and exploring result in new products, new techniques, and new forms of organization and new markets. Mytelka (2001) states innovation is both gradual and cumulative. Innovation is a process, it is not a stage. The Innovation process involve continuous interactivity between suppliers, clients, universities, productivity centres, standard setting bodies, banks and other critical social and economic actors. Innovation is not merely an individual act of learning by a firm or entrepreneur, but is situated within a larger system that both enables and draws on the innovative process. Lundvall (2000) argues that innovation systems are both social and dynamic. Laws, social rules, cultural norms, routes, habits, technical standards etc elements govern societal interactions in innovation system. The nature of all the elements in the system and the linkages among the elements cause the dynamic. According to Niosi (2002), the financial flows between government and private organizations; human flows between universities, firms, and government laboratories; regulation flows emanating from government agencies towards innovation organizations, and

knowledge flows (spillovers) among these institutions' are decided by the dynamic of innovation system. The complexity of linkages in a mature national system of innovation is well summarized by the OECD diagram shown in **Figure 4.1**



Source: OECD (1999)

**Figure 4.1: Model 1: Actors and linkages in the innovation system**

In this model the three levels of economic activity; macro, industry and firm are inter-related leading to the development of new products, improved national innovation capacity and ultimately country performance. The model does not however refer specifically to China or to JVs.

#### 4.2.2. Model 2: A Schematic Representation of an Innovation System



Source: Mytelka (2000: 17).

#### Figure 4.2: Model 2: Innovation systems

A network of economic agents, institutions and policies is part of an innovation system, (Lundvall 1992, Nelson 1993) in the mean time, the innovative behaviour and performance of economic agents and institutes are affected by the policies. This model defines innovation as an interactive process, this process involves the interaction among enterprises, the process also involves enterprises are supported by institutions and organizations, including industry associations, R&D, innovation

and productivity centres, standard setting bodies, universities and vocational training centres, information gathering and analysis services and banking (Mytelka 2000).

According to Mytelka (2000), there are three key elements in the innovation process, including linkage, investment and learning. Freeman (1988) and Mytelka (1999a) explain how policies and routine interactions lead actors to develop a set of habits and practices with respect to innovation. Existing habits and practices are reinforced or changed by policy dynamics, which is relevant in innovation system of developing countries (Mytelka, 2000). Mytelka (2000) state 'system of innovation approach is a reconceptualization of the firm as a learning organization embedded with a broader institutional context'.

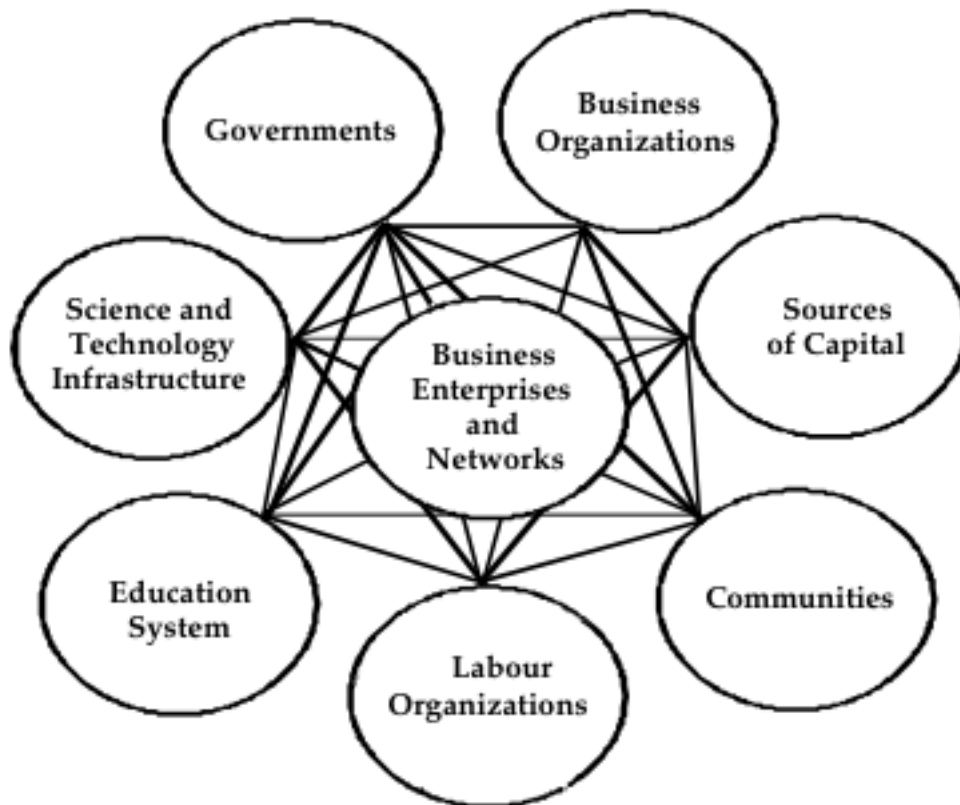
This model shows the structure of market effected by transnational corporations; the pace and direction of technological change; international agreements dealing with trade, investment and intellectual property (Mytelka, 2000). International investment agreements protect foreign investor. The life and scope of patent grants are affected by Intellectual property rights. Intellectual property rights prevent imitation for catch up and close follower strategies. Higher proportions of R&D around the world happen within the board networks of transnational corporations (Mytelka, 2000). A schematic representation of an innovation system showed in **Figure 4.2 above**. Once more the model is not specific to China or JVs but is useful as a way of describing what happens when innovation capabilities are increased in an economy.

#### **4.2.3. Model 3: Interactions in the Innovation System**

There are various definitions of "innovation system", According to Nelson (1993) and Edquist (1997) such a system requires:

- a focus on innovation as a result of interactions among various players in a system;
- the players include private sector enterprises and public sector institutions;
- their interactions include exchanges of knowledge as well as financial transactions;
- a recognition that the structure and composition of an innovation system evolves over time, based on the interactions of the players, as well as on specific interventions that influence the resources available to and behaviour of various players;
- Innovation system interactions can be analyzed at different levels, including supranational, national, sub national (e.g., regional, sectoral).

The following model 3 recognizes interactions in the innovation system as depicted in the following diagram:



*Source: Ontario 2002: Task Force to Review the Ontario Technology Fund in the Context of an Innovation-based Society*

**Figure 4.3: Model 3: Interactions within an innovation system**

This model focuses on the firm and identifies its various stakeholders. The identification is useful but once again not specific to China or JVs. A consideration of these models led the researcher to develop her own model for the research based on many of the concepts in the literature models described above.

**4.3. Synthesis of the literature: researcher’s own Innovation Process Model**

Based on the literature of academic authorities on the innovation process, the researcher developed her own innovation process model. In the current literature, there are many literatures on the innovation process, there are lots of literatures on

joint venture, but no one combines both together, particularly research based on joint ventures between Western company and Chinese company.

Current existing innovation models are inadequate for the purpose of this research, because the existing models do not address:

- incorporated JVs – international
- Different levels, including national system levels, knowledge base levels, industry levels and company levels, etc.
- combined JV and innovation

The researcher is trying to examine how international joint ventures help Chinese companies to create its innovative abilities through:

- Becoming part of a wide innovative network in its industry helps to create innovative capabilities. (Powell and Grodal, 2005)
- Taking part in an open innovation system in its industry helps to build up innovative capabilities and create more innovation both for the firm and their industry. (Chesborough, 2004)
- Relating closely to universities, and particularly their research laboratories help to create more innovation. (Link and Siegel, 2007)
- Relating closely to Research Institutions helps to create more innovation. (Link and Siegel, 2007)
- Developing a social atmosphere that encourages innovation in a JV brings good results (Fragerberg et al, 2005)



- Developing a strong strategic planning system encourage innovation (Taylor, 1984)
- Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)
- Focusing on developing IP (Intellectual property) leads to more innovation (Granstrand, 2005)

This is the researcher's contribution to the current literature.

#### **4.3.1. The Researcher's Own National Innovation System Model**

The model below (**Figure 4.4**) illustrates the way in which innovation is developed through the integration of the Western/Chinese JV into the Chinese innovation system. The top layer of the model shows the Chinese economic system as exemplified by the knowledge base contained within it. As we travel down the model we reach progressively the industry, then the JV, and ultimately the new product or process and then the market. The green colour quadrangles deal with aspects of the Chinese economic system that exist and provide the basic infrastructure for Chinese innovation to take place. These are discussed first below to set the scene. The red colour ellipsoid bubbles represent the conditions that, it is proposed, are required if a truly stimulating innovatory climate and system is to develop in China, rather than a dominantly imitative manufacturing system.

In the following national innovation system model, there are key elements; levels; actors; factors and linkages among the elements and factors in the model. They are the elemental and basic units to construct the national innovation system. These elements, levels, actors, linkages and factors are related with each other closely.

## **Levels**

Grey colour quadrangles are Levels. There are six levels in this model, National Innovation System Level; Policy, Society Level; Knowledge Base Level; Industry Level; Company Level and Market Level.

## **Key Elements**

The green colour quadrangles are key elements of the national innovation system which are part of the system. However the elements are described given or static. The key elements are situated on (1) the National Innovation System Level; (2) the Policy, Society Level and (3) the Knowledge Base level. Nowadays with the development of globalization, the world has entered a phase of shifting from competition centring on developed nations to competition that includes developing nations, and in which international competition will further intensify. Against this background of new countries and regions making inroads into the world economy, companies are seeking the optimum environment, and making capital and personnel move drastically. Cross-border alliances of corporations and corporate takeovers are also gaining momentum. Western firms go abroad to cooperate with international firms. The National Innovation System Level is categorized by the nations: Western National Innovation System and Chinese National Innovation System. Policy, Society Level is also classified as Western Policy, Society and Chinese Policy, Society. Knowledge Base Level is categorized by the nations: Western Knowledge Base and Chinese Knowledge Base.

- In the National Innovation System Level, the key elements are Western Politics and Economy; and Western Environment, culture, tradition; Western national

Character; Chinese Politics and Economy; and Chinese Environment, culture, tradition; Chinese national Character.

- In the Knowledge Level, the key elements are Western Knowledge Base and Chinese Knowledge Base.
- In the Industry Level and Company level, Wider Industry Network; Open innovation; Innovative Strategic Planning; Innovation as Primary Objective and Social Atmosphere are the key elements.

### **Main Actors**

The yellow colour quadrangles in this model are the actors who can act or do things in the Innovation System.

- In the National Innovation System Level, Western Government Permissions /Support and Chinese Government Permissions /Support are the actors.
- At the Industry Level and Company Level, a Western Firm utilizes the Western Knowledge; The Chinese Firm utilizes Chinese Knowledge; Western Firm; Chinese Firm; their joint venture company; University; Research Institution; Innovation Financing are the actors. Because the researcher assumes that there are employees in the firms, researchers in the Research Institutions and university; there are accountants dealing with the finance and the officers in government who formulate and implement the policies.

### **Key Factors**

Red colour ellipsoid bubbles are the 8 key factors of helping Chinese firms to creating innovative capabilities through IJVs in the whole industry. These eight factors are situated on both the industry level and the company Level. To create

innovation, we need elements. But we also need people doing things, so the actors are most important to the innovation. Both elements and actors constitute the innovation system. Red colour ellipsoid bubbles surrounded by green colour circle are both elements and key factors. Red colour ellipsoid bubbles surrounded by yellow colour circle are both actors and key factors. Both elements and key factors are Wider Industry Network; Open Innovation; Innovative Strategic Planning; Innovation as Primary Objective; Social Atmosphere and Patents (IP). Both actors and key factors are University; Research Institution and Innovation Finance. Innovation Financing is one of the very important key factors of helping Chinese firms creating innovative capabilities through IJVs in the whole industry.

The Red colour ellipsoid bubbles marked P indicate the Propositions on which the research is based. They are in the view of the researcher the key factors that determine the level and quality of innovation in a national system focused on cross border joint ventures. It is upon these eight propositions that the research project has been concentrated.

## **Results**

Purple colour ellipsoid bubbles including new ideas, new Product/Services, they are the results of innovation. At the market Level, the blue colour ellipsoid bubbles are Customers/Market, they are related with the branding and firm's reputation.

## **Linkages**

In the Policy, society Level, there are grey arrows showing the linkages. The linkages show the relationships among the key elements, levels, key factors and actors. At the Policy, society Level, the grey arrows show National Innovation system influence Knowledge Base through formulating and implementing the policies. In

Western Countries, Western Politics and Economy influence the Western Knowledge Base through formulating and implementing the Economic Policy and Tax, Financial Policy. Western Government Permission/Support influences the Western Knowledge Base through formulating and implementing Labour Policy and Science & Technology Policy. Western Environment, Culture, Tradition, National Character influence the Western Knowledge Base through formulating and implementing Social Infrastructure Policy and Education Policy. In China, Chinese Politics and Economy influence the Chinese Knowledge Base through formulating and implementing the Economic Policy and Tax, Financial Policy. Chinese Government Permission/Support influences the Chinese Knowledge Base through formulating and implementing Labour Policy and Science & Technology Policy. Chinese Environment, Culture, Tradition, National Character influence the Chinese Knowledge Base through formulating and implementing Social Infrastructure Policy and Education Policy.

At both industry Level and Company Level, the black arrows show the relationship between the Joint Venture Company and nine key factors (Wider Industry Network; Open Innovation; University; Research Institution; Innovative Strategic Planning; Innovation as Primary Objective; Social Atmosphere; Intellectual Property and Innovation Finance).

# AN NATIONAL INNOVATION SYSTEM MODEL

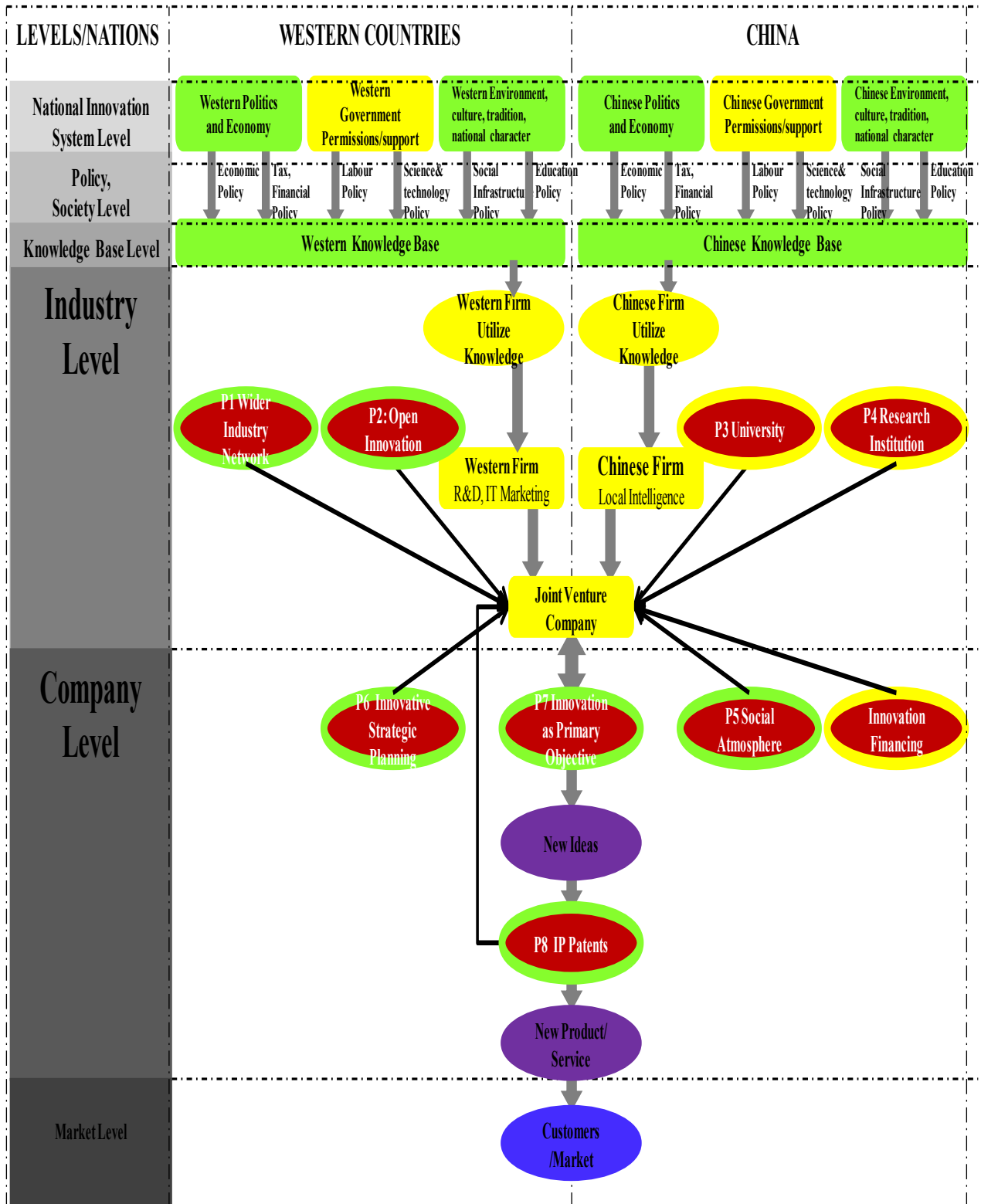


Figure 4.4: The Researcher's Own National Innovation System Model

In summary, the green colour quadrangles bubbles and the yellow colour quadrangles bubbles relate to conditions in the Chinese infrastructure, industry and government policies that shape the atmosphere for innovation. The Red colour ellipsoid bubbles identify the propositions that this research suggest are necessary for the JVs to adopt if China is to benefit by way of innovation from the Western/Chinese joint ventures operating in China. It is proposed that if these joint ventures exhibit the characteristics reflected in the seven propositions they are likely to lead to good innovation performance.

#### **4.4. The Focus of this Research**

The National levels of the model are not part of this research. The '*elements*' are those aspects of the top-line society aspects not being researched but taken as given. They are however critically important for the development of innovation in Chinese society. Other researchers can, based on this PhD thesis, carry out further research; for example, the research areas in the National Innovation System; National Innovation Policy; Knowledge transfer through IJVs, etc. The Marketing Level is also not the focus of this research, other researchers may use the finding of this research to carry on the research, and determine how can Chinese firms develop world-known brand names after building up their innovative capabilities?

This PhD research focuses on propositions which are at the industry and company level and are concerned with the impact of cross-border JVs on innovation. They address the question: how can international joint ventures create innovation and so help China to become a more creative economy in terms of its innovation capabilities? The propositions identify factors that have been suggested in the literature as likely to lead to increased innovation. One of the aims of the thesis is to

investigate whether in these factors are considered important in practice by JV managers.

#### **4.5. The propositions of this research**

JV companies need innovative capabilities if they are to develop new products and services that are worthy of developing into major global brands. This thesis has developed eight propositions, which are suggested as the key characteristics of The Research Propositions

In the last thirty years, innovation networks and co-operation have become crucial factors for expanding firms' resources of innovation and building up innovative capabilities. Western firms come to China to set up business building plants or subsidiaries in China, and build up innovation networks in China. At the same time, Chinese firms have taken active part in the international division of manufacturing, and also have been members of innovation network of western firms. China has been the developing country with the biggest amount of FDI utilization. Western firms build up their innovation collaboration network in China, and China economy and Chinese firms at the same time impact on innovation collaboration network. Chinese firms also participate in the innovation network of western firms of Hi-Tech and the international resources of Western Firms. According to Wang (2005), there are three factors which influence the innovation network between Western Firms and Chinese firms: firstly, the innovative network depends on the characteristics of western firms, including the advantages of technology, the type of R&D. Secondly, the characteristics of high-tech industrial climate in China also influences the innovative network between Chinese firms and Western firms, for example, the absorptive capabilities of Chinese firms; Wang (2005) also states that the innovation



collaboration network of western firms in developing countries and developed countries are different. Western firms have more activities in establishing innovation networks in developed countries and the technology transfer in network is bi-directional. Western firms establish innovation networks and the technology transfer in network is unidirectional.

Nowadays with the high speed of globalization and development of information technology, traditional companies find it difficult to keep their boundaries. Firms are encouraged to access external resources and information because of technological innovation. According to Chesbrough and Teece (1996), Upton and McAfee (1996), firms increasingly become part of networks and strongly rely on collaborations and partnerships. Firms can absorb all the resources in the networks through different types of alliances and relationships. Gulati (2000) states the conduct and the performance of firms can be examined by their networks relationships. Firms have both horizontal and vertical relationships with other organizations; it helps to enforce firms' competitive advantages. To some extent the idea of strategic networks extends the theory of the RBV (the resource-based view of the firm). Firm should look for the source of value-creating resources and capabilities beyond the boundaries of firms (Gulati, 1999).

Becoming part of a wider innovative network in its industry can impact on the technological innovation of firms. Powell (1996) states that the locus of innovation augments interorganizational collaboration and the network of learning. It is not only individual firms that are relevant when the knowledge base of an industry is both complex and expanding. The sources of expertise are widely spread. Thus it can be seen that wider networks have powerful influences on technological innovation.

According to the Chinese State Drug Administration (1998), there are 961 joint R&D collaboration projects (66.6%) of 1444 between Chinese pharmaceutical firms and universities in Chinese pharmaceutical industry in 1996. Therefore, becoming part of a wider innovative network in its industry helps to create innovative capabilities.

Western firms in joint ventures provide the technologies, management processes, brands or key knowledge and capabilities that help to develop future competitors from Chinese firms. It helps Chinese firms to set up their innovative network and further build up their innovative capabilities. Chinese partners of JVs can establish their wider innovative network through the followings way: Firstly, Chinese joint venture partners can access JV western partner's technologies. IPR or design features to include in their own products. Secondly, local suppliers improve productivity and quality levels as a result of equipment transfers and training provided by foreign manufacturers and subsequently produce and sell components or products they were previous sub-contracted to manufacture. Thirdly, Chinese firms link directly to distribution channels or customers (internationally) introduced by joint venture partners, to sell their own competing products or services. Fourthly, they use copycat western brands or logos, packaging, and design features outside the partnership for alternative or competing products. Therefore:

**Proposition 1: Becoming part of a wide innovative network in its industry helps to create innovative capabilities. (Powell and Grodal, 2005)**

In the 20<sup>th</sup> century, companies in manufacturing generally used their own ideas, and transformed them into products with their own R&D facilities. The companies just like a castle; it was protected by the wall built up by company secrets and an array of

patents. According to Pryor (2007), the idea of closed innovation to prevent others firms competing in the marketplace is short-sighted. Traditionally, new business development processes and the marketing of new products took place within firm boundaries. But there are several factors that change closed innovation. Firstly, the mobility and availability of highly educated people has increased recently. It causes a large amount of knowledge to develop outside research laboratories. Secondly, employees move to new jobs and bring their knowledge and skills to their new company. This helps knowledge to spread among firms in the whole industry. Thirdly, venture capital has increased significantly; good ideas and high technology can be developed outside the firms. Fourthly, there are many other companies in the supply chain; for example, suppliers can impact on the innovation process.

As the result of these factors, firms start to look for many different ways to increase the effectiveness of their innovation process, new technologies and ideas outside the company; cooperation with suppliers and competitors to create more innovation in the industry grows fast.

There are several reasons why taking part in an open innovation system in its industry helps to build up innovative capabilities. Firstly, the principles of innovation show that open innovation systems can help the firms to build up their capabilities. According to Chesbrough (2003), the principles of innovation are as follows:

*Closed Innovation Principles:*

- The smart people in the field work for us.
- To profit from R&D, we must discover it, develop it, and ship it ourselves.
- If we discover it ourselves, we will get it to the market first.

- The company that gets an innovation to the market first will win.
- If we create the most and the best ideas in the industry, we will win.
- We should control our IP, so that our competitors don't profit from our ideas.

*Open Innovation Principles:*

- Not all the smart people in the field work for us. We need to work with smart people inside and outside the company.
- External R&D can create significant value: internal R&D is needed to claim some portion of that value.
- We don't have to originate the research to profit from it.
- Building a better business model is better than getting to the market first.
- If we make the best use of internal and external ideas, we will win.
- We should profit from others' use of our IP, and we should buy others' IP whenever it advances our business model.

Secondly, according to Pryor (2007), five benefits of open innovation prove open innovation can strength the firm's innovative capabilities.

- Open innovation can leverage the R&D budget. In most industry, R&D costs the majority of a firm's budget. In closed innovation, firms could invest similar amount of money in the development of similar technologies, whereas if they cooperate together, the open innovation can gather all the R&D budget from different firms, gather more sources, gather more technology, get strength from all companies in

the industry, and it can create more powerful innovation and technology development for their industry, and every firm can use it.

- Open innovation can extend the reach and capability of new ideas and technologies during R&D. Many firms develop the ideas or technologies that do not fit with corporate goals. In a closed innovation system, firms hide these ideas or technologies to prevent competitors getting them. These firms ignore these sources of potential profit, whereas if other firms could get this information additional profit could be made. And these hidden new ideas and technologies could go to the market in the first place instead of being hidden within some firms.
- Open innovation can help to refocus on internal resources to develop new technologies, products and services. Open innovation can achieve cooperation R&D and develop the same technologies costing less and using fewer researchers than for an individual company. It helps the individual company to reduce costs of recruitment and training. An individual company can use the saved capitals and staffs on the company's bottom line and the company's higher valued-added tasks.
- Open innovation can carry on R&D at lower risk and with less resources. The major share of R&D budgets is used to develop products and technologies predicted to succeed in the current market because managers do not want to take risk with something too new. There is a small portion of budgets used to develop less 'secure' innovation which may not have a current market, but could be the breakthrough in a future market. Open innovation can help to develop both 'safe' innovation and less 'secure' innovation, once the less 'secure' innovation succeeds, this new breakthrough will develop a new market for the company.

And the company can sell the relevant technologies to other companies to make profits.

Open innovation helps to create an innovative atmosphere in the whole industry and nurture an innovative culture inside the company. Open innovation can develop the relationship between firms and their external innovators. Companies need to get the new ideas and new information from external channels. Companies cannot develop everything inside the box. Companies need to know their competitors' behaviour and consumers' demands in the current market. Collaborating with your competitors to develop the new technologies is the best way to learn their new ideas and business strategy. Therefore:

**Proposition 2: Taking part in an open innovation system in an industry helps to build up innovative capabilities and create more innovation both for the firm and their industry. (Chesborough, 2004)**

China is developing from a resource-driven economy to a technology-driven economy. The Chinese government encourages innovation rather than imitation. R&D expenditure has increased three times in the past seven years and continues to increase. Industry-science linkage is one of key factors for innovation capabilities in the national innovation system. In the past knowledge was created in Government research Institutes and Universities, but enterprise found it difficult to utilize the knowledge because there was no strong connection between GRIs, universities and enterprises. Since China started to reform, industry-science linkage has improved a lot during the last thirty years because of high competition pressure and institutional

changes. Spin-offs, R&D outsourcing and co-publication are three aspects of industry-science linkage.

Government Research Institutes (GRIs) and Universities are encouraged to set up their spin-offs and commercialize their technology directly. And the spin-off companies provide capital to GRIs and universities which do not have any more budgets from government. Currently, although the size of the spin-off industry is very small, it is very important for high-tech industry in China. Spin-off companies provide Scientists, researchers from GRIs and universities many opportunities to access market knowledge. Tsinghua Science Park is the first national science park. There are more than 400 companies located in the science park. Tsinghua University is the top university in China; it cooperates with nearly a third of 400 companies. Two-thirds of the 400 companies are IT companies, environmental and life science companies. Incubator facilities for start-up firms are also encouraged to locate within parks. Since 2000, the Chinese government continuously supports research and higher education. Developing spin-off companies are one of primary objectives of GRIs and Universities. Therefore:

**Proposition 3: Relating closely to universities, and particularly their research laboratories helps to create more innovation. (Link and Siegel, 2007)**

All GRIs are not generally within universities. The Chinese government has encouraged closer connection between these institutions and enterprising innovation orientated companies. Traditionally it was normal for institutions and companies to develop separately, which meant a lot of new ideas, were lost to the market. The

government has become aware of this and is currently encouraging GRI/Company crosspollination of ideas. This must increase innovation. Therefore:

**Proposition 4: Relating closely to Research Institutions helps to create more innovation. (Link and Siegel, 2007)**

An innovative atmosphere helps innovation development. It should be nurtured inside the company. Companies need to nurture an environment to encourage employees to think in unusual way and creative ways. Both products business and service businesses need to follow standardized routines. Routine business is different from innovation. Companies need to encourage and develop creative ideas. The CEO and executive managers must create an innovative atmosphere for innovation. Employees shares new ideas and new thinking to create a social atmosphere of innovation. And the most important is that the company should not just talk about innovation, but must take action. It needs to build up its innovative culture. A firm's innovative culture and atmosphere needs a long time to establish through shared, experienced, and emphasized attitudes, values, goals, objectives and practices.

Innovation needs an innovative environment to encourage value change. Change is very difficult to accept for both employees and companies. Companies need to find new markets, develop new operations and adapt to new societal changes. Encouraging creativity, thinking both inside the box, and outside the box, makes the thinking box bigger, and makes the employees and companies ready to capitalize on innovation opportunities. The purpose of creating an innovative atmosphere is to plant the seed of creativity, create the future of innovation, foster company value



growth and increase the value of customers and stakeholders. A key objective must be to develop in the JV a social atmosphere that encourages innovation. Therefore:

**Proposition 5: Developing a social atmosphere that encourages innovation in a JV brings good results (Fragerberg et al, 2005)**

It is the CEO and top management team's responsibility to establish strategic planning and a vision including innovation. If the company does not develop systems through its strategic planning that lead to innovative thinking, the company will not succeed in innovation. The strategic plan also needs to be realistic. The management needs to create employees passion and creativity combined with measuring employees' satisfaction or financial performance. Therefore:

**Proposition 6: Developing a strong strategic planning system with innovation as a focus encourages innovation (Taylor, 1984)**

Unless the fundamental objective of a JV includes the development of innovations it is likely that other objectives will dominate. For example the Chinese partner will concentrate on learning the Western technology and the Western partner will attempt to access the large Chinese market or ensure that its manufactured products are made efficiently and at low cost. However if innovation is made a key priority of the JV then performance will be measured by this criterion and in all probability innovative performance will be achieved. For example in high-tech JVs innovation is frequently highlighted as a key measure of success, and as a result Chinese partners learn to improve their innovation processes. Therefore:

**Proposition 7: Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)**

As China begins to develop a knowledge-based economy, the enforcement of intellectual property rights (IPR) becomes increasingly important. This is particularly in telecommunication, pharmaceuticals, automobile where professional bodies and standards are set up.

- ***IP rights don't limit the competition for new technology creation*** IP rights don't limit competition. On the contrary, it prevents the ideas and new inventions being stolen. It also protects the new inventions and new products so that they can get their investment return in the market. Pharmaceuticals, high-tech, IT, medical devices, and green technology are the key industries which need to rely on IP rights. In these industries, usually there are several products competing in the market to try to occupy more market share customers. The competition relies on their most advanced technologies. Competition among these products can push the development of the whole industry.
- ***IP rights do not drive up the cost of innovation*** Developing IP right benefits innovation. IP rights provide a more stable and less risky environment for all sectors. And it can help to conduct research, encourage development, commercialize and market their products and new inventions. IP rights can protect entrepreneurs, inventors, and companies to protect their new inventions, achievements and investments. And they can be paid back through profits and put more capitals into further research and development. And IP right also have

transparency in the patent system. Other inventors can learn from their achievements promote the innovation further development; therefore it helps the whole society achieve progress. If there are no strong IP rights, inventors do not have the incentive to create more innovation, they may just keep their inventions as commercialization secrets and other companies in the industry cannot share the new inventions, it does not help the whole industry development.

- In terms of innovation output, one of the largest differences between domestic and foreign applications is the structure of the patent application. For domestic firms, the majority of their patent applications are utilization model or design, although the number of invention applications has been increasing as well. For foreign applications, the invention application is the main category. The number of invention applications by domestic firms exceeded for the first time their foreign counterparts in 2003. However, the foreign firms still outperformed their Chinese counterparts significantly in terms of the numbers of granted invention patents in the past years.

Among foreign patent applicants, the multinational enterprises from Japan and the U.S. are the most active applicants, while German, Korean and French companies are also applying for a large number of patents in China. The distribution by fields of technology reflects to a large extent the competitive strengths of these multinationals in the Chinese market. Therefore:

**Proposition 8: Focusing on developing IP (Intellectual property) leads to more innovation (Granstrand, 2005)**

The research focuses on testing these eight propositions by means of semi-structured interviews. The next three chapters describe the case studies to which the propositions have been applied.

If JV companies are able to score highly on these eight key factors they can be said to have developed strong innovative capabilities. This has been explored with particular focus on the Sino-Western IJVs in this thesis.

## **4.6. Summary**

As background for the development of the sophisticated model of innovation proposed in this thesis, this chapter has described China's national innovation system and considered a number of innovation models in the literature. A more refined innovation model, aimed at filling in existing models, has been developed. Based on this model and a reading of the relevant literature, eight propositions that guide the empirical part of this research were stated. The following chapter deals with the methodology that was adopted to test the model and propositions..

# Chapter 5: Research Methodology

## 5.1. Introduction

This chapter aims to address objectives: a research philosophy, a research methodology and the methods chosen for this research. In order to explain how the researcher arrived at choices in both areas, the chapter briefly reviews the possible options.

## 5.2. Research Philosophy

People have two fundamentally different ways of looking at the world. Some see the world objectively; facts are facts and little interpretation is necessary. Other sees it more subjectively and believes that the world is seen differently through different eyes. These are the two extremes and there are many who stand somewhere between them. Sociologists (especially Burrell and Morgan 1979) have identified a number of different stances between these extremes, and have allocated to them particular qualities and titles. The first part of this chapter reviews a number of these categories or paradigms.

### 5.2.1. Major Paradigms

#### (1) A Positivist Paradigm

The quantitative methodology results from the scientific method. The world is external and objective. Science is value-free and the observer is independent. The researcher should respect the facts and find out the causality. And they also should look through the phenomena to recognize the simplest elements, then find out the hypotheses and test them by fieldwork. Collis and Hussey (2003) argue that social

scientists working in this paradigm should behave as independent observers and accept pre-existing reality. They need to conduct their research in a detached fashion and avoid their values and bias influencing their objectives. The positivist is concerned with the facts or causes of the social phenomena rather than the subjective state of the individual. Collis and Hussey (2003) also identify the positivist as seeking a logical reason in the research. They prefer precision, objectivity and rigour to hunches, experience and intuition as the means of investigating research problems. Positivists believe the study of human behaviour should be conducted in the same way as studies conducted in the natural sciences, which assume the social reality is independent and exists regardless of human's awareness (Collis and Hussey, 2003). The Ontological assumption answers "what is reality?" The epistemological assumption answers "How do we obtain knowledge of that reality?" In the view of the positivist, the behaviour of investigating reality has no effect on the reality.

Positivists believe "laws provide the basis of explanation, permit the anticipation of phenomena, predict their occurrence and therefore allow them to be controlled." (Collis and Hussey, 2003) Social and natural worlds are bound by fixed laws constructed by cause and effect. *Variables* are an attribute of an entity which can be measured and observed. A *Theory* describes the inter-relationship among variables, definitions and hypotheses. It develops a systematic view of phenomena. The quantitative methodology focuses on operationalism and is measured by taking large samples. A survey is a very important part of the quantitative exercise.

## **(2) A Phenomenological Paradigm**

From a Phenomenological point of view, 'the world' and 'reality' are decided and changed by people's thinking (Husserl, 1964, in Easterby-Smith, Thorpe and Lowe, 1991:24). In the *Phenomenological paradigm* the world is socially constructed. Individual behaviour and thinking decide the science and the world. The observer is part of what is observed. So the social researchers do not have access to objective facts, because there are both the opinions of research subjects and the opinions of researchers. The meanings that individual people add to their experiences are very important. The researchers should be involved in different situations and environments and try to understand what is happening there. And they develop their ideas through induction from the data. This method suggests the use of multiple methods to establish different views of phenomena. The phenomena can also be investigated in-depth using small samples (Angvin, 1999).

Social scientists point out that physical scientists research objects which are outside and independent of humans, whereas social scientists research the action and behaviour which are generated from within the human mind. They believe the "*interrelationship of the investigator and what was being investigated was impossible to separate, and what existed in the social and human world was what we thought existed*" (Smith, 1983).

*Phenomenology* is the science of phenomena. Allen (1990) states a phenomenon is "a fact or occurrence that appears or is perceived, especially one of which the cause is in question." The *phenomenological paradigm* believes that the participant's own frame of reference is devoted to the understanding of human behaviour (Collis and Hussey, 2003). Phenomenologists believe the social reality is within the human

being. Therefore the reality is influenced by the behaviour of investigating reality. The qualitative approach emphasizes the subjective of human activity. It focuses on the meaning of social phenomena rather than its measurement.

Collis and Hussey (2003) suggest that phenomenologist believe social reality depends on the human's mind. There is no reality independent of the mind. The process of research will influence what is researched. According to Van Maanen (1983), the research methods used in the Phenomenological paradigm are "*an array of interpretative techniques which seek to describe, translate and otherwise come to terms with the meaning, not the frequency of certain more or less naturally occurring phenomena in the social world.*"

The phenomenological paradigm shows the limitation of the positivistic paradigm. The main criticisms explain the differences between the two philosophical paradigms.

The two philosophies are very different and solve different questions. The *positivist* or *functionalist paradigms* emphasize the regularities in the social world. The phenomenologist or interpretive paradigms focus on the view that the social world can only be understood from the view of observers, and the observers must go to the spot to get first hand information of the subject. (Burrell and Morgan, 1979)

According to Burrell and Morgan (1979) these are two philosophical paradigms 'alternative realities and mutually exclusive ways of viewing the world'. The two radical methods cause fighting in many researchers' mindset.



### 5.2.2. Two Dimensions: Four Paradigms

Burrell and Morgan (1979) define four distinct sociological paradigms which can analysis social theories. The figure describes the relationship between these paradigms, including *radical humanist*, *radical structuralist*, *interpretive* and *functionalist*. In the diagram, every paradigm shares common features with its neighbours on the horizontal and vertical axes in one dimension, but it has different feature on the other dimension.

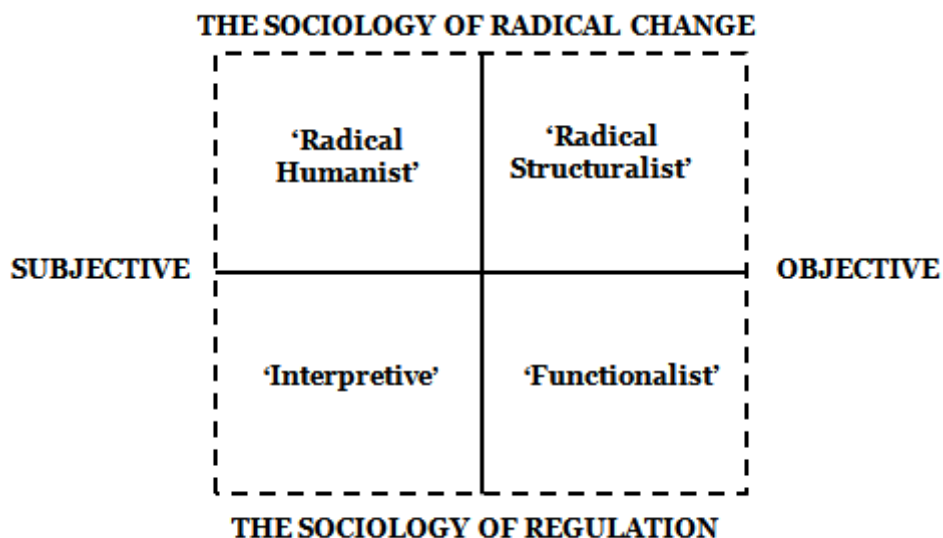
The four paradigms are defined by basic meta-theoretical assumptions. Each paradigm represents a group of theorists who have a common perspective. Every paradigm also separates a group of theorists from other group of theorists belonging to other paradigm. A group of theorists in different paradigms have different views of the social world.

According to Burrell and Morgan (1979), all social theorists can be allocated into four paradigms according to the meta-theoretical assumptions. The differentiation of the basic similarities and differences between the works of theorists can be identified by these four paradigms. People also can allocate their own frame of reference into these four paradigms. Burrell and Morgan (1979) state four paradigms which provide a tool for mapping intellectual journals in social theory, for both theorists who contribute to this area and the individual person.

The activity within the each paradigm is very considerable, whereas an inter-paradigmatic 'journey' is seldom carried out (Burrell and Morgan, 1979) Keat and Urry (1975) state "for individual scientist the change of allegiance from one paradigm to another is often a conversion experience." There is a major break with his intellectual tradition when the theorist changes his original paradigm position to the

other paradigm position. He will be welcomed by his new paradigm theorists and sever ties with his former paradigm theorists.

Some believe that these four paradigms exclude each other. There is no synthesis among them; they are contradictory to each other. Each paradigm is based on opposing meta-theoretical assumptions. Every paradigm provides alternative views of social reality. The natures of the four paradigms represent four different views of society (Burrell and Morgan, 1979). No theorist can be based on more than one paradigm once he accepts the assumption of one paradigm; in the mean time it denies the other three assumptions of three paradigms.



Source: Burrell & Morgan (1979)

**Figure 5.1: Paradigms for the Analysis of Social Theory**

### **5.2.3. Another View of Paradigms**

The positivistic and phenomenological paradigms are two extremes. According to Morgan and Smircich (1980), there are a whole range of possible paradigms. In their view there are six alternative classifications and alternative paradigms. They develop a continuum of these assumptions with six stages.



The right end of continuum is the extreme phenomenologist view. Morgan and Smircich name it the *subjective* end. “Reality as a projection of human imagination” (Morgan and Smircich, 1980) in this assumption, all social worlds are inside the human being’s mind.

### **5.3. Types of Research Methodology**

Once the researcher’s philosophy had been identified as basically positivist/functionalist, she needed to move on to choose a research methodology. This depends more on the needs of the research than on the researcher’s view of the world. Basically there are two types of research methodologies – quantitative and qualitative.

#### **5.3.1. Qualitative Research**

According to Faulkner (1993), qualitative research is strongly contextual, emphasises process, observing a sequence of events, and giving insights into associations. The case study by semi-structured interviews is the most widely-found part of the qualitative method.

#### **The Nature of Qualitative Research**

Bryman (1989) describe the main preoccupations of qualitative research.

- Firstly, the researcher “adopts the stance of an insider to the organization, and accordingly there is a strong accent on the interpretation offered by the managers themselves of the nature of their organization.” There is a strong accent on interviewees’ interpretations of events.
- Second, “the researcher gives a strong sense of context.” It develops the context of the environment being researched in some depth.

- Third, qualitative research emphasizes process- the unfolding of events in time. It tells a story through time as events unfold.
- Fourth, most qualitative research is adopts a loose structure; it shows the other feature of qualitative research-flexibility. It tends to be low on the structuring of issues, and strong on developing theory after, rather than prior to the interviews (of grounded theory, Glaser and Strauss 1967).
- Fifth, field notes from participants, interview/conversation transcriptions and documents are three main sources of data. Qualitative research employs a number of information sources which can be cross-checked, notably interview transcripts, press clippings, and perhaps the Minutes of Board meetings.
- Sixth, because the conception of organizational reality is held to be socially constructed, organizational culture needs to be examined. Qualitative research is a valuable instrument for identifying an organisation's culture.
- Seventh, the researcher “observes the flow of interaction at the first hand and develops an understanding what was important to his subjects as a direct product of that proximity.” Through the closeness of the interviewer to the subject of the research, a close understanding of what matters most can be more easily determined.

### **The Limitation of Qualitative Research**

However, quantitative researchers have doubts concerning the "*scientific*" nature of qualitative research, since they claim that insights derived from the case study are not of general validity. "*Qualitative research is fine for exploratory studies, but*

*quantification is necessary to establish the validity of any findings"* (Goode and Hatt 1952)

Indeed Miles (1979) is even stronger in his view: "Qualitative research on organizations cannot be expected to transcend story-telling..." He argues that the analyst faces "...the steady tension between the unique contextually specific nature of single sites, and the need to make sense across a number of sites." This negative view of case studies is rejected by qualitative researchers. Smith (1989) suggests that the case study is a way of organizing social data. This includes the development of that object over time, a factor that surveys and questionnaires, with their comparative statics approach are not typically designed to capture. He claims that statistics only have meaning for the researcher, if they can be made to fit a theory, which must by definition be constructed on logic not on pure numbers alone. Yin (1981) suggests that: "The distinguishing characteristic of the case study is that it attempts to examine (a) a contemporary phenomenon in its real life context, especially when (b) the boundaries between phenomenon and context are not clearly evident."

According to Bryman (2001, P282), quantitative researchers describe four criticisms of qualitative research:

- "Qualitative research is too subjective". Quantitative researchers believe qualitative researchers have unsystematic views about what is important, and qualitative findings are based on these views and the close relationship between the researchers and people studied. Qualitative researches begin with the open-ended questions or problems, while quantitative research is more structured and tends to begin with a clear hypothesis. (Bryman, 2001).

- “Difficult to replicate”. Quantitative researchers emphasise the ability of different researchers to repeat a given research in different contexts. However, qualitative research is less structured compared with quantitative research and there are no standard procedures for replication. In qualitative research, the researcher is central to data collection. For example through carrying out interviews and observation. Bryman (2001) states that qualitative research involves a process of interpretation with research subjects and hence the interpretation of their responses is decided by the subjective learning of the researcher.
- “Problem of generalization”. Quantitative researchers argue that “interviews are conducted with a small number of individuals in a certain organization or locality.” Because of this, qualitative research cannot be generalized.
- “Lack of transparency”. Quantitative researchers argue that qualitative research reports are sometimes unclear about how people were chosen for observation or interview. Bryman and Burgess (1994) state that the process of qualitative data analysis is frequently unclear. These are the areas of a lack of transparency in qualitative research.

### **5.3.2. Quantitative Research**

Bryman (1989) describes the general orientation of quantitative research. First, hypotheses contain concepts which need to be *measured* in order to test hypotheses systematically. The process of translating concepts into measures is *operationalization*. These measures are treated as variables. “*Measurement is a preoccupation for quantitative researchers, by virtue of its centrality to the overall research process.*” (Bryman, 1989)

Bryman (1989) states the second preoccupation is *causality*. Causality shows how things come to be the way they are. Implicit or explicit statements about causes and effects are contained by many hypotheses. Causal effects are described by *independent variables* and *dependent variables*. Establishing cause-and-effect relationships is one of the most important preoccupations in social survey design (Bryman, 1989).

Bryman (1989) describe the third preoccupation as generalization. The investigation can generalize the findings. In social survey research generalizability reveals the sample as representative of a larger population.

The fourth preoccupation is *replication*. Investigations should be capable of *replication* in quantitative research. The same research procedures can be used by a researcher in another study to check the validity of the investigation. Replication is very similar to generalizability. Replication can also check the biases and predilections of the researcher if their findings are verified. The same research design and measurement procedures can be done by another researcher, and the findings should be the same. It is possible to verify a social scientist's findings by using the same procedures. But qualitative research has no replication.

### **The Advantage of Quantitative Research**

Quantitative research is much stricter in its approach to hypothesis testing. Its key element in much social science research is the survey questionnaire, designed to test the validity of propositions, and to measure the degree to which one concept can be associated with another.

According to Faulkner (1993) the quantitative researcher should:



- “Develop a number of propositions or hypotheses which, if validated, support a theory.”
- “Design a questionnaire, frequently with multiple choice questions to aid statistical analysis.”
- “Persuade a statistically significant number of relevant people to complete the questionnaire.”
- “Analyse the data to determine the level of correlation between selected independent and dependent variables, and establish the level of significance of the results.”

If possible, the researcher seeks to explain as much as possible of the variance between a perfect 100% correlation, and the one actually obtained.

### **The Limitation of Quantitative Research**

The theorists of qualitative research criticize quantitative research based on its epistemological and ontological foundations. Bryman (2001) argues that the critique of quantitative research includes “*criticisms of quantitative research in general as a research strategy; criticisms of the epistemological and ontological foundations of quantitative research; and criticisms of specific methods and research designs with which quantitative research are associated.*”

According to Bryman (2001) there are four criticisms of quantitative research:

- “Quantitative research fails to distinguish people and social institutions from the world of nature.” Schutz (1962) argues there are differences between the social world and the natural world. He believes people can interpret the world around

them and people have self-reflection. Whereas the natural science has no self-reflection.

- “The measurement process possesses an artificial and spurious sense of precision and accuracy.” Theorists of qualitative research argue that the relationship between measures and the concepts are developed by the theorists of quantitative research and are not real. Cicourel (1964) describe quantitative approach as providing “a solution to the problem of meaning by simply ignoring it.”
- “The reliance on instruments and procedures hinders the connection between research and everyday life.” Quantitative research relies on research instruments to subjects, such as structured interviews and self-completion questionnaires. Cicourel (1982) asks if survey respondents have the requisite knowledge to answer the question. Are the topics of the questions similar to their everyday life?
- “The analysis of relationships between variables creates a static view of life that is independent of people’s lives.” Blumer (1956) argues that the relationship between variables ignores the “the process of interpretation or definition that goes on in human groups”. Quantitative research creates a static social world and separates it from the people who build it up.

The use of quantitative research methods seems more likely to lead to *scientific* results, because they are closely related in method to those used in the physical sciences. However, these methods also have their limitations. In quantitative research, the questions tend to be closed-ended ones to facilitate statistical analysis, but this often forces the respondent to choose between a numbers of answers, none

of which may accurately reflect his views. It is also difficult to introduce a sense of time sequence to quantitative analysis. Furthermore the quantitative researcher should explore the complex organisational reality.

Faulkner (1993) suggests that a representative, random and statistically adequate sample of questionnaire respondents is obtained for subsequent analysis from an accurately determined population is the ideal quantitative research. However, it is difficult to obtain. There are at least two important problems. First, the low proportion of completed questionnaires may lead to an unrepresentative sample. Second, the acceptable size of the sample as a proportion of the population relevant to the research is not known, but it is probably a minimum of 60-this means that constructing a suitable sample may be very difficult in practice.

On the positive side, well structured quantitative research giving high correlations and a strong significance test may lay reasonable claims to reflect underlying associations with perhaps some generalizable predictive value. It may also give pointers to the difference in relative importance between different variables, a difficult thing to do in case-study work. (Faulkner, 1993)

### **5.3.3. Comparing Qualitative and Quantitative Research**

Bryman (1989) compare seven characteristics of qualitative research with quantitative research.

- First, quantitative research emphasizes interpretation less than qualitative.
- Second, quantitative studies give little attention to context. The researcher takes a number of variables which represent a sample of organizations. They do not get “feel” for the organizations.

- Third, quantitative research focuses less on the process of organizational reality.
- Fourth, quantitative research has a rigorous analytical and statistical framework within which data are to be collected. In survey research, the questionnaires or interview schedules specify in advance what the researcher can and cannot find. Whereas qualitative research is more likely to follow a loosely structured approach to collect data (Bryman, 1989).
- Fifth, quantitative research tends to use a single type of data source; qualitative research has the potential to use many data sources.
- Sixth, quantitative research views organizational reality as external to (and often irrelevant to) the researcher. Qualitative researchers believe that organizational reality is created by people and hence is highly relevant to research.
- Seventh, a qualitative researcher normally engages very closely with organizational phenomena, while a quantitative researcher will keep research subjects at a distance.

After considering the above theories of research philosophy and methodology, the researcher felt most comfortable with a basically functionalist philosophy. She also arrived at the view that a complex and diffuse subject like innovation could not be most usefully addressed through quantitative analysis. Quantitative analysis is valuable when correlations are sought between factors in the search for causality, or when the aim is to identify the factors that go to make up the variance between 100% correlation and that found in an empirical sample. It also takes a large number of detailed and fragmented data and subjects it to statistical analysis. This was not what was required from this research. It was important to understand the 'story' of

how a Sino-western joint venture sought to achieve innovation. What actually happened in the history of the joint venture was therefore the key to the research and for this a qualitative interview based methodology was adopted as the most appropriate.

The researcher therefore adopted a multiple case study approach as recommended by Yin (1984) with the aim of gaining insights into the factors that were common in enterprises aiming at innovation as a key part of their mission.

Clearly sufficient insights could not reasonably be expected to be obtained by addressing only one case study situation. The issue therefore presented itself of how many cases should be sought. There is no definitive answer to this question. However, the number ten was felt to be both an acceptably large number of cases to give a wide variation of situations to analyse, and to be sufficiently small to be tackled within the time frame allowed for a PhD piece of research. In this the researcher followed Eisenhardt (1989) in choosing multi-case research.

The next issue was whether grounded research or hypothesis/proposition based research should be carried out. The researcher came to the view from her literature search that the amount of previous research on the subject being studied was not sufficient to justify the adoption and testing of clear hypotheses. She also took the view that grounded research (Glaser and Strauss 1967) was too unstructured an approach and was likely to lead to much wasted research effort in seeking the nuggets of 'truth' required. She decided therefore to adopt a proposition testing approach based on a set of propositions in relation to innovation discovered in the literature. She recognized that there may be other propositions that could have been

chosen but on reflection, and after the pilot study felt that her set provided a very good research challenge.

Generally these propositions referred to some of the key conditions necessary for the development of innovation capabilities in a company. They did not necessarily add the further qualifying dimension of applying to innovation brought about only through cross-border joint ventures. However it was recognized that the Western element of the JV provided the new injection of ideas and this, at least in the early days of 'reform' in China, made the JV an important vehicle for innovation activity. It was noted that research into such JVs in relation to innovation provided the fundamental 'gap' in the literature that the research sought to fill, so this limitation was not felt to be significant,

Having decided to aim at ten case studies the researcher then questioned whether innovation would be differently approached in traditional manufacturing industries, high technology industries and service industries. However, as she soon discovered, getting access to industries and companies of choice was by no means easy. She therefore accepted the offers of interviews that she was able to obtain, and was pleased to discover that in fact the three categories were covered by her research, even if not in a balanced fashion, in so far as she had only one service company in the list.

The criteria for actual JVs selected to study were that they had been in existence over two years and were formed of parent companies of sufficient size and reputation to make interesting and informative study. In this endeavour the researcher felt very happy with the sample she eventually obtained by largely opportunistic and networking methods.

### **5.3.4. Difference between Propositions and Hypotheses**

Cooper and Schindler (1998) state that developing a hypothesis or question for further research is the immediate purpose of exploratory research. Their definition of a proposition is that *“it is a statement about concepts that may be judged true or false if it refers to observable phenomena.”*

Logic replaces data as the basis for evaluation during the theory-development process. *“Theorists must convince others that their propositions make sense if they hope to have an impact on the practice of research. If the theoretical model is a useful guide for research, by definition, all the relationships in the model have not been tested. If all links have been empirically verified, the model is ready for the classroom and is of little value in the laboratory.”* (Whetten, 1989)

Dillon, Madden and Firtle (1994) and MacDaniel and Gates (1999) argue that “a hypothesis is an assumption or guess that the researcher makes about some characteristic of the sample population.” Willemse (1990) describes “a hypothesis as an assumption to be tested with the objective of making statistical decisions based on a scientific procedure. It is an attempt to determine when it would be reasonable to conclude, from an analysis of a sample, that the entire population possesses a certain property.”

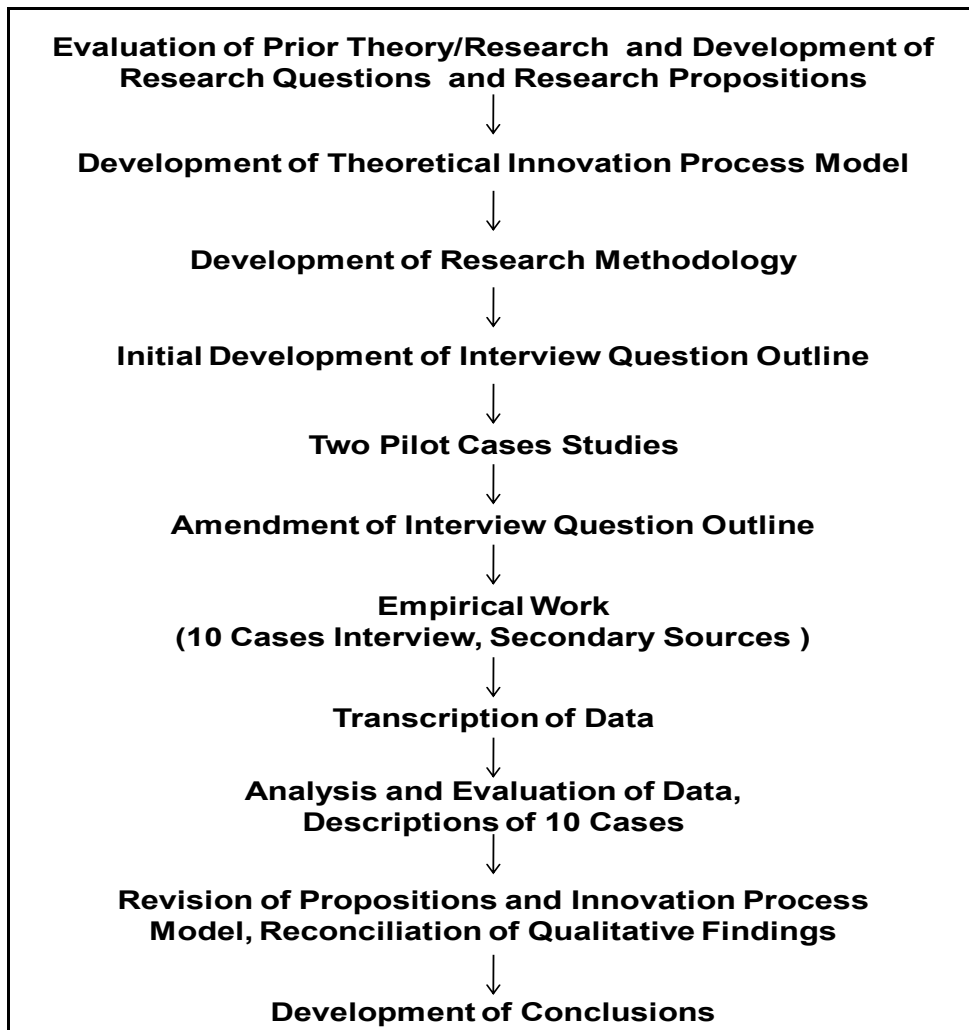
Bryman (2001) defines a hypothesis thus: *“An informed speculation, which is set up to be tested, about the possible relationship between two or more variables.”* Collis and Hussey (2003) describe a hypothesis as a testable idea about the relationship between two or more events or concepts. Statistical analysis is generally used to test a hypothesis.

According to Whetten (1989) “The primary difference between propositions and hypotheses is that propositions involve concepts, whereas hypotheses require measures.” Propositions should be well in the Whys, the Hows and the Whats. Generally propositions are used in research where there is insufficient established theory to develop hypotheses confidently. Hypotheses are used where the literature is more strongly established on the subject. This research uses propositions.

#### **5.4. The Research design and process**

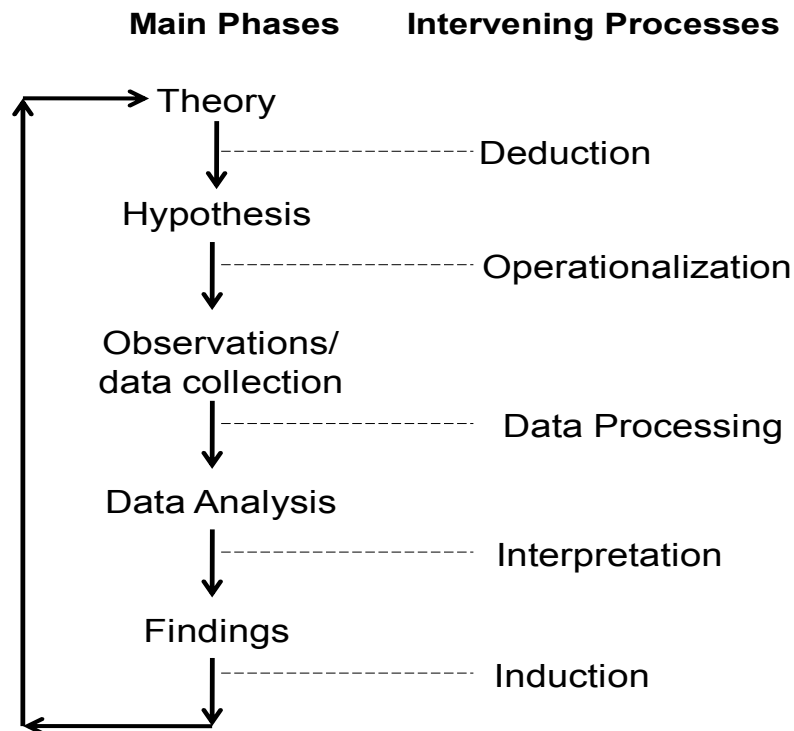
In summary the researcher has adopted a basically functionalist paradigm. The research is based on case studies rather than, for example, a large-sample questionnaire based survey. This research uses qualitative methods of semi-structured interviews. After an initial literature review, some tentative propositions were developed, and these were refined following two pilot studies. The pilot studies and the main research provided 10 cases, and semi-structured interviews were used to build up rich pictures of 30 companies (10 cases include 20 parent companies and 10 children companies). The research framework was carried out by the following steps, as shown in **Figure 5.3**.





**Figure 5.3: The research framework**

**Figure 5.4** is an example of a deductive approach to the relationship between theory and data. In the last step there is a movement in the opposite direction from deduction, which is induction. This deductive approach is usually associated with quantitative research. Robson (2002) provide a very similar model of deductive research.



Source: Bryman (1988a)

**Figure 5.4: The logic structure of the Research Process**

## 5.5. Method of Data gathering

The data for the case studies was both primary and secondary in nature. The researcher sought all possible information of a secondary nature from company reports, company literature and from the internet. She then prepared an interview check list and embarked on interviews with four senior executives per joint venture for the primary research. The interviewees were selected to cover a range of functions, finance, marketing, general management and strategy generally. All interviewees were asked the same questions, which were based on the propositions. Since the interviews were intended to be semi-structured, interviewees were

encouraged to develop their answers in an open formatted way, and where possible to be somewhat anecdotal. By the fourth interview it was generally felt that the same ground was being repeated to some extent and information saturation was being achieved. Four interviews were felt therefore to be sufficient.

Most of the forty interviews were with Chinese managers and were carried out in mandarin, although this was not exclusively the case. Some executives also worked in one or other of the parent companies, while others worked entirely within the joint ventures themselves. All interviews were tape recorded with the permission of the interviewees and subsequently transcribed. Each interview took between one and one and half hours. The researcher agreed with most interviewees that they would not be personally identified in the thesis and indeed nor would their company. For this reason the only copies of the thesis including company names were those submitted to the examiners. Further copies have been anonymised to keep faith with the interviewees. Hence each JV, and its parent companies, are referred to using code names.

It is suggested that the whole process was successful largely because the researcher is a Chinese national, speaks mandarin as her first language and has a strong network base in China. However despite this some comments are necessary in relation to the difficulty of obtaining social research data in Chinese companies and joint ventures. Culturally Chinese executives are very cautious in what they say to non-members of their company. It is believed in the West that there is a tendency also for such executives to tell interviewers what they think they want to hear, sometimes at some cost to historical accuracy. There may be some truth in this.

Certainly it was impossible to get the interviewees to discuss present or past problems in the JV, or to make indiscreet anecdotal comments.

Despite these limitations the researcher felt that she was able to get very useful information from her interviewees, which given its consistency across industries and companies might make some claims to a degree of generalisability, to the extent that this is at all possible using qualitative research methods.

### **5.5.1. Collecting the data**

In this research, the researcher developed a sample through networking to gain access to a sample of major JVs in the country. The key details were as set out below.

- 10 case studies of major JVs operating in China.
- Innovative industries in China.
- Different categories of industry: high-tech, medium or low-tech and service.
- Qualitative research based on semi-structured interviews.
- 4 interviews per JV.
- Proposition-testing methodology.

### **5.5.2. The Cases**

The five Joint Ventures in high-tech industries in the in-depth research adopting the two partner (Western and Chinese) joint venture form are:

- **H1W** and **H1C** with their joint venture **JVH1**

- **H2W** and **H2C** with their joint venture **JVH2**
- **H3W** and **H3C** with their joint venture **JVH3**
- **H4W** and **H4C** with their joint venture **JVH4**
- **H5W** and **H5C** with their joint venture **JVH5**

The four Joint Ventures in Low- and medium-Tech (LMT) industries in the in-depth research adopting the two partner joint venture form are:

- **LM1W** and **LM1C** with their joint venture **JVLM1**
- **LM2W** and **LM2C** with their joint venture **JVLM2**
- **LM3W** and **LM3C** with their joint venture **JVLM3**
- **LM4W** and **LM4C** with their joint venture **JVLM4**

The one Joint Venture in service industries in the in-depth research adopting the two partner joint venture form is:

- **S1W** and **S1C** with their joint venture **JVS1**

**Table 5.1: A Description of the 10 Cases**

<b>INDUSTRY</b>	<b>CASE</b>	<b>JV COMPANY</b>	<b>JV PARTNETS (Western/Chinese)</b>	<b>HISTORY (years)</b>
<b><u>High-tech</u></b> Telecommunications	<b>1</b>	<b>JVH1</b>	<b>H1W/H2C</b>	<b>14</b>
	<b>2</b>	<b>JVH2</b>	<b>H2W/H2C</b>	<b>13</b>
	<b>3</b>	<b>JVH3</b>	<b>H3W/H3C</b>	<b>14</b>
	<b>4</b>	<b>JVH4</b>	<b>H4W/H4C</b>	<b>8</b>
	<b>5</b>	<b>JVH5</b>	<b>H5W/H5C</b>	<b>6</b>
<b><u>Low and Medium-tech</u></b> Automobile Chemical	<b>6</b>	<b>JVLM1</b>	<b>LM1W/LM1C</b>	<b>15</b>
	<b>7</b>	<b>JVLM2</b>	<b>LM2W/LM2C</b>	<b>4</b>
	<b>8</b>	<b>JVLM3</b>	<b>LM3W/LM3C</b>	<b>18</b>
	<b>9</b>	<b>JVLM4</b>	<b>LM4W/LM4C</b>	<b>9 Finished in 1998</b>
<b><u>Services</u></b> Logistics	<b>10</b>	<b>JVS1</b>	<b>S1W/S1C</b>	<b>14</b>

### **5.5.3. The Pilot Case Studies**

JVS1 and JVLM1 were chosen as pilot case studies to test the preliminary propositions, and to investigate the effectiveness of semi-structured interviewing of senior executives involved in the alliance, as a fundamental method for eliciting and testing the validity of the propositions. The two JV companies were chosen as examples of successful joint ventures between Western and Chinese companies. One JV Company is in the service sector and the other is in the low and medium technology sector. The researcher was able to gain access to the two JV companies through personal contacts.

In this research, data about innovation in joint ventures was sought through in depth interviews with individual managers in the alliances. In some cases, the managers also worked for the parent companies, and could therefore provide information not only from the perspective of the joint venture but also from the viewpoint of one of the parent companies. As the purpose of the pilot study was initial testing of the propositions and exploration of the interview approach, only two alliances were investigated at this stage. The interviewees were selected on the basis of their power of decision and level of information they handle. **Table 5.2** contains details the two pilot cases included in the study.

**Table 5.2: Description of two pilot case studies**

Case	Industry	JV company	Country	Western and Chinese Partners	History (years)
<b>A</b>	Service	JVS1	UK then HK	S1W/S1C	14
<b>B</b>	Low and Medium-tech	JVLM1	USA	LM1W/LM1C	15

There are two criteria to identify the appropriate interviewee, namely:

- They must be knowledgeable about the company and its competitive environment (Campbell 1955)
- They must be familiar with the joint ventures strategy, the knowledge about innovation and the learning process.

Hence, the most appropriate interviewees are the top managers responsible for the innovation in joint ventures. Usually the top managers are the strategy manager, the finance manager, the marketing manager, and the human resource manager.

**Table 5.3** provides the list of managers interviewed for the pilot case studies. Each interview in the pilot study lasted about two hours and was recorded, allowing the interviewer to pay more attention to the top managers and to ask sub-questions arising out from their stories/answers. In order to achieve triangulation, the researcher sought data and information from annual reports and specific literature on each organization’s underlying philosophy and working practices in addition to the interviews.

**Table 5.3: Description of Interview Schedule**

Case	Interviewee Position	Interview Dates	Interview Location
<b>A</b>	1. Head of Strategy and Change Department	23/02/2007	China face-to-face Interview
	2. Head of Financial Department	24/02/2007	China face-to-face Interview
	3. Head of Human Resources Department	24/02/2007	China face-to-face Interview
	4. Head of Marketing Department	23/02/2007	China face-to-face Interview
<b>B</b>	1. Strategy Manager	26/02/2007	China face-to-face Interview
	2. Financial Manager	27/02/2007	China face-to-face Interview
	3. HRM Manager	27/02/2007	China face-to-face interview
	4. Marketing Manager	27/02/2007	China face-to-face interview

All the interviews were analyzed by building categories, reflecting common patterns in the answers of the interview interviewees and among companies (Eisenhardt, 1989). The researcher compared and contrasted cases in order to draw conclusions as suggested by (Miles/Huberman 1994).

The pilot study had various benefits for the research. First, it helped the researcher to focus the research specifically on the issues of innovation. Secondly, it led to the refinement of the research propositions that informed the research. Thirdly, it allowed the researcher to develop a more succinct question schedule for the main semi-structured interviews. As a by-product, the researcher was more attuned to the need



to ensure a good cross-section of JVs for the main study, in particular JVs that had been established for several years (so that an innovation strategy could have had time to develop). The pilot study made it clear that innovation is not restricted to high tech JVs, but occurs in low and medium tech JVs as well.

## **5.6. Summary**

This chapter has reviewed briefly the range of options available to a researcher in terms of research philosophy and research method and considered their strength and limitations particularly in relation to the research project on hand. Having chosen a functionalist approach combined with qualitative, case study based research using semi-structured interviews and secondary data, the researcher then details her precise way of working and the results of her prior pilot studies. The next three chapters will describe the case studies and their key characteristics as regards innovation capabilities.

In the next three Chapters (6, 7 and 8), the ten case studies are discussed individually. Chapter 6 examines the five high-tech joint ventures, Chapter 7 examines the four low and medium-tech joint ventures, and Chapter 8 examines the service industry joint venture. For each case, a general description of the joint venture and the parent companies is provided. This is based on publicly available material, such as corporate websites, financial statements, annual reports and marketing material, and also on comments made by the managers interviewed. During the interviews, some managers provided written material, both items also available in the public domain and items not readily available to the public. In order to make the general descriptions more readable, and to maintain anonymity, they do not contain detailed references to these sources.

Following the general descriptions of each joint venture, the views of the managers from that joint venture relating to the eight propositions are discussed. Based on direct quotations and on indirect summaries of managers' views, an overall assessment is arrived at for each proposition for each case studied. After the individual analyses set out in Chapters 6, 7 and 8, a cross-case analysis is undertaken in Chapter 9. In order to summarise the views expressed by the 40 managers interviewed about the eight propositions being investigated, a form of qualitative content analysis (Flick, 2009, pp. 323-328) was performed.

# Chapter 6: Findings of the five cases in High-Tech Industry

This chapter considers the five cases of High-tech joint ventures. In each case, there is a short introduction explaining the background to each JV and its parent companies, and then a discussion of specific findings on a proposition-by-proposition basis. The JVs presented are identified anonymously as JVH1, JVH2, JVH3, JVH4 and JVH5. In this and the following two chapters, descriptive material has been taken from a range of sources, but these sources are not identified in order to maintain anonymity.

## 6.1. Case 1: JVH1 (telecommunications)

Case 1 describes the joint venture between a Western partner, identified here as H1W, and a Chinese partner, identified here as H1C, set up in 1996.

### 6.1.1. JV Company and parents companies

#### **Western Partner: H1W**

H1W is the top manufacturer of mobile devices according to market share in the world. And it is a leader in converging internet and communication industries. It has over 100,000 employees in 100 countries. The main products are GSM (Global System for Mobile Communications), CDMA and W-CDMA (UMTS). Its internet services cover applications, games, music, map, media and message through its platform. H1W also provides telecommunications network equipment, solutions and services.

H1W has R&D, manufacture and sales in many counties in the world. Till the end of 2009, it has R&D centres in 16 countries employing more than 30,000 people, representing 30% of all employees. Its Research Centres are located in several countries, China, India, United States, etc. The corporation also has more than 10 manufacturing facilities in China, Finland, India, South Korea, etc.

By 1998, H1W's focus on telecommunications and its early investment in GSM technologies had made the company one of the world's largest mobile phone manufacturers. Between 2000 and 2008, H1W's turnover increased almost fivefold from 6.5 billion Euros to 31 billion Euros. Logistics continues to be one of H1W's major advantages over its rivals, along with greater economies of scale.

### **Chinese Partner: H1C**

Established in 1906, the company was "the first communication manufacturer in China". It is currently the largest such company. The company achieved many "firsts" in the history of communication in China: for example, the beginning of the research and production of the microwave equipments in 1958, the successful production of the mobile communication products in 1982, the first China digital microwave circuit built by the solid-state 34MB/S equipment. Now, the company has become one of the biggest national high technology enterprises and integrates research, development, production and sales of communication products.

The company focuses on business applications and the complementary communication fields, and provides products and services in the fields of intelligent communication, coal and power control, network and video application, industry and commerce and post call centres, as well as in wireless transportation, communication power, distribution frame, base station antenna and mechanical

processing. The company's philosophy is "Absorb the essence of technology to build a bright future".

### **IJV Company: JVH1**

When H1W entered the Chinese market, the Chinese government required them to have a local partner according to policy. The primary objective of H1W for the JV is to generate value for the stockholders, which is always number one objective for most firms. H1W brings in capital into the JV, as well as technology transfer. JVH1 engages in the China telecommunications industry and other sectors of the electronics industry, including the manufacture and marketing of telecommunications systems and equipments, mobile phones as well as consumer electronics and industrial electronic products. JVH1 also engages in other industrial and commercial operations; securities trading and other investment activities. All these need high-technology and innovation.

### **6.1.2. Findings**

#### **(1) Innovation networks**

Four managers interviewed in the JVH1 case have emphasised the importance of innovation networks. They describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities. The strategy manager of JVH1 states:

*We joined the innovative networks in high-tech industry and it helps it to create innovative capabilities. And the innovative network in the communication industry relates closest with our technology. For example, we have joined global associations, such as GSM Association, 3G Association, CDMA, the (International Telecommunications Union (ITU) as well. The association is one type of innovative network. A lot of these types of associations are related to technology. When*

*[JVH1] wants to know about GSM, it joins the GSM Association and then it knows what is going on there and learns from other members through the association. The Associations bring in a lot of members, operators, vendors, manufacturers, etc. This is how the innovative network works.*

Over ten years the inter-organizational networks are becoming very crucial to innovation success. Networks can build up innovative capabilities, including collecting a large number and different kinds of ideas, accessing resources easily, and enhancing the transfer of knowledge. In formal collaborations, when the firms cannot achieve the goals by themselves, the collaborations may help the division of innovative labour so that all the firms can accomplish the goal together. The investments in mutual learning and the diverse collaborations are associated with increased patenting. Patenting is very important to the innovation process.

The marketing manager of JVH1 mentions when they wants to develop specific technology, they need their innovative networks in the industry to achieve the goal, he gives an example:

*For example, Chinese TDSCDMA, which is Chinese 3G technology. TDSCDMA is 3G technology for the Chinese market. It is home grown here in china. It only exists here in China. But we cannot achieve the goal by ourselves; the innovative networks in the industries could help the division of innovative labour so that all the firms can accomplish the goal together. Then we need to create a TDSCDMA Association that would actually bring in the different parts of the process, bringing in vendors, bringing in cheap makers, operators, such as China Mobile, which implemented that technology, [H1C] is doing very well. Then we need to create the parameters of what is expected from the technology. TDSCDMA is a very specific technology that we want to achieve and create. The created TDSCDMA Association will become a global association.*

Four managers of JVH1 all strongly agree becoming part of a wide innovative network in their industry helps to create innovative capabilities.

## (2) Open Innovation

In the H1W/H1C case, strategy manager supports taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry, however, the other three managers interviewed including marketing manager, HRM manager and finance manager, agree with this idea in principle, but state that it does not happen in practice very much.

The geographical and thematic extent of an Open Innovation network reflects the ambition of JVH1 to foster innovation, tackle key technical challenges and unlock global business opportunities in collaboration with the world's best experts. JVH1 has signed formal framework research agreements with different strategic academic partners to take part in an open innovation in its industry. SYMBIAN Foundation is a very good example of open innovation in the telecommunication industry. JVH1 was involved in establishing SYMBIAN Foundation. SYMBIAN Foundation is very similar to the operation system Linux which is also open innovation and is being worked on by many parties. The strategy manager of JVH1 states:

*Open Standards means that the firm is doing R&D together with other firms, and the firm can share the technology or products with other firms in the industry. It is not held back by anybody; all firms research together and share the outcome of innovation. SYMBIAN Foundation is a very good example of open innovation. And there will be many companies who are also involved in creating and develop SYMBIAN.*

He also points out:

*Through open innovation, it creates a lot of standards, and most firms can use these standards free. Nobody owns this. So this is called Open Association. It is basically what Open System is. Another example is Linux, Everybody works and*

*creates Linux. No single company can do it by itself. And any firm can use Linux free.*

Throughout its history, JVH1 has adapted and made constant innovation to its operations to respond to the needs of the market. It is currently transforming and shaping its business operations to reflect the evolving nature and structure of a converging mobile and internet world. JVH1 currently has three reportable segments: Devices, Services and Networks.

One out of four managers agrees with that open innovation helps to create more innovation, three managers agree with this idea in principle, but state that it does not happen in practice very much.

### **(3) University-Commercial relationships**

Strategy and marketing managers in the H1W/H1C case have strongly supported the idea that companies should work closely with Universities on innovation. HRM manager agree with this idea, However finance manager comments that information is not totally shared with the universities for reasons of commercial secrecy, universities are therefore partners but only partially so. The marketing manager of JVH1 point out:

*“We have a lot of agreements with lots of universities. Also we usually set up our R&D centre close to universities there. We have a lot of projects with the universities; we strongly believe that these researchers and scholars in universities think outside the box, as they are not trained by the normal industry thinking. So, you have industry thinking, that is more or like inside a box, and the university is outside Industry, and outside industry thinking. We have industry thinking here. Researchers and scholars in universities are innovative, and very fresh, have fresh ideas and very different approaches which are very valuable.”*



Above all, two manager strong agree with this idea, one manager agree with it, and one manager agree with the proposition in principle, but state that it does not happen in practice very much.

#### **(4) Company-research institutions cooperation**

Marketing manager agrees that relating closely to research institutions helps to create more innovation. And they have cooperated with different research institutes, and R&D centres to cooperate on many projects. However, strategy manager, HRM manager and finance manager agree with this idea in principle, but state that it does not happen in practice very much. The marketing manager of JVH1 point out:

*“Our company is actively engaging in innovation through selective and deep research collaborations with world-leading research institutions. By sharing resources, leveraging ideas, and tapping each other’s expertise we are able to create vibrant innovation ecosystems, multiply our efforts, enhance innovation speed and efficiency, and derive more value for our organizations and ultimately for our end-customers.”*

Above all, only one manager agrees with this idea, the rest of three managers agree with it in principle, but believe that the cooperation is not close in practice.

#### **(5) Developing a social atmosphere for innovation**

Four interviewed managers have supported this idea. Finance and HRM agree with it. Strategy manager and marketing manager strongly agree with it. They agree that developing a social atmosphere that encourages innovation in a JV brings good results. The marketing manager of JVH1 point out:

*“Here, if you look at most internet companies, they have flexible hours, they have relaxed environments and they have individualized environments so everyone can create their own environments. So what you do is to create many different ways to do it. It depends on the company, for example, if you go to Yahoo... they don't believe in strict structures, so they do not create structures. The company is not*

*structured at all. These R&D companies do not believe in these structures at all. They try to create a free environment, and promote free thinking. And it will bring more innovation outcomes for the companies.”*

In the H1W/H1C case, four interviewed manager agree with developing a social atmosphere for innovation help JV Company to create innovative capabilities.

### **(6) Strategic Planning system important to innovation**

Four interviewed managers have supported this idea. Finance manager agrees with it. Strategy manager, HRM manager and marketing manager strongly agree with it. They agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation. The strategy manager mentions:

*“China government emphasises Chinese firm needs innovative capabilities. We devote 10% of our sales profits to the R&D. Innovation is the big concept in our strategy plan, it not only refers to the technology, and it is also involved in the whole business process, supply chain. Through our strategic plan which focuses on innovation, we use innovation and the best innovative methods in the finance department, HRM department, marketing department, sales and popularization department.”*

Four managers believe strategic planning system with innovation as a focus encourages innovation.

### **(7) Innovation as a primary objective of both partners in a JV**

Only finance manager agree with this idea, he agrees that having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation. However, marketing manager disagrees with it. The strategy manager and HRM strongly disagree with it. They believe that the primary objective of both

partners is to make profit rather than innovation. The strategy manager of JVH1 expresses his view:

*“The primary objective of both partner companies is to generate volume and profit for the stockholders. It is not innovation. The primary responsibility of a company is always to the shareholders, which is always number one. Innovation is just a tool to get there rather than an objective.”*

Only one manager believes having innovation as one of primary objectives of both partners at the outset of the joint venture is important, the other three managers disagree with this idea.

### **(8) Focussing on IP development increases innovative capabilities**

Four managers support that focusing on developing IP leads to more innovation. They also comments that applying for the IP protection still can share innovation among firms in the industry.

The financial manager of JVH1 points out:

*“Applying for the Intellectual Property (IP) protection helps to create innovation. But it does not mean we do not share our innovation with other companies in our industry. Other companies can pay for us to get the patent. For example, when you put your money into the bank, it does not mean you cannot share your money with other people.”*

Above all, four managers believe developing IP help to create innovative capabilities.

## **6.2. Case 2: JVH2 (Telecommunications)**

Case 2 describes the joint venture between a Western partner, identified here as H2W, and a Chinese partner, identified here as H2C, set up in 1996.

### **6.2.1. JV Company and parents companies**

#### **(1) Western Partner: H2W**

H2W is a global leader in communication solutions and electronic solutions. It started with mobile radios. It expanded its business worldwide and gradually became a global company. Currently H2W has nearly 100,000 employees worldwide. And now its business includes wireless communications, semiconductors, automobile electronics, and broadband and internet access products. It is a technology leader in the area of mobile phones, two-way radio and commercial GSM and CDMA systems. Its sales volume reaches US\$27.3 billion.

It has communication inventions and innovations for more than 70 years from leading the cellular communication revolution with the development of cellular phone till now 4G telecommunications. H2W has the market-leading position in WiMAX deployments worldwide.

#### **Development stages in China**

For H2W innovation is the company's life-force, and core competitive advantage. Innovation supports the company from 80years ago till now. In 1987 H2W established a branch office in China. It came to China with the most advanced technology in the world from the Baseband Processor (BP) Phone to the 3G phone. H2W not only brings advanced technology, it also has four principles of localisation; firstly, investment and technology transfer, secondly joint venture and cooperation,

thirdly employment of local talent, and fourthly supply chain localization. The company has employed these principles throughout its 22 years in China. H2W has two joint venture companies in Hangzhou. One company called JVH2. The products include mobile, equipment, the mobile terminal. H2W also has set up another joint venture with a Chinese partner, which does not form part of this research.

### **Establishing an R&D centre in China**

H2W devotes 10% of their sales on R&D. In 1996, H2W set up their first Chinese research centre. 1999, they established a research institute. By 2009, the corporation has invested 3.8 billion dollars in China, it devote 1.2 billion dollars into R&D. H2W has nearly 3000 R&D researchers in China. It has many breakthrough technologies, for example, Chinese handwriting recognition technology; Voice-recognition Technology (it converts human speech into a digital code that a computer can understand); Capability Maturity Model Integration, it has 5 grade, initial, Repeatable, Defined, Managed, Optimizing (CMMI5 model). In the six cities of Beijing, Tianjin, Shanghai, Nanjing, Hangzhou, Chengdu, it has 18 R&D centres. Researches in these 18 research centres include hardware, software and mobile terminal, 3G network, 4G network, software supporting, advanced material and environmental protection material. These are all Chinese leading edge research topics.

The Applied Research Centre of H2W is a dynamic, global network of H2W's engineers. The technologies and usage models generate both business opportunities and innovative approaches to solving customers and market

challenges. The Applied Research Centre identifies researches and creates solutions that allow end users to interact with information and content easily.

The Applied Research Centre is the largest research & development institute among multinational corporations in China. The R&D centres aim to develop H2W's long term success in China through technology development and innovations. The technology and strategy vision of R&D institutes of H2W is to develop it to become the leader in telecommunications industries through technology development and innovation. It also provides the world end to end solutions from chip set to system integration and appliance development with the aid of alliance of the R&D centres. The R&D institutes also emphasizes promoting programs to build up more local talents through the technology partnership and exchange programs with China science and technology community.

## **(2) Chinese Partner: H2C**

H2C is one of the largest mobile communications equipment companies and the largest company in China communication industry. H2C provides total solutions for mobile communications network. Its technological capability and competitive abilities are in a leading position in mobile communications industry. It focuses on research, development and manufacture of mobile system equipment and terminal equipments, as well as the provision of system solutions, such as value-added software, engineering management, and technology support and network maintenance services. H2C is also involved in the manufacture of financial electronic equipment and electronic products, the development of network information systems and system integration business. Its products include financial products, such as automated teller machine (ATM), payment terminals, software and solutions, and

system products, such as switching networking products and solutions and support services. H2C operates its business mainly in Hangzhou, Zhejiang Province in China.

H2C has become a leading mobile communications company with more than 10.5 billion revenue in 2009 and 3.565 net assets. The company grew its sales by 160 times and its net state-owned asset by 70 times in less than 10 years.

### **(3) IJV Company: JVH2**

The motivations for setting up JVH2 are the following: firstly, to satisfy the customers' demands and bring more value to shareholders, and increase the benefits of employees. Secondly, H2W tries to achieve a win-win strategic plan through cooperation with a Chinese local company.

The strength of JVH2 is using innovation to solve all of its problems, for example in the areas of R&D, technology and employee training and relations. Innovation is the "DNA" of JVH2, and arises in a wide range of areas, including employee training, facilities management, supply chain management, manufacture, product and process.

JVH2 also has innovation problems: firstly, it is trying to enhance employee awareness of the significance of innovation at all levels inside the company. Secondly, JVH2 needs to satisfy customer' demand, which gives rise to the need to be responsive to, and even to anticipate, new requirements. Thirdly, the company needs to manage the balance between innovation and risk, which involves paying close attention to the timing of investment and the capital required.

## **6.2.2. Findings:**

### **(1) Innovation networks**

In the H2W/H2C case, marketing manager agree that becoming part of a wide innovative network in its industry helps to create innovative capabilities. The interviewed strategy manager, finance manager and HRM managers strongly agree with this idea, the strategy manager of JVH2 took the view that the company needs to participate in the industry innovative network, industry alliance, and industry association. In the industry innovative network, the company can see itself clearly and see its strengths and weakness. The company can make judgements on the future. JVH2 has quite a lot of innovative cooperation programmes with other companies in the telecommunication industry. It is a member of the innovative network and involved in both mobile terminals and micro chips.

The interviewed financial manager of JVH2 emphasise that once a firm raises the standard for technology it often creates a new association for the whole industry. He points out:

*It is about the newest R&D results. We have established the industry standards. And China telecom industry starts to develop. China has started to establish China telecom industry standards during the last 20 years. We have positively participated in the process of setting up standards.*

Four managers describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities.

### **(2) Open innovation**

'Open innovation is the use of inflows and outflows of knowledge to speed internal innovation.' (Chesborough, 2006) According to Chesborough, the open Innovation paradigm can be described as internal research and development (R&D) activities



which lead to internally developed products that are then distributed by the firm. In other words, open innovation is the use of inflows and outflows of knowledge to speed internal innovation, and expand the markets for external use of innovation. A firm should use both external ideas and internal ideas, and internal and external paths to market in order to advance their technology.

In H2W/H2C case, marketing manager support taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry but are less inclined to give away technology secrets. However, strategy, finance and HRM managers have supported the concept of open innovation but with some reservations as to its practicality. The Marketing manager of JVH2 expresses his view:

*We take part in an open innovation system in the telecom industry. We cooperate with our supplier together to design the mobile. For example, the mobile cover of JVH2 is designed by our suppliers. When we need to design the mobile cover, during our design stage, we will cooperate with the suppliers.*

The open Innovation paradigm treats R&D as an open system. Open Innovation suggests that both inside or outside sources can bring valuable ideas to the company and the valuable idea can also go to market from inside or outside the company. He adds:

*We have meeting with them. We tell the supplier what is the function of mobile cover and what is the characteristic of the mobile cover, etc. We give the blueprint to the suppliers. The mobile cover design company is the most specialized company. We ask them to provide very valuable and professional comments. This is also the early stage involvement. Through the open innovation system, we can achieve our objective more innovatively, more efficiently and with better resources and less time.*

Above all, one manager agrees with this idea, other three managers agree with it in principle, but state that it does not happen in practice very much.

### **(3) University-Commercial relationships**

Chinese universities play an important role as a source of fundamental knowledge and industrially relevant technology in modern knowledge-based economies. The achievement of universities in the Chinese innovation process has developed increasingly since late 1970s. Universities in the Chinese national innovation system are crucial actors instead of “ivory towers” only developing knowledge, without making a contribution to industry. The Chinese government also uses universities as instruments for knowledge-based economic development.

In H2W/H2C case, strategy and HRM managers have supported the idea that companies should work closely with Universities on innovation. The interviewed strategy manager of JVH2 expresses his view:

*“The University is a specialized institute for research. Our company has the capital, advanced equipment and worldwide career; we cooperate with universities and research institutes which will lead to the multi-win situation. It will not only benefit the R&D but also the whole telecom industry. We has cooperated with many China universities, for instance, Tianjin University, Peking University, etc.”*

However, finance and marketing managers agree with the proposition in principle, but state that it does not happen in practice very much, they comment that information is not totally shared with the universities for reasons of commercial secrecy. Universities are therefore partners but only partially so.

### **(4) Company-research institutions cooperation**

In H2W/H2C case, the interviewed strategy, finance and HRM managers strong support the idea of cooperation and prove that relating closely to research

institutions helps to create more innovation for Chinese firms. In recent years, the rise of the Knowledge Economy in China has underscored the essential role technological innovation has played in economic development. As key institutions in the innovation process, universities and public research institutes have become one of most crucial roles in national innovation systems and their linkages with industry. The financial manager of JVH2 points out:

*“Our company has cooperated with many China research institutions, for instance, Beijing Institute of Technology, etc, we share our R&D results and research data together. At the same time, this is the way that we learn from other research institutions, this is the how we improve our innovative capabilities.”*

However, the marketing manager agree with the idea in principle, but state that it does not happen in practice very much.

#### **(5) Developing a social atmosphere for innovation**

The four interviewed managers have supported this idea. They agree that developing a social atmosphere that encourages innovation in a JV brings good results. The HRM manager of JVH2 expresses her opinion:

*“Our company has 5 value strategic methods, including innovation, trust, team cooperation and achievements. Innovation ranks in the first place. We have developed a social atmosphere, or you may call it a social system to encourage innovation. We have the company’s innovative culture which is deeply rooted inside the company. We usually have the training courses; discussion and learning related to the advanced technology and advanced products for employees. We try to find out the cleverest methods, the most innovative atmosphere and the most efficient system to create more innovations and solve any problems through R&D.”*

Four managers believe that developing a social atmosphere that encourages innovation in a JV brings good results.

## **(6) Strategic Planning system important to innovation**

Four interviewed managers have strongly supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation. The marketing manager of the JV Company JVH2 point out:

*“Yes, we did develop our strategic planning system that leads to innovative thinking. A strategy plan is very macroscopic. During it we formulate the key strategic actions and set out the action plan and organisation structure; we need to satisfy the requirements of the customers and the market. We need to bring value to the customers and increase their value through innovation. We need to make more profit through innovation. Accordingly, we develop our strategy plan focused on innovation.”*

The strategy manager of the JV Company JVH2 points out:

*“Innovation is our company’s life-force and core competitive advantage. Innovation supports JVH2 till now. JVH2 has four strategy plans since it was established, including: innovation; investment and technology transfer; cooperation; talent employee localization and supply chain localization. These strategy plans help JVH2 to cultivate its independent innovative capabilities during these years, which also relates closely with China telecom development history.”*

Four interviewed managers have strongly supported that developing a strong strategic planning system with innovation as a focus encourages innovation.

## **(7) Innovation as a primary objective of both partners in a JV**

Strategy and marketing managers interviewed in H2W/H2C case believed this idea to be important. They agree that having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation. And these investigated firms have innovation as one of primary objectives at the beginning of joint ventures. However, the finance and HRM managers disagree with it, they

believe that the primary objective of both partners in a JV is to make profit rather than innovation, innovation is just a tool to achieve it.

The strategy manager of the JV Company JVH2 points out:

*“Back in the early 80s, both H2W and H2C have innovation as a primary objective at the beginning of the JV. JVH2 decided to focus on innovation and that's how we became number one. We decided to focus completely on mobile technology innovation. After the 1990s, we have a stronger CDMA, have better standards and have a very customer-centric approach. I agree that both partners have innovation as the primary objective at the beginning of JV which leads to more innovation.”*

The marketing manager of the JV Company JVH2 points out:

*“We try to achieve a win-win Strategy situation or multi-win strategy situation. If the firm does not have innovation as a primary objective at the beginning of the JV, it cannot be a competitive force in the market. Having innovation as a primary objective is common sense for both JV partners.”*

In summary, two managers agree that having innovation as primary objective leads more innovation; the other two managers disagree with it.

## **(8) Focussing on IP development increases innovation**

Four interviewed managers in H2W/H2C case have supported this idea. They agree that focusing on developing IP leads to more innovation. The strategy manager of the JV Company JVH2 point out:

*“It is a very important statement, I support it totally. Firms focusing on developing IP lead to more innovation. At the same time Innovation has risk. Intellectual property can stimulate innovation and lead the industry to good development.”*

Above all, four managers all agree that focusing on developing IP leads to more innovation.

### **6.3. Case 3 JVH3 (telecommunications)**

Case 3 describes the joint venture JVH3 between a Western partner, identified here as H3W, and a Chinese partner, identified here as H3C, set up in 1998.

#### **6.3.1. JV Company and parents companies**

##### **(1) Western Partner: H3W**

H3W is owned equally by a Japanese Electronics Company and a Swedish Electronic Company, announced its first joint products in that year. The background of the joint venture was that the Japanese Electronics Company had less than 1 percent market share in the worldwide cell phone market. It wanted to achieve more market share, and to achieve this, it collaborated with the Swedish Electronic Company to form the JV handset company, H3W. The vision of H3W was to become the leading communication entertainment brand. Customers would be inspired to use their mobile phones for more than just communication. Everyone would be able to create and participate in entertainment experiences. This strategy blurs the lines between communication and entertainment.

According to the company profile, H3W is a global provider of mobile multimedia devices, including feature-rich phones, accessories and PC cards. The products combine powerful technology with innovative applications for mobile imaging, music, communications and entertainment. The net result is that H3W is an enticing brand that creates compelling business opportunities for mobile operators and desirable, fun products for end users. The products of H3W have universal appeal and are different in the key areas of imaging, music, design and applications. The company has launched products that make best use of the major mobile communications

technologies, such as the 2G and 3G platforms, while enhancing its offerings to entry level markets.

According to the company reports, H3W strives to be a cutting edge provider of applications, forging partnerships with developers and content providers. Strategic agreement with partners is one way in which the company is bringing the best and latest in entertainment content to its users. H3W undertakes product research, design and development, manufacturing, marketing, sales, distribution and customer services. Global management is based in London, and R&D is in Sweden, UK, France, Netherlands, Japan, China and the US.

## **(2) Chinese Partner: H3C**

H3C was founded in Beijing in 2003. H3C is a leading domestic IT equipment manufacturer and service provider. Manufacturing and trading telecom products, technical research and services are the main business of H3C. Its industrial scale and strength plays a leading role in many industrial fields, for example, communication systems, terminal, auxiliary equipment, industrial application and value-added service.

According to the company profile, H3C has many first-class national certifications and qualifications, including telecom project programmes and designing, telecom engineering surveying, project contracting and telecom construction bidding and bid invitation, providing customers with high quality products and services.

The advantages of H3C in TD-SCDMA competition lie in the following aspects: firstly, in organization networks, it is competitive in price, secondly, it is competitive in application and thirdly, scale product line construction has been finished and this will

increase price competitively in the near future. Current challenges relating to TD-SCDMA are products stability and capability, network standardization and optimization, and cost reduction. Therefore lots of work needs to be carried out, and H3C was requested to provide High Speed Downlink Packet Access (HSDPA) by China Mobile and provide High Speed Uplink Packet Access (HSUPA).

H3C takes scientific innovation as the motive power for development. It has formed an internationally leading R&D system and a mature and efficient sales service network to actively tap international markets, providing products for dozens of countries, such as the United States, Japan, Russia, France, Finland, Sweden, Norway, Britain, United Arab Emirates and India. It has established joint ventures in Latin America and the Middle East and representative offices in countries of Africa and Latin America.

### **(3) IJV Company: JVH3**

For H3W, the main purpose of the IJV is to comply with Chinese policy. The government regulates that all manufacturing in the area of telecommunications must be IJVs. A secondary purpose is to reduce the risk to the market. The third purpose is to secure entry to the market. Because H3C already has a distribution channel, H3W can use this distribution channel. Access to the market requires innovation. H3C is the No 1 telecommunications company in China. It is the government approved company. H3W sells to the market through this company. H3W has several JV companies in China. They are all called H3W Mobile: H3W Mobile Holding, H3W Mobile Manufacturing Limited and H3W Mobile R&D Technology Corporation Limited.



The successful factors for creating innovation through IJVs are a combination of two talented firms; H3W and H3C. For China, H3C contributes talent and market intelligence. It also has industrial policy support, government support, tax rate, and other incentives. There are lower taxes for IJVs. In IJVs the Chinese side wants more technology. And H3C should have ideas, concepts and feasibility-studies, which includes market research and competitive analysis. Both partners and JV Company benefited from innovation as it was a commercial success.

The first innovation of JVH3 was in 2003. JVH3 used the strength of H3W to launch camera-phones. From 2003, JVH3 launched several very successful camera-phones. The second innovation was the music phone in 2005. Music is one of the strengths of H3W Ltd. The Smartphone is another innovation. JVH3 is not the first to have the Smartphone, but it made the Smartphone fashionable in the market. JVH3 has a very successful Smartphone. In a short period of 8 years, when people think of JVH3, they can remember camera phone, music phone, and smart phone.

JVH3 almost died once. Then with the innovation of another company it is making 10 million units annually and the revenue is split between the two partners.

JVH3 has developed a system in its strategic planning that leads to innovative thinking. A lot of companies put innovation as one component of strategy. Innovation is so important to JVH3 that it would probably die if it did not do well in this aspect. JVH3 has a very systematic and scientific way to develop innovation. It has the R&D department, to decide what new technology there will be in the pipeline. It has very clear targets. JVH3 also has good processes, and very clear performance goals. JVH3 seeks innovation every year. For example, it targets a certain number of new patents every year. To make sure this happens, it needs a good process for creating

innovation. JVH3 includes innovation in the scorecard, planning when the next phone will come out, etc. Progress in innovation is assessed on a daily basis; it is a process performance goal.

### **6.3.2. Finding:**

#### **(1) Innovation Network**

R&D collaborations in high-tech industries generate attention that attracts other partners who collaborate in developing ideas (Powell et al.1999). Powell et al (1999) argue that network experience has a positive influence on patenting; the rate of increase diminishes with additional experience. This is the “cycles of learning” process in which R&D collaborations generates attention that attracts other partners, who collaborate in developing ideas. The diversity of affiliations will increase the firm’s experience at managing collaborations and transferring knowledge and the firms’ centrality in the industry will also be increased. Greater centrality is related to the higher rate of patenting. The R&D partnership will work because of centrality and patenting. And the cycle for the centrally placed firm will restart.

In H3W/H3C case, four managers agree becoming part of a wide innovative network in its industry helps to create innovative capabilities. The strategy manager points out:

*As I said, when companies mention innovation, innovation happens during R&D. There is not too much innovation after R&D. Our company follows the trend of the latest technology. For example, take smart-phone operating system - SYMBIAN system, through networks, we cooperate with Nokia Telecom; Motorola Telecom, etc. Then the smart-phone operating system is jointly-researched and jointly-owned by Nokia Telecom and our company. And we also sell the SYMBIAN system to other companies. As a network can help our company to see how the industries are going? And we must work with it.*

Four managers all describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities.

## **(2) Open innovation**

In H3W/H3C case, only marketing manager supports taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry. However, strategy, finance and HRM managers have supported the concept of open innovation but with some reservations as to its practicality. The Marketing manager of JVH3:

*In most cases, companies do in-house innovation. In other cases, the firm learns and shares with other companies. Bluetooth is a good example of an innovation outcome of open innovation. It can be made open to any other companies in the industry. Another example, GSM and GPRS is a widely accepted technology in the telecommunication industry. It is jointly-produced by several big firms as it is Open Innovation. Everybody in the telecom industry owns it.*

Above all, one manager agrees with this idea, the other three managers agree with it in principle, but state that it does not happen in practice very much.

## **(3) University-Commercial relationships**

In H3W/H3C case, only marketing manager support the idea that companies should work closely with Universities on innovation.

However, sometimes firms' commercial interests limit information sharing among the universities, scientists (Powell and Owen-Smith 1998 and Owen-Smith 2003). Another large network is the network of scientists. Crane (1972) claims knowledge grows and the structure of scientific communities affects the expansion of knowledge. The most important benefit of scientific communities is that the members of the relevant community openly share the research results and information. Powell

and Owen-Smith 1998 and Owen-Smith 2003 argue that research commercialization by universities limits the innovative benefits of scientific communities. And firms' commercial interests stop the information sharing among the scientists.

Strategy and finance managers agree with this idea in principle, but state that it does not happen in practice very much, HRM manager disagree with it and comment that information is not totally shared with the universities for reasons of commercial secrecy, universities are therefore partners but only partially so. The HRM manager of JVH3 describes:

*"In most cases companies choose universities for innovation partners. The companies want to expand external resources for innovation. They want the talent in universities, even their local knowledge (of local market). In most cases they are in cooperation. But it is not full-scale cooperation; it is only one or two products cooperation. The universities are not the companies' only research department, and cannot be depended on. The company will select one or two key products for the universities annually. The firms cannot do business by relying on universities. The firms will share their technology on certain levels to the universities, but never all of it."*

Above all, one manager agree with this idea, two managers agree with it in principle, but state that it does not happen in practice very much; the rest one manager disagree with this idea. The H3W/H3C case proves that this issue exists in high-tech industry. And firms' commercial interests stop the information sharing among the scientists. The research commercialization by universities prevents the innovative benefits of scientific communities.

#### **(4) Company-research institutions cooperation**

In H3W/H3C case, strategy and HRM managers agree that relating closely to research institutions helps to create more innovation. And they have cooperated with

different research institutes, and R&D Centres to cooperate on many projects. However, finance and marketing managers supported the concept of cooperation between company and research institution but with some reservations as to its practicality.

The strategy manager of JVH3 expresses his opinions:

*“The evolution of the academia-market interface in the China economy will impact the Chinese innovation system. In addition, university-research institute-industry linkages can help Chinese firms to build up more innovative capabilities. The evolving institutional relationship between academia and industry is very important, such as the roles which ITRI or Chinese research institutes have played in the growth of high-tech industries in China.”*

Above all, two managers agree relating closely to research institutions helps to create more innovation. Two managers agree with it in principle, but state that it does not happen in practice very much.

### **(5) Developing a social atmosphere for innovation**

In H3W/H3C case, strategy, finance and HRM managers agree that developing a social atmosphere that encourages innovation in a JV brings good results. However, the marketing manager believe it in principle, but state that it does not happen in practice very much.

The finance manager of JVH3 point out:

*“Before we have new products in the market, we will have formal and informal meetings with agents to communicate with them. We discuss together with the agents about the R&D, design, manufacture, management and market popularization. We will listen to their opinions. And we will improve our products according to their comments. This is the way we integrate the good experiences from our partners. We try to create a social*

*atmosphere to encourage more innovation. Before the new products go to the market, the products already have these qualities.”*

In summary, three managers agree with this idea, the rest one agrees with it in principle, but with some reservations as to its practicality.

### **(6) Strategic Planning system important to innovation**

In H3W/H3C case, four interviewed managers have supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation. The strategy manager of JVH3 points out:

*“A lot of companies put innovation as one component of their strategy plan, because innovation is so important to us that we would be dying if we cannot do well in innovation. So the company has a very systematic and scientific way to develop innovation. We have the R&D department, to decide what new technology there will be in the pipeline. They have very clear targets for everything. Of course, the same management requirement goes to the supply chain, and everywhere. We seek innovation every year. In high tech, systematic innovation in the strategic plan is not something new. It is the lifeblood of the industry.”*

Four managers have supported this concept that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation.

### **(7) Innovation as a primary objective of both partners in a JV**

In H3W/H3C case, four managers all disagree that innovation is a primary objective of both partners in a JV; they believe the objective for the Western partner is to comply with the policy and gain access to the market. The first goal is to comply with the policy of the country and the purpose of innovation is not primary. The government regulates that all manufacturing in the area of telecommunications must

be JVs. The second is to gain access to the market. The third is to reduce the risk to the market and to secure entry to the market. If the Chinese company already has a distribution channel, western firms can use the same channel.

The HRM manager of JVH3 point out:

*“Our primary objective of both H3W and H3C is commercial success. JVH3 almost died once. But later we focused on innovation and cooperated with other firms innovatively. Now we are making 10 million units annually. The revenue is split between the two partners.”*

The main JV objective for Chinese partner is to absorb western firms' advanced technology and experiences. The strategy manager of JVH3 point out:

*“The best benefit for the Chinese firms from having Western JV partners here is actually having a stronger competitive capacity and learning what to do. You should look at the Japan and Korea model back in the 70s and 80s. And they have very successful cell phones and innovative companies, because they started by copying and then they developed their own technology. So Chinese firms have different features and services and then Chinese firms take and copy from Western partners, and actually become even better than Western firms in the end.”*

Four managers believe that the objective for the Western partner is to comply with Chinese government policy and gain access to the market; the objective for the Chinese partner is to absorb western firms' advanced technology and experiences.

## **(8) Focussing on IP development increases innovation**

Four interviewed managers in H3W/H3C case have supported this idea. They agree that focusing on developing IP leads to more innovation. The strategy manager of JVH3 point out:

*“Focusing on developing IP leads to more innovation because IP can protect innovation. Most companies are applying for IP rights to protect their innovations.”*

*The key breakthrough in innovation can be protected by IP rights. Then we can go on to get more innovation. Innovation can help the firm to keep its core competitive. For example, we add the lunar calendar in our phones for which we apply for IP. Intellectual property can also help a nation to develop sustainability.”*

Above all, four managers believe that developing IP helps to create more innovation.

## **6.4. Case 4: JVH4 (telecommunications)**

Case 4 describes the joint venture JVH4 between a Western partner, identified here as H4W, and a Chinese partner, identified here as H4C, set up in 2001.

### **6.4.1. JV Company and parents companies**

#### **(1) Foreign Partner: H4W**

H4W is a famous Korean company; it has over 70 year history. Its diverse businesses spans advanced technology, semiconductors, skyscraper and plant construction, petrochemicals, fashion, medicine, finance, hotels and more. H4W has high-tech electronics manufacturing and digital media in the worldwide. It focuses on innovation, high-quality products and services, talented people, responsibilities, and collaboration with partners and customers.

H4W was established in the 1960s in South Korea. It produces electronic appliances: H4W has more than 60 products and has a prominent market share in the global market. In 2005 H4W became the most popular electronics brand in the world, even Sony lags behind it. In 2007, the handset division of H4W overtook American rival Motorola, making it the world's second-largest mobile phone maker. At the end of 2007, H4W exceeded the \$100 billion mark in annual sales for the first time in its history. In 2009, H4W overtook Siemens of Germany and Hewlett-Packard



of the U.S. with revenue of \$117.4 billion to take the No.1 spot as the world's largest technology company.

H4W focuses on four areas: Digital Media, Semiconductor, Telecommunication Network, and LCD Digital Appliance. The main growing business areas related to LCD, Digital Media, and Semiconductor at 2006. The Telecommunication Network business area includes multi-service DSLAMs and fax machines; cellular devices such as mobile phones, PDA phones, and hybrid devices called Mobile Intelligent Terminals (MITs); and satellite receivers. In order to become a leader in the field of digital integration, H4W in the home, mobile, office and core components developed areas of business strategy.

### **Three Development Stages in China**

- *Stage 1: Localization (2000-2003):* The early stage of H4W China localization was manufacture localization. The company's Chinese agent became involved with trademark marketing; channel marketing; maintenance of the terminal.
- *Stage 2: H4W trademark marketing:* H4W started Chinese manufacturing and set up the JVH4 with H4C. JVH4 began to popularize the H4W products in the Chinese market. The company began full-scale marketing and sales in the China market, which included market research specifically relating to China. For example, JVH4 used the opportunity of the Olympic Games in Beijing to advertise and spread H4W mobiles. The mobile phone total sales of H4W in 2002 are 24.4 billion RMB. The export is 220 million U.S. dollars and the domestic sales ranked tenth. In total there are about main 10 mobile brands in the market. The market share of H4W has risen from 12% to 21% in 2009, showing how quickly H4W has developed in China.

- *Stage 3: Branding 'China H4W' (2003-2006):* As a multi-national company, every time H4W comes to a different country, it tries to develop localization. It wants to build the 'China H4W' brand name locally. Hence, the general manager of H4W wants to create "H4W" brand [the brand name would be the actual name of the Western company] in China. This would include manufacturing, R&D, marketing, distribution and training talent in China, building strong relationship with the Chinese government, and developing public welfare in China. H4W has everything to achieve this goal in China, for example, it has research institute of H4W in China to undertake the R&D. By the end of stage 3, H4W totally outsold Chinese local brands.

## **(2) Chinese Partner: H4C**

H4C is a large-scale state-owned holding group. The company is based in Tianjing, which is the birthplace of China's electronics industry. H4C started earlier than many other Chinese companies in the industry, and it has a fifty years history. Since reform it has taken shape in a larger scale, a solid foundation and achieved rapid growth. Up to now, the company has 90.000 employees, and has a wholly owned subsidiary of 35 joint ventures and nine research institutes; it has fixed assets of 5.565 billion RMB and current assets worth 9.117 billion RMB.

H4C focuses on a number of key competitive products in six major industrial categories. Its products include digital program-controlled switches, photoelectric end machine, fax machines, mobile communications equipment with military and civilian-based communications industry; medium and large-screen colour TV, VCR, keyboard, camera at the core of the broadcast audio and video industries; chip components, glass bulbs and tubes, electronic transfer Yi harmonic, VCR heads ,

delay line, electrolytic capacitors at the core of the electronic components industry; automated instruments, electrical instruments focused instrumentation industry and photocopiers, plotters and video equipment, office automation industry.

### **(3) IJV Company: JVH4**

JVH4, an IJV between H4W and the H4C, was founded in August 2001, located in the West Tsing District, a microelectronics industrial area in Tianjing. It produces GSM mobile phones.

JVH4 started production immediately. The production and sales (domestic and overseas) of JVH4 jumped to third place in the China mobile phone market. Its total sales rose to 6.93 million units and sales of 82.4 billion RMB in 2003.

JVH4 encourages innovation in a number of ways. First, it requires its employees to be innovative. Secondly, it encourages innovation in the operating structure of the business. Thirdly, it has many product and process innovation through R&D activities. Fourthly, the company is good at communication with its customers. It attaches importance to responding to its actual and potential customers; through product innovation, analysis of market change, technological change and customers' demand for new and improved products and services. Innovation extends to methods of interacting with customers, where the company seeks to move beyond traditional sales methods.

## **6.4.2. Findings:**

### **(1) Innovation networks**

In H4W/H4C case, four managers agree with this idea and have emphasised the importance of innovation networks. JVH4 provides three types of different networks

and cooperating with three different operators, and it needs to provide different products and services. The cooperation helps JVH4 to develop the Omni-bearing innovative capabilities and service capabilities to work for the operators. Different Operators have different characteristics. There are seldom telecom companies which can provide the three types of network at the same time. JVH4 is the strongest company in the telecom industry; JVH4 is very willing to cooperate with operators. In terms of capabilities, JVH4 has developed its strong innovative capability through cooperation. And it has access to the experiences of operating companies globally.

The quotation of strategy manager of JVH4 illustrates this:

*We cooperate with CHINA MOBILE and other network operators in a depth program. Our first cooperation was with CHINA MOBILE on the project 'Depth custom-made'. We did not cooperate with network operators before and do not have experience of alliances. But through the cooperation, it helps us to create new ideas, new operating concepts, new sales methods, new sales channels, and new products. Till now, we are very successful according to the sale volumes which benefit from becoming part of a wide innovative network in our industry.*

The HRM manager of JVH4 states that:

*Our company has innovative networking; there are not a lot of association networks established by us. We established SYMBIAN association, Bluetooth association etc. We invite other Chinese local mobile companies, such as Xiaxin and Bodao, to join the industry associations. Another way is to speak at public forums, also, write technical papers. We have many ways to check on the latest technology and to associate it to networks with other companies.*

The financial manager of JVH4 states that:

*We cooperate with China Mobile on the project called 'TDSCDMA flagship internet mobile R&D foundation'. China mobile gives funds to telecom companies to require them to do the research. All the telecom companies work together to research into*

*TDSCDMA. And in the end this project can provide a high-speed wide and band internet TDSCDMA mobile.*

In summary, four managers in this case describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities.

## **(2) Open innovation**

In H4W/H4C case, only strategy manager support open innovation, the firm cannot do everything by itself because of the limit of capital and timing and the venture. At the moment, corporations R&D activities can satisfy its requirements. Secondly, the corporation also buys the technology from other companies, so the corporation can save corporations time and investment.

However, marketing, finance and HRM managers have supported the concept of open innovation but with some reservations as to its practicality, They all support taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry but are less inclined to give away technology secrets.

The Strategy manager of JVH4 expresses his opinion:

*From my understanding, the company must have its own things as in its own edge. Something that makes it stands out and is unique and sells. Our company has its own mobile. A company needs to have its own special things, at the same time; the whole industry is an industry chain. It is also crucial to join the open innovation system in the industry. Take an example; we join the SYMBIAN system which is an open system. This is the way we learn from each other, learn from the leaders of telecom industry through open innovation system. We can learn the advanced technology.*

Above all, one manager agrees with this idea, the other three managers agree with this idea in principle, but state that it does not happen in practice very much.

### **(3) University-Commercial relationships**

In H4W/H4C case, marketing and finance managers interviewed in this research have supported the idea that companies should work closely with universities on innovation. However strategy and HRM managers comment that information is not totally shared with the universities for reasons of commercial secrecy. Universities are therefore partners but only partially so.

The quotation of the marketing manager of JVH4 illustrates this point:

*“For the universities, in terms of mobiles, we cooperate with Tsinghua University and Peking University, top China universities. And we set up several scholarships for these top universities. We have other research centres around China as well.”*

In summary, two managers agree with this idea, the other two managers agree with it in principle, but state that it does not happen in practice very much.

### **(4) Company-research institutions cooperation**

In H4W/H4C case, marketing and finance managers agree that relating closely to research institutions helps to create more innovation. And their company has cooperated with different research institutes, and R&D Centres to cooperate on many projects. However, the HRM manager disagree with it, the strategy manager describe that relating closely to research institutions helps to create more innovation for Chinese firms, it is the ideal situation, but he observed that some Chinese do not have close relationships with research institutions. His quotation illustrates this:

*“China has an ‘Establishing innovative country’ strategy. China emphasizes Science technology as the first productive force in national innovative capabilities. Since late*

*1970s China implements an Open door policy involving interaction between research institutes and companies, especially in the IT industry, and in mobile telephony. But the relationships between Chinese companies and research institutes still needs to improve. More research fruits can be turned into commercial use. If Chinese firms can work closely with the research institutes, this can help them to build up their innovative capabilities.”*

Above all, two managers agree with this idea, one manager disagree with it, and the rest one manager agree with the proposition in principle, but state that it does not happen in practice very much.

### **(5) Developing a social atmosphere for innovation**

In H4W/H4C case, marketing, finance and HRM managers have supported this idea. They agree that developing a social atmosphere that encourages innovation in a JV brings good results. However the strategy manager agree with the idea in principle, but state that it does not happen in practice very much.

The marketing manager of JVH4 point out:

*“We develop a social atmosphere to encourage innovation inside the company, and it helps us to create more innovations. We develop a social atmosphere in two ways; firstly, in terms of promoting innovation, we give samples of the R&D to the employees to give us feedback on the interface, the structure, etc.”*

In summary, three managers agree with agree that developing a social atmosphere that encourages innovation in a JV brings good results, the rest one manager agree with the idea in principle, but state that it does not happen in practice very much.

### **(6) Strategic Planning system important to innovation**

In H4W/H4C case, all managers agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation.

The HRM manager of JVH4 expresses his view:

*“In addition to having an innovative culture and innovative atmosphere inside the firm, innovation is developed through our strategic plan. To make sure this happens, it should have good processes and very clear performance goals in the firm’s strategic plan. We need good processes for creating innovation first, and to achieve our performance through innovation in the end. For example, we will promise a certain number of new patents as performance goals our every year. At the same time, we will put this in our scorecard, such as when is it that the next phone will come out? This must be done each day. This is how we develop our strategic plan focused on innovation, and innovation can help the firm to achieve its goals.”*

Above all, four managers all agree that a firm developing a strong strategic planning system with innovation as a focus is important.

### **(7) Innovation as a primary objective of both partners in a JV**

In H4W/H4C case, only marketing managers believed this idea to be important. He agrees that having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation. However, strategy, finance and marketing managers disagree with it, they do not agree firm have innovation as one of primary objectives at the beginning of joint ventures.

The quotation of marketing manager of JVH4 illustrates:

*“At the beginning of joint venture, we have innovation as one of primary objectives, special product innovation and channel operation innovation. At the beginning our sales and marketing channels are very long. Now it is more flexible and complex. National agents’ representatives and district agents, electronics sales shops (for example, GUOMEI, SUNING) are our three main sales channels. National agents’ representatives have many branches over the country. The branches connect with all the retailers. This is marketing channel innovation. Marketing operation capabilities improving, marketing channel change contributes to our success.”*



The strategy, finance and marketing managers of JVH4 believe the JV objective for Western partner is to satisfy the Chinese government requirement and at the same time to make profits. The strategy manager of JVH4 point out:

*“A JV is the way that Western firms satisfy the China government requirement. The attitude of Western firms is to establish the deep-going cooperation with the Chinese partner in the long term. It matches the Chinese government requirement at their highest limit. In this big situation, the behaviour of Western enterprises and their operation conception suits the whole China business environment.”*

He also point out:

*“It helps the Western firms to put more efforts to research the requirement of local customers and identify local customer requirements. The investment capital in the Chinese market and the investment capital in training local talents help the Western firms to get more profit and benefits. These business behaviours push the Western firms to develop well locally.”*

Above all, only one manager agree with this idea, the rest three managers believe the JV objective for Western partner is to satisfy the Chinese government requirement and to make profits.

### **(8) Focussing on IP development increases innovation**

In H4W/H4C case, four managers have supported this idea. They agree that focusing on developing IP leads to more innovation. The strategy manager of JVH4 expresses his opinion:

*“Our company has its own R&D centre, we have developed a system to develop intellectual property, and we own hundreds of IPR in using TD and some of the top secrets. We have a new broadband mobile which is in development. The Chinese government has invested in this as well. We will apply IPR for this product. It can protect our firm’s innovation and help to create more innovations.”*

In summary, all managers agree that focusing on developing IP leads to more innovation.

## **6.5. Case 5: JVH5 (telecommunications)**

Case 5 describes the joint venture between a Western partner, identified here as H5W and a Chinese partner, identified here as H5C, set up in 2004.

### **6.5.1. JV Company and parents companies**

#### **(1) Foreign Partner: H5W**

H5W's business develops very well in China, Vietnam and the U.S. It expands its business in Asia, America, and worldwide and overcomes the geographic barriers. H5W is becoming a world leader and develops into a hub for the global telecommunications industry. In 2006, H5W achieved record revenues of KRW 10.651 trillion and expanded its customer base to more than 20 million subscribers. This is the second year in a row that it recorded more than KRW 10 trillion in revenue, a first in the Korean mobile telecommunications industry. It will continue to develop and deliver leading-edge services. With wired and wireless multimedia services that enable the mobile lifestyle, H5W is creating options for work, leisure and culture. Its core technologies and services are fuelling the new world of digital convergence.

H5W is a provider of mobile service in Korea, with 50.5% of the market share as of 2008. Since being established in 1984 the company evolved from a first generation analogue cellular system, to second generation CDMA, then to the world's first third generation synchronized IMT-2000 cellular system. H5W also became the world's first to commercialize HSDPA in May, 2006. The company's current services include

NATE, a wired and wireless integrated multi-Internet service, June, a multimedia service, MONETA, a financial service, Telematic service such as NATE Drive and even Digital Home service. In 2004, H5W launched the world's first DMB satellite. The carrier currently provides satellite DMB to its subscribers through a subsidiary company. It also offers a variety of internet services, many through another subsidiary.

H5W believes in doing business at the hub of the global telecommunications revolution. It pioneered first-generation analog mobile communications in Korea. It was first in the world to commercialize CDMA technologies, ushering in the era of second-generation mobile communications. H5W is dedicated to becoming a leader in the global telecommunications industry. As the era of ubiquitous mobile telecommunications brings hope and happiness around the world, it intends to fulfil its role as a true visionary for the age of digital convergence and promise.

### **Cooperation in China and Set up the TD-SCDMA Test**

H5W entered the Chinese market in 2001 and set up the joint venture company with H5C in 2004, it is the first cooperation partnership for a foreign telecommunications service provider in the Chinese market. JVH5 provides wireless Internet service under one of the brands of H5W. In 2006, H5W was the first foreign communications service provider to conclude a MOU with the China National Development and Reform Commission to develop TD-SCDMA in China.

H5W established its cooperative partnership with China National Development and Reform Commission in 3G communications technology by advancing the Korea-China TD-SCDMA project. Then two partners set up the TD-SCDMA Joint Service Development Centre in Beijing and a test centre in Korea. They launched the TD-

SCDMA test bed on April 2007. H5W use TD-SCDMA test bed to expand 3G services and promote the competitiveness of TD-SCDMA. H5W strengthens its leadership in the Asian mobile communications industry through the Korea-China TD-SCDMA project.

## **(2) Chinese Partner: H5C**

H5C was founded as a Government-owned corporation, established in 1994. Starting as a wireless paging and GSM mobile operator, it currently provides a wide range of services including a nationwide GSM mobile network, long-distance, local calling, data communication, Internet services and IP telephony in mainland China, and has operated a CDMA network in Macau since 2006. At the end of April 2008, the company had 125 million GSM subscribers and 43 million CDMA subscribers. As of November 2008 the CDMA operations have been moved to China Telecom and Universal Mobile Telecommunications System (UMTS) has just launched in major cities across China on May 2009. Compared to other mobile providers H5C is ranked as the world's third-biggest mobile provider. On January, 2009, H5C was awarded WCDMA license to expand its business to 3G telecommunication. In July 2009, H5C signed a \$700 million deal with a major international infrastructure vendor to upgrade the company's GSM network.

The main business includes: GSM mobile communication service, WCDMA, communication service, domestic & international telephone call service; local telephone business, data communication service, Internet service; IP telephone; satellite communication service, telecommunication increment service, as well as other telecommunication service. More than 300 subsidiary companies are established under the new mechanism, and they are spread in 31 provinces in

China, the autonomy regions, the municipality as well as the Macao Special Administrative Region.

### **(3) IJV Company: JVH5**

H5W invests a lot of capital in China's mobile communications market. H5W established a close partnership with H5C, which leads to great achievements. JVH5 is China's second largest communications service provider. It provides wireless Internet services. JVH5 focuses on developing the next-generation communications technologies. JVH5 tries to validate and popularize China's unique technology. JVH5 also tries to find more business opportunities in developing music and video games through strategic alliances.

JVH5 tries to satisfy the needs of the customers. It tries to create the need of the customers in terms of strategy, which are sometimes also decided by the competition as well. It has the ability to stand above and sees what changes there are in the market and reacts to them quickly. It can actively anticipate the needs of the consumers.

Strategic plans and tactic are the key factors to the success of business. JVH5 cooperates with China Mobile and it needs to satisfy their requirements and demands. The requirements come from its partners' competitors. The cooperation partner China Mobile has its competitors, China Union, China Telecommunications, etc. There are competitions between them. The requirements also come from customers' customers. And the terminal customers have different requirements. There also have the requirements from the whole industry, because the telecom technology is developing. All above situations bring new demands.

## **6.5.2. Findings:**

### **(1) Innovation networks**

The four executive interviewed in the H5W/H5C case agree that innovative networks help to create more innovation. According to Powell & Grodal (2005), the number of members of a network effectively that share their information and skills depends on the nature of knowledge, conceptualized in term of tacitness or explicitness which are the very crucial factors. It is easier for the networks rooted in a division of innovative labour to transfer tacit knowledge in the form of finished inputs. However, the networks involved in the co-creation of novel ideas may succeed or the networks fail due to the capability to convey and transfer ideas in firms, and the ideas are not easily codified.

Developing the capacity to simultaneously enhance the flow of information among the current member of networks and the new members is another important factor in the networks of innovators. Most research focuses on high technological industries, and patents are used as a proxy for innovation.

The strategy manager of JVH5 emphasised one enterprise cannot do everything by itself because their resources and capital is not enough. Secondly, they need to judge the market trends, and the company need to know their competitors, who are in the market? Then the company can differentiate itself with other companies and know its strength in its industry according its own resources and, capital.

The Shared Multi-Party Relationships provide the technical standards for high-tech Industries. (Aker, 2001) Rosenkopf and Tushman (1998) note multi-party relationships connect technical professionals across organizations. Aker (2001) analyzes the IBM user group Share and finds out that the main innovation coming

out of Share provided the basis for both system programming and operating systems. The most important advantage of Share network provides the technical standards. The other vital advantage is the diffusion of knowledge among computer companies and users. Once a firm raises the standard for technology it often creates a new association for the whole industry.

In H5W/H5C case, the interviewed strategy manager defined:

*It is very important to establish the united technology standard for the high-tech industry through an industry innovative network. BLT, GSM, CDMA, etc are all the standards. There are 2G, CDMA (3G) in the US. There also exist BLTE, FD, TD, and 4G. So it needs an innovative industry to manage the process, or there will be problems. The analog is very similar with how radio works, FM and AM are analog signals, and anybody can listen to them if they have the right frequency. There are two technologies in the analog world: the AMPS and ETACS. And they are becoming digital.*

He also points out:

*There are Individual Multiple Access (TDMA), and the Multi-vidual Multiple Access (CDMA). CDMA is called GSM in Europe and Asia because transactions are not correct. There are three different digital standards worldwide. When people travel from Europe to the USA, they cannot use their phones because of the different standards. It ends up having three standards in AMPS analog and two different standards (DO/DB) in 3G. China tries to get its own home-grown 3G technology, which is TDSCDMA, and tries to reinvent the wheel, and TDSCDMA is a global standard. Eventually, there should be only one standard in about 2011. It needs an innovative network in the telecommunication industry to achieve it because the mobile industry is very big and standardized.*

In H5W/H5C case, the interviewed financial manager states:

*Eventually, in about 2010, 2011, there should be only one standard in the mobile industry. If you want some special technology inside your phones, you will need to*

*join the associations that provide you with this. The mobile industry is very standardized, and you have a lot of standards.*

All the managers interviewed agree that wider networks help JV companies to create innovative capabilities.

## **(2) Open innovation**

The four executive interviewed in the H5W/H5C case have supported the concept of open innovation, but with some reservations as to its practicality.

The strategy manager gave an example:

*Our company has its own private operation system, but it also uses Linux, multi-system, multi-operation platform, which are the open innovation resources in the industry, all firms in the industry share these technologies. And Open innovation resources help our company to satisfy different customers' requirements.*

Above all, four managers agree with this idea in principle, but state that it does not happen in practice very much.

## **(3) University-Commercial relationships**

The strategy and HRM managers have supported the idea that companies should work closely with Universities on innovation. However the finance and marketing managers comment that information is not totally shared with the universities for reasons of commercial secrecy. Universities are therefore partners but only partially so.

Both internal and external factors have led many firms to set up stronger linkages with universities; it promotes and strengthens the firms' innovative capabilities and their contributions to innovation and economic growth. These long term cooperative relationships also show new structural features of the national universities systems and their industrial environments.



Old universities rather than new universities accept entrepreneurial start-ups because they have excellent and established research reputations, and world-class professors. (Franklin, Wright, and Lockett, 2001) Franklin, Wright, and Lockett (2001) observed UK universities regarding entrepreneurial start-ups that emerge from university technology transfer. They distinguished between academic and surrogate (external) entrepreneurs and old and new universities in the United Kingdom. New universities are not good at academic research and they do not accept entrepreneurial activity easily. The most significant barriers to the adoption of entrepreneurial-friendly policies are cultural and informational. The old universities have the most favourable policies according to external entrepreneurs. In China the link between Universities and manufacturers is developing since the 1970s and here too the older universities have stronger industrial links than the newer ones.

The strategy manager of JVH5 states:

*“We have many cooperation research projects with Chinese universities, take an example, Tsinghua University, as one of China’s most renowned universities, has become an important institution for fostering talent and scientific research with a 98 year history of excellence. Among over 120,000 students who have graduated from Tsinghua since its founding are many outstanding scholars, eminent entrepreneurs and great statesmen. Through cooperation with Tsinghua University, we can share expertise and laboratory facilities with the university.”*

Two managers agree with this idea, however the other two managers agree with it in principle, but state that it needs to improve the relationship in practice very much.

#### **(4) Company-research institutions cooperation**

In the H5W/H5C case, only the strategy manager agrees that relating closely to research institutions helps to create more innovation. However, finance, HRM and marketing managers suggest that relating closely to research institutions helps to

create more innovation for Chinese firms, it is the ideal situation, but they observed that some Chinese do not have close relationships with research institutions.

The HRM manager of JVH5 states that Chinese firms have several issues nowadays; they need to develop strong relationships with the research institutions which can help Chinese firms to create their independently innovative capabilities.

He points out:

*“Chinese local brand firms haven’t solved the R&D issue independently, or the innovation issue, sales and marketing issue etc. They only have superficial technology and still do not grasp the core technology, Chinese local mobile companies are still a distance behind western mobile companies, they have the conception and requirements, but they still have not got strong innovative capabilities. Chinese firms needs to cooperate with research institutions closely. It can help Chinese firms becoming more innovative.”*

Only one manager agrees with this idea, the other three managers agree with it in principle, but state that the connection between research institutes and companies are not close. Nowadays, with R&D becoming international and the Chinese economy and technology improving, the Western multinational enterprises not only expand their market in China, but also begin R&D activities. Except for their independent R&D activities, they also have more connection with Chinese universities and research institutes. This becomes the typical characteristic. Chinese companies also need to improve their innovative capabilities through cooperating with the researchers in universities and research institutes.

## **(5) Developing a social atmosphere for innovation**

In the H5W/H5C case, the four interviewed managers have supported this idea. They agree that developing a social atmosphere that encourages innovation in a JV brings good results.

The marketing manager of JVH5 expresses his similar view:

*“We have the customers test in our meeting room. And there are three cameras in the meeting room. Every time we have a new product go to the market, we will invite the friends or relatives of our employees to come to our meeting room to use our new products. These guests usually chat in the meeting room; they will become our first group of customers. They will automatically comment on the new mobile, whether they like or not? Which function they like the best? Which part they think it is not so good. The cameras will record what they discuss about. And it is very true. Afterwards we will tell them that we observe their conversations. This method helps us to get the customers’ true thinking about new products.”*

All managers agree with this idea, they believe that developing a social atmosphere that encourages innovation in a JV brings good results.

## **(6) Strategic Planning system important to innovation**

In the H5W/H5C case, four interviewed managers have supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation.

The marketing manager of JVH5 expresses his opinion:

*“The strategic plan and tactics which focus on innovation are the key factors to the success of business. In our strategic plan, the firm needs to have innovative capabilities and R&D capabilities. We need to develop our strategic plan to notice the industry’s demanding, customers’ demanding, customers’ changing and industry’s competitive change. So in our early stage of formulating our strategy plan we should develop our innovative thinking, then we will be in a proactive position.”*

All managers agree that innovative strategic planning help JV companies to create innovative capabilities.

## **(7) Innovation as a primary objective of both partners in a JV**

In the H5W/H5C case, only the finance manager agrees that having innovation as one of the primary objectives of both partners at the outset of the joint venture leads to more innovation. However, the finance, marketing and HRM managers disagree that innovation is a primary objective for both partners at the beginning of JV.

The strategy manager of JVH5 expresses his view:

*“By the time that Western firms finish JV with Chinese partner, Western firms have lost its advantage already. Innovation of Western firms has already pretty much expired because all Chinese firms have actually come up with it. Chinese firms are going to outright copy the technology through IJV. There are lots of copies of Western products in Chinese market. Chinese firms are basically going to end up making what the Western firms made two years ago. And then, what Chinese firms need to be doing is to jump to the more advanced technology.”*

Chinese firms started with copying what western firms were doing, but actually Chinese firms became much better and actually developed their own things and their own way of doing things. So they are learning because they are associating themselves with Western partners. But they actually learned first by copying what Western firms were doing and then improved on it. And if the JV breaks up, then the Chinese company becomes the western firm's competitor. Marketing managers take American mobile phone as an example, when it entered Chinese market before 1995, it had 90% market share. However, many Chinese mobile phone companies appear in the market after 2004. Now Chinese companies can make mobile phones as they learned from the American. Finance manager took another example, Taiwan firms with the similar experience, developed new superconductors for chip platform. They created an integrity process for the mobile phone which made the mobiles very

easily. They also learn from American Company, know how to do sales-marketing, how to design and how to play this game.

Above all, only one manager agrees that innovation is one of the primary objectives of both partners. The other three managers disagree with it.

### **(8) Focussing on IP development increases innovation**

In the H5W/H5C case, four interviewed managers have supported this idea. They agree that focusing on developing IP leads to more innovation.

The quotation of marketing manager of JVH5 illustrates:

*“Our company has a set of integrity processes and systems to develop intellectual Property and has a set of integrated systemic organization to operate IPR. We have our own research institute and have many researchers in the mobile terminal. Through our experiences in developing IP, it does help us to create more innovations.”*

It has to be recognized of course that the movement towards the development of IP, and that towards Open Innovation, push in different directions. A company therefore has to be very clear when it will take part in open innovation and when it will focus on IP development.

## **6.6. Summary**

This chapter has discussed the high tech case studies and the findings in relation to them. The next chapter deals similarly with the traditional low and medium tech industries.

# **Chapter 7: Findings of four cases in Low- and Medium-Tech Industry (LMT)**

This chapter sets out the four Joint Ventures in Low- and Medium-Tech (LMT) industries in the in-depth research which are adopting the two partner joint venture form: these have been anonymised as JVLMT1, JVLMT2, JVLMT3 and JVLMT4. In addition this chapter presents the findings of the LMT cases.

## **7.1. Case 6: JVLMT1 (Motor components: filters)**

Case 6 describes the joint venture between a Western partner, identified here as LM1W, and a Chinese partner, identified here as LM1C, set up in 1994.

### **7.1.1. JV Company and parents companies**

#### **(1) Foreign Partner: LM1W**

LM1W is a cross continental company with plants in America, Britain, France, Mexico, Belgium, India and Korea. The company's headquarters is in Tennessee. It is the largest filter maker in the world to serve the market of automobile, civil engineering, generator sets and marines. The company has a world-wide reputation for high quality filters and premier service.

LM1W is the world technology leader in manufacture of diesel engines. LM1W has set up 23 plants in 9 countries, 15 distribution centres as well as three joint ventures around the world. There are more than 160 OEM plants serving it located around the world.

In August 2006, the first technical centre of LM1W in China was opened in Wuhan City. The East Asia Technical Centre provides engineering and technical development services for the full range of products of LM1W built in China, including diesel, turbochargers and filtration products.

## **(2) Chinese Partner: LM1C**

Founded in 1969, LM1C is one of the 3 giant auto makers in China. Based in Hubei, the company's business extends nationwide and is developing internationally, integrating manufacturing, scientific research, and trading into a very large scale enterprise. It owns 32 specialized plants, 22 fully invested or share controlled companies, working with international technology leaders to bring world-class products to China.

Its main businesses include passenger vehicles, commercial vehicles, engine, auto parts & components, and equipment. Through over 40 years of development, a set of R&D and manufacturing facilities have been established as well as an extensive distribution and after-sales network, which unfolds a business display founded in Hubei whilst radiating throughout the whole nation. The major business facilities are located in Shiyan, Xiangfan, Wuhan and Guangzhou.

As of 2007, LM1C has gained an annual output of 1,137,000 vehicles, a sales income of RMB 164,800,000,000, 12.94% market shares and 121,000 registered employees. In 2007, the domestic market shares of medium/heavy duty commercial vehicle and medium duty bus topped 1st; light duty commercial vehicle and SUV secured 2nd and car the 3rd.

### **(3) IJV Company: JVLM1**

JVLM1 was established as a joint venture in 1994 between LM1C and LM1W with a total investment of 15 million US dollars. The purpose of JV firstly is profit seeking. Secondly, JVLM1 tries to create the innovation for China Automobile. Thirdly, JVLM1 wants to make the products in China and sell them to the customers. It creates produce capability in China locally. It creates efficiency manufacture and facility in China to support the customers. The local customers can enjoy similar good quality products at a lower price. JVLM1 is a professional filter company producing filters for vehicles and all kinds of internal combustion engines.

When JVLM1 was found, the area around it was mainly farm land. In the early days, JVLM1 did not have many customers, the annual sales of the company were fairly low, and everyone in JVLM1 struggled with very limited financial resources to ensure the company survived. In 1996, it began operations and filter production. Local customers could then enjoy the good quality products and a lower price. The company broke the even point in 1998. It produced 2.64million filters and 85.52 million RMB sales in 1999. In 2000 it exceeded 100 million RMB sales. In about 5 year's time, JVLM1 succeeded to become the top brand in the filtration industry in China as well as the market leader.

In 2001, there was a booming in the automotive market in China that led to a rapid market expansion of JVLM1. This booming in market was peaked in 2002 and in 2004. It became one of the very successful joint-venture companies between LM1C and LM1W, providing a big contribution to the mother companies.

The markets, products and system cost of JVLM1 are critical performance parameters for their customers. To achieve cost leadership, they continue to



leverage their innovative technology, economies of scale, global presence and customer partnerships. JVLM1 has focused on reducing costs and lowering their breakeven point to maintain a competitive advantage and to deliver quality products to their customers. Through joint ventures there are historical changes that have happened in Chinese Industries. China began to produce new technical filtration products which service the auto industry today.

At the same time, JVLM1 also faces some major innovation problems, such as its lack of general innovative creativity amongst employees; lack of time, lack of resources and lack of innovation demanded for its products from customers. It needs to take information from customers, but they do not demand product innovation. JVLM1 is trying to find the gap in the market, and then create something new to put into the market. The high cost of innovation is another problem. Some innovation will come out from parents companies first. Furthermore, innovation of their filter products will depend on the innovation of the diesel engine. Once designers change the structure of diesel engines, the filters will need to change to match this new requirement. Then JVLM1 needs to create new products or improve their existing products. It does not have many new requirements.

JVLM1 is now entering a new chapter in history. It is now growing as a world class company with advanced equipment and management, an annual production capacity of 4 million spin-offs and 1.1 million air filters, and a responsive system to market demand. It established a complete distribution network to serve OEM and AM markets of the LM1C, OEM and AM markets of LM1W, and other customs in domestic and international markets. It has become a young giant in filtration in China.

## **7.1.2. Finding:**

### **(1) Innovation networks**

In the LM1W/LM1C case, four managers interviewed have stated that networks are important in creating innovative capabilities for JV companies.

The strategy manager of the JV Company JVLM1 described how they became part of a wide innovative network in their industry, which has helped to create innovative capabilities. He totally agreed with the above proposition. He mentioned that innovation needs four factors, as follows: training, timing of investment, resources investment and good and stable operation system. JVLM1 is part of the LM1W's worldwide innovation, organization and sales networks. LM1C is also a big innovation, marketing and organization network. JVLM1 is therefore part of both companies' innovative networks. Because LM1W is a worldwide corporation and has advanced technology in its industry, JVLM1 can be supported by the worldwide innovative resources of LM1W and America LM1W Filtration.

Both formal ties and informal ties are vital to the process of innovation. Networks can provide different kinds of sources of information and capabilities than the firms without collaboration relationships. Both direct and indirect ties have positive influences on innovation. The informal ties within organizations have the potential to make an important contribution to innovation. Powell et al (1996) argue that "Beneath most formal ties lie a sea of informal ties." The formal ties are strongly supported by informal connections. (Cross, Borgatti and Parker 2002) And Ruef (2002) suggests that the perfect networks structure combine both formal ties and informal ties, In other words, keeping both strong relationships and weak relationships is vital to the process of innovation.

Managers interviewed have emphasised that both formal ties and informal ties are vital to the process of innovation. The marketing manager of JVLM1 declares:

*Our company has formal ties and informal ties within our parents group. In formal collaborations, when we cannot achieve the goals by ourselves, the collaborations within our parents group could help the division of innovative labour worldwide, so that we and other firms within parents group can accomplish their goal together. We also have informal ties with other firms. The formal ties are strongly supported by informal connections. In all these three entities, when innovation happens in any time, it will benefit all three entities.*

Above all, all managers support this idea that wider network help JV Company to create innovative capabilities.

## **(2) Open innovation**

In the LM1W/LM1C case, only the strategy manager supports taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry. However, the finance manager disagrees with it; the marketing and HRM managers have supported the concept of open innovation but with some reservations as to its practicality, but taking part in an open innovation system are less inclined to give away technology secrets.

The strategy manager of the JV Company JVLM1 points out:

*We participate in an engineering conference in America for sharing innovation and innovative practice. Innovative practice refers to learning what other companies are doing and copying what they are doing. Based on external new technology, we can improve our quality according to our company's capabilities. We share external new information and external new technology.*

Commercial interests limit the development of the open innovation system and of information sharing among the firms. The financial manager of the JV Company JVLM1 expresses her view:

*We do not have open innovation, American companies and European companies have more open innovation, for example, there is Society of Automobile Engineers (SAE) international in America Motor industry, they share research or innovation achievements, publish papers. They set up standards and provide the standard for all companies within the industry, which encourages the whole industry development and benefits companies. Our parent company takes part in open innovation. . . . Chinese companies pursue more economic benefits and are less open to sharing. We also have Automobile Association in China, but less innovation results. For example, we did not create our own emission standard, we usually use European emission standards domestically. So we are still on the learning stage, not the leading stage in our industry.*

Above all, one manager agrees with idea, two managers agree with it in principle, but state that it does not happen in practice very much; one manager disagrees with it completely.

### **(3) University-Commercial relationships**

In LM1W/LM1C case, strategy and finance managers have supported the idea of firms and universities cooperating in innovation, however, the HRM manager disagrees with it, the marketing manager agrees with the proposition in principle, but states that the relationship is not close in practice.

The strategy manager of the JV Company JVLM1 points out:

*"I strongly support this statement. The laboratories in universities maybe have the most advanced facilities to do some tests, also there are researchers in universities to do the test, and the researchers have the knowledge to do the test. The scholars*

*or researchers have knowledge to invent the products. These are the reasons why we relate closely to universities.”*

One manager agrees that linking with a university help JV Company to create more innovative capabilities. And one manager disagrees with it, and other two managers agree with it in principle, but believe the relationship is not close in reality.

#### **(4) Company-research institutions cooperation**

In LM1W/LM1C case, marketing and finance managers interviewed have supported the idea that relating closely to research institutions helps to create more innovation. And they have cooperated with different research institutes, and R&D Centres to cooperate on many projects. However, strategy and HRM managers agree with the cooperative in principle, but observed that some Chinese do not have close relationships with research institutions.

The finance manager of the JV Company JVLM1 points out:

*Cooperation is close because of the economic benefits. We have linked to the Chinese research institutes and cooperated with them on projects. We give them the research objective. They do research for us. We have achieved many product innovations, process innovation and methods innovation through cooperation with them. The research result in research institutions leads to commercialization.*

Above all, two managers agree that the relationship with research institutes help JV companies to create innovative capabilities. The rest two managers agree with it in principle, but believe the relationship is not close in reality.

#### **(5) Developing a social atmosphere for innovation**

In LM1W/LM1C case, four managers agree that developing a social atmosphere that encourages innovation in a JV brings good results.

The strategy manager of the JV Company JVLM1 points out:

*“Chinese firms need to invest in a system that encourages people to discuss innovative thinking and exchange information inside the firm. Chinese firms need to develop a discussible atmosphere or a discussable environment for employees discussing new technology and innovative thinking, sharing and exchanging information. We develop a social atmosphere to encourage innovation in our firm.”*

Then he adds his second points:

*“Well, the second thing JVLM1 does here is the excellence awards system. What this does is a lot of message sharing. We look at the reports submitted on a yearly basis and we have different awards for them. These excellence awards have different categories. Best practice with the best part of the company will then be shared. Sharing information is how we develop a social atmosphere for innovation.”*

Four managers all support the proposition that developing a social atmosphere in JV is important.

## **(6) Strategic Planning system important to innovation**

Four managers have also supported the proposition that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create innovative capabilities.

The human resource manager of JVLM1 noted how “both parent companies will give us targets” relating to strategic planning, while the strategy manager of JVLM1 brought up the need for long-term strategic planning:

*We usually have medium or long term development planning following the industry development trend, regulation law and environment requirements. We plan how to achieve our objectives, how to invest the resources, time, and people, what to do and the direction of development. We have medium term strategic planning (5 years), and long-term strategic planning (10 years); these plans are the scheme for employees developing new products, the direction for R&D activities, and the guides for salesmen selling our products.*

All managers believe an innovative strategic planning system is very important to JV Company.

### **(7) Innovation as a primary objective of both partners in a JV**

The strategy and marketing managers agree that having innovation as one of primary objectives of both partners at the outset of the joint venture leads to create innovative capabilities. However, finance and HRM managers believe that survival and profit are the primary objective for both JV partners.

The financial manager of JVLM1 comments on the complex objectives of different parties to the JV:

*The JV Company has an independent operation system, which involves us in cultivating our own innovative capabilities, but we do not have innovation as our primary objective. Our Chinese partner wants to learn new technology and new skills from our Western partner. The primary objective for our JV Company is surviving and further development, for which product research and product innovation is essential.*

Above all, two managers agree with this idea, the rest two managers disagree with it.

### **(8) Focusing on IP development increases innovation**

Four executive managers have supported that focusing on developing IP leads to more innovation. The financial manager of JVLM1 observed that some individual investors cooperated with the company in order for their patents to be commercially exploited.

## **7.2. Case 7: JVLM2 (Motor cars)**

Case 7 describes the joint venture between a Western partner, identified here as LM2W, and a Chinese partner, identified here as LM2C, set up in 2005.

### **7.2.1. JV Company and parents companies**

#### **(1) Western Partner: LM2W**

LM2W is one of the world's most successful automotive companies. With divisions in Cars, Trucks, Vans, Buses and Financial Services, LM2W Group is one of the biggest producers of premium cars and the world's biggest manufacturer of commercial vehicles with a global reach. Financial Services of LM2W provides its customers with a full range of automotive financial services including financing, leasing, insurance and fleet management.

The company's founders made history with the invention of the automobile in 1886. As an automotive pioneer, LM2W continues to shape the future of mobility. The Group applies innovative and green technologies to produce safe and superior vehicles which fascinate and delight its customers.

With the development of alternative drive systems, LM2W is the only vehicle producer investing in hybrid drive, electric motors and fuel-cell systems, with the goal of achieving emission-free mobility in the long term. This is just one example of how LM2W willingly accepts the challenge of meeting its responsibility towards society and the environment.

LM2W sells its vehicles and services in nearly all the countries of the world and has production facilities on five continents. Its current brand portfolio includes some of the world's most valuable automotive brands. In 2009, the Group sold 1.6 million



vehicles and employed a workforce of more than 256,000 people; revenue totalled €78.9 billion and EBIT amounted minus €1.5 billion.

## **(2) Chinese Partner: LM2C**

LM2C is a wholly state-owned large enterprise. LM2C may exercise the rights and interests of investors of state-owned assets to the wholly-owned holdings, shares enterprises which belong to LM2C. Besides this, LM2C also carries out operation, management and supervision in accordance with the law and assumes responsibilities for maintaining and increasing the value of the company.

LM2C now is the centre of planning, capital operation, product development and talent in Beijing automotive industry development, which owned the enterprises and institutions in vehicle manufacturing, parts manufacturing, Auto trade service, motor R&D, motor education, investment and financing business. Additionally, LM2C realized the merger and reorganization with Beijing Xing Oriental Industrial Co., Ltd., and now has the staff of 48,000.

On 30th November 2004, the No. 1,000,000 vehicle--AUV passenger car manufactured by LM2C had been off-lined. In 2007, the joint venture between LM2C and America Engine set up, aiming to set up a high-end light engine production base. As it is known, America Engine is the only light-duty diesel engine production base abroad of America, and is also the biggest investment project producing light-duty engines in China.

In 2008, LM2W and LM2C signed a letter of intent, agreeing to establish a medium- & heavy-duty truck manufacturing company of 50: 50 joint ventures in China. In addition, they would supply the relevant products and technologies, setting the

international development platform in the low-end commercial vehicle market segments.

Since China "the 11th 5-year planning", led by the new scientific concept, LM2C has improved its strategy, operations and capital control by emphasizing the new strategy of "way of grouping, development by 'leaps and bounds'" and promoting the development of grouping; its industrialization has been realized by enhancing product R&D, support, manufacturing and service integration; platforms have been set up by improving the management system, the management mechanisms and the operational means innovation; internationalization has been achieved by promoting self-development in opening-up cooperation. Beijing automotive industry is now going to be an important pillar of the capital high-end economic industry and modern manufacturing. LM2C actively promoted the strategic cooperation; it has gradually achieved the industrial structure of the simultaneous development in cars, sport utility vehicles (SUV) and commercial vehicles. At present, it has achieved a total of 6,000,000 motor vehicles produced and sold.

### **(3) IJV Company: JVLM2**

As the People's Republic of China opened its doors to the West in the late 1970s, foreign partners tried to sell their vehicles in China's vast domestic market and to use low-cost Chinese labour for their supply chains. The Chinese sought access to modern automotive technology, as well new hard currency investment and income. The result was LM2C in partnership with LM2W and LM2W North East Asia Ltd. The Chinese partner created a large-scale joint venture with the foreign partner that seemed to make money and appeared to be successful.

Established on August 2005, JVLM2 is a joint venture founded by LM2C and LM2W.

The objective is to produce sedans and technologies for the Chinese market and in a second step also to utilize expansion opportunities outside China. The approval of the Chinese authorities was required for the establishment of the joint venture. The purpose of JV is to offer customers tailored products and services for the automotive world both for China and worldwide. The company's wide range of products and services enables customers to rely on the firm for comprehensive, 'total' solutions. JVLM2 wants to provide to Chinese customers the advanced products and services at a low cost. It wants to provide the same high-quality products and services as LM2W do worldwide. Through JV, JVLM2 is creating a new era for the auto industry and market of China.

JVLM2 keeps up with fast-changing demands. The Chinese car market is one of the world's fastest growing and most dynamic markets. Demand for a certain model and make can change by the month, so Chinese automotive manufacturers must watch the market closely and respond quickly when they see a trend developing. They must also keep a close eye on costs to ensure a solid return on investment. The number of Chinese car manufacturers and car brands has surpassed those of the United States, formerly the world's largest automotive producer. Car prices in China have also decreased as an increasing number of manufacturers compete for a market share. To maintain competitiveness, manufacturers must quickly and accurately predict the cost and return on investment of individual vehicle models. For JVLM2, this meant innovation would help the company maintain its competitive edge and keep the expected return. To improve cost control and maintain healthy profit margins, JVLM2 implemented an innovative management system.

JVLM2 is trying to become the top performing key player in the Chinese market. JVLM2 is creating a new epoch for the auto industry and market of China.

### **7.2.2. Finding:**

#### **(1) Innovation Network**

In LM2W/LM2C case, four managers describe how their company has become part of a wide innovative network in their industry, thereby helping to create innovative capabilities. They also explained the value of industry innovative networks:

*We join the industry innovative network, for example, the engine association. The innovative network helps to turn ideas into products and to share information, including environment change, market requirement, etc. It builds up the high platform for creating more innovation. Our company is one of the main members in the industry association; we share our experiences and future development with other members. We are the best company in our industry and have the highest production. (Strategy manager, JVLM2)*

All managers agree wider networks are very important to create innovative capabilities for JV Company.

#### **(2) Open innovation:**

In LM2W/LM2C case, only the marketing manager strongly supports taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry. The HRM manager disagrees with this idea. Strategy and finance managers have also supported open innovation in principle, but most JV Companies do not join the open innovation because of protecting technology secrets.

The quotation of marketing manager of JVLM2 illustrates:

*We take part in open innovation system to share the innovative practice in the whole industry, including conferences, meetings, training, for all members of an industry organization. Consulting firms participate in the training of other companies, and learn from other companies. We participate in lots of conference that share open innovation outcomes. We show other companies' slides, and PowerPoint presentations about what we are doing and in what way. This is the way we communicate.*

Commercial interests limit the development of the open innovation system and of information sharing among the firms. The HRM manager of JVLM2 points out:

*We know taking part in open innovation system is very important; it helps all the firms and our industry move forward. But we only can contribute to the open innovation system to some degree. We will not give too many details on our new technology, new products or new function, because we spend so much money to invent this new product, we create it independently. In business, we need to compete with other companies. Every company needs to keep the key technology and core competence to themselves instead of sharing with other companies. These are commercial secrets.*

Only one manager strongly supports this idea, two managers agree with it in principle, but state that it does not happen in practice very much, for the rest one manager believes business secrets prevent a JV company participating actively in open innovation in industry.

### **(3) University-Commercial relationships**

In LM2W/LM2C case, strategy, HRM, Finance managers have supported the idea that companies should work closely with Universities on innovation. However, the marketing manager comments that information is not totally shared with the universities for reasons of commercial secrecy.

Strategy manager of JVLM2 also supported the value of cooperation with universities:

*Firstly, our researchers work together with the researcher in the university. We can learn from the university, share with their resources including equipment and software, and train our employees, increasing their knowledge. Universities have more professional research. For example, there are many national science laboratories in universities.*

The financial manager of JVLM2 pointed out some benefits from within a cost-benefit perspective:

*When a computer company designs and creates new software, usually before it goes to market, they will give it to a university free to try and test, which is one of the advantages of university cooperation. So there will be good software in the university. When we cooperate with a university, the university will use this software and do the test for us. If we buy this software in the market, it will be very expensive.*

Three managers interviewed in this case have supported the idea of firms and universities cooperating in innovation. The fourth manager believes universities are partners but only partially so.

#### **(4) Company-research institutions cooperation**

In LM2W/LM2C case, the marketing and HRM managers agree that relating closely to research institutions helps to create more innovation. And their company has cooperated with different research institutes, and R&D Centres to cooperate on many projects. Strategy and finance managers suggest that relating closely to research institutions helps to create more innovation for Chinese firms; it is the ideal situation, but they observed that some JV companies do not have close relationships with research institutions.

Big Companies have close connections with research institutes. However, small companies nearly have few links with research institutes. The quotation of strategy manager of JVLM2 illustrates this:

*“As far as I know, not all companies in China relate closely to research institutions. Usually in China, big companies have close connection with research institutes. But small companies seldom have such links. The big companies in China, for example, DongFeng Co, Ltd, Haire, have links with many research institutes and universities, because they are a state owned enterprise (SOE), and the Chinese government and education department will send researchers or graduates to these companies to do the research. It also becomes an obligation and social responsibility to accept researchers or graduates from research institutes or universities. So there are many cooperation research projects between SOEs and research institutes. SOEs will never leave a project. It only depends on how many projects they can arrange and manage. This doesn't happen with newer smaller companies.”*

Above all, two managers agree with this idea, the other two managers agree with it in principle, but state that the relationship with research institutes is not close in practice.

### **(5) Developing a social atmosphere for innovation**

In LM2W/LM2C case, four managers agree that developing a social atmosphere that encourages innovation in a JV brings good results.

The quotation of marketing manager of JVLM2 illustrates:

*“We have regular training, e-learning, discussion, comments, feedback, in which the employees are involved and they also can express their opinions, and they can also share their thinking with other employees. We encourage a social atmosphere that stimulates innovations. We always look for new methods in marketing, product popularization, cooperation with customers, satisfying customer's requirements. We award recognition to outstanding employees who initiate good marketing methods, excellent marketing operation concepts and so forth. This is our way of developing an innovative social atmosphere and encouraging more innovation.”*

Four managers all believe an innovative social atmosphere helps JV companies to create innovative capabilities.

### **(6) Strategic Planning system important to innovation**

In LM2W/LM2C case, four executive managers have supported this concept; they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation.

The quotation of marketing manager of JVLM2 illustrates:

*“In marketing innovation, before our sales focus on the East China and South China, in order to achieve our sales targets, we need to expand our sales to West China and North China nowadays; we also need to develop the marketing innovation in strategy planning.”*

Four managers believe that strategic planning focusing on innovation help JV Company to create innovative capabilities.

### **(7) Innovation as a primary objective of both partners in a JV**

In LM2W/LM2C case, four managers disagree that JVs have innovation as one of primary objectives of both partners at the outset of the joint venture. They believe the objective for the Western partner is to comply with the Government policy and gain access to the market. The main JV objective for the Chinese partner is to absorb western firms' advanced technology and experience.

The strategy manager of JVLM2 points out:

*I think 'profit' should take place of 'innovation'. We need to make the profit first. Once we have the money, we can think about other things, for example, creating the innovation, high productivity, cost reduction, operation efficiency, team work, team spirit. I think innovation is one of the primary objectives of both partners to create innovative capabilities.*



The finance manager of JVLM2 expresses her view:

*“We do not create innovation because of innovation. We create innovation because we pursuit profit maximization, efficiency maximization, assets utilization maximization.”*

Four managers believe that innovation is the primary objective for both JV partners at the beginning of JV.

### **(8) Focussing on IP development increases innovation**

Four managers interviewed have supported this idea. They agree that focusing on developing IP leads to create innovative capabilities for JV companies.

The strategy manager of JVLM2 agreed with the idea, noting:

*We set up the patent objectives for every department every year. If the department does not achieve the patent objective, then employees in this department will suffer a reduced salary, however, we will award the employee or department for applying IP. The head of every department encourages their employees to develop more patents. Applying for patents protects our innovation: we already apply for lots of patents. The small companies copy our products and sell at a cheap price.*

Above all, four managers support this idea, and they suggest a JV company can take part in open innovation and focus on IP development, although the movement towards the development of IP and towards Open Innovation are in different directions.

### **7.3. Case 8: JVLM3 (Motor car)**

Case 8 describes the joint venture between a Western partner, identified here as LM3W, and a Chinese partner, identified here as LM3C, set up in 1991.

#### **7.3.1. JV Company and parents companies**

##### **(1) Foreign Partner: LM3W**

LM3W is the largest, earliest, and the most successful international partner in China's Automotive Industry. It started its connection with China as early as in 1978, and has been taking the leading position in the Chinese automotive market for more than 20 years. Its first joint venture in Shanghai in China was established in October 1984. In 1984, LM3W signed a 25-year contract to make passenger cars in Shanghai. Since, at that time, vehicle manufacturers could not own a majority stake in a manufacturing plant, venture of LM3W took the limit of 50 per cent foreign ownership.

The second joint venture, JVLM3 was established in Changchun in February 1991. Today, LM3W has 14 representative companies in the country, with Shanghai Automotive Industry Corporation and LM3C being the two major Chinese partner companies, undertaking parts delivery and service provision for both customers and industry in addition to vehicle production.

By May 2004, LM3W was responsible for the areas of sales and marketing, technology, purchasing, personnel and governmental relations as well as finance. The tasks include supervision of the Chinese associated companies of LM3W, and the set-up of new business segments.

LM3W enjoys sales of about 18% of the Chinese market in 2007, and is the largest foreign carmaker. The Chinese market is one of the main markets of the Group. Operations in China include the production, sales and services of whole cars, parts and components, engines and transmission systems. The company's locally manufactured and imported vehicles are sold under various brand names in China.

The goal of LM3W is to continue its market leadership as the most successful car manufacturer by responding to the challenges with a strong local manufacturing network.

## **(2) Chinese Partner: LM3C**

LM3C is a state-owned enterprise with publicly-traded subsidiaries. A maker of automobiles, buses, light, medium, and heavy-duty trucks and auto parts, LM3C became China's first automobile manufacturer when it unveiled the nation's first domestically-produced passenger car in 1958.

In 1953, the first year of the first five-year plan, LM3C broke ground for its first factory, but it wouldn't produce its first product, the commercial truck, for three more years. LM3C initially made only commercial trucks but started producing passenger cars in 1958. These vehicles, the luxury sedans, were the first domestically-produced Chinese automobiles.

Though LM3C was not the first Chinese automaker to take on foreign partners, its early joint venture with LM3W in 1990 made it the second Chinese auto company to develop a strong cooperative relationship with a foreign counterpart, something which is mandatory for foreign automakers selling products in the Chinese market. Other foreign joint ventures followed. LM3C cooperated with Toyota as a foreign joint

venture partner in 2003. LM3C established a joint venture with General Motors in 2009 and has joint ventures with a handful of other foreign companies as well.

While primarily manufacturing products for sale in its home market, LM3C has exported products to many countries beginning in 1957 with the sale of three commercial trucks to a businessperson in Jordan. It has had customers in more than 80 countries throughout the life of the company. In 2009, LM3C is the largest machinery corporation and the second largest auto manufacturer in China.

### **(3) IJV Company: JVLM3**

JVLM3 is a major passenger sedan joint-venture between LM3W and LM3C set up in 1991. It is China's first modern passenger sedan industrial base of considerable economic scale.

JVLM3 was formally established on February 1991, and officially received by the State in August 1997. Its passenger cars officially began production on 2004. Through its continuous expansion, JVLM3 has become a company with a daily production capacity of over 1000 motor vehicles, with additional capacity for export of assembled vehicles, power trains and component parts.

JVLM3 manufactures the products of two globally known brands, and with more than 20 years of development experience in China was the first global premium car brand to realize domestic production in China. These famous brands of car are very popular among consumers. JVLM3 is a mature production base in China, with a complete portfolio of both A-, B- and C-grade cars.

## **1988-1996**

Joint venture agreements on the manufacturing under license were signed on August 1988, with this date marking the conclusion of negotiations lasting one year. The joint venture agreement included both the technology transfer for the production and planning, and the setting up of after sales support. Expertise was in addition transferred by providing training for some 500 Chinese workers in Europe. Furthermore, around 30 Western employees were posted to China to provide production support.

## **Since 1996**

In November 1993, the then-Board Chairman of LM3C and LM3W signed a letter of intent on the integration of production and an engine plant into the JVLM3 joint venture, which had been established at the end of 1991. The joint venture currently employs around 9,800.

Beginning with the production of the first batch in 1991, JVLM3 had grown from an enterprise with a registered capital of merely RMB3.712 billion, to a major automotive enterprise with total assets of RMB27.6 billion.

JVLM3 adopts advanced technologies and equipment to manufacture some of the world's most famous brands. The establishment of the company heralds the entry of China's automotive industry into a new era of large-scale production.

### **7.3.2. Finding:**

#### **(1) Innovation networks**

Four managers have emphasised the importance of innovation networks. They also describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities.

The marketing manager explained the value of industry innovative networks:

*I agree totally with this proposition; the industry innovative network is the platform for technology development R&D activities improvement. Companies can share the current new products in the market and discuss the development direction of the industry, which can help companies' further innovation. . . . We also cooperate with our parent companies on the projects of engine design, car design, raw material etc. We cooperate with many suppliers from different industries, including material suppliers. And we cooperate with our customers and create innovation according to their requirements.*

Four managers agree that becoming part of a wide innovative network in its industry helps to create innovative capabilities.

#### **(2) Open innovation**

In LM3W/LM3C case, HRM manager agree taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry. However, the strategy manager disagrees with it. Marketing and finance managers have also supported open innovation in principle; it does not happen in practice very much because of technology secrets.

The HRM manager of JVLM3 states her view:

*We join the engineer society. And we participate in the Institute of Engineering. We contribute our innovation to the open innovation resources. We introduce our new*

*innovative products to the industry. We will write papers and sent them to the Institute of Engineering. The institute publishes the paper, and other companies and customers will know our new products. Or the Institute invites us to deliver a seminar. In the seminar, we will list the information on innovative products. This is how we contribute to the open innovation system.*

Commercial interests limit the development of the open innovation system and of information sharing among the firms. The marketing manager of JVLM3 took the following view:

*Open innovation is very ideal principle, but in the real world, even if we share technology and information with others, we always have terms, conditions and it costs money. There is no absolutely open and free technology. When the research laboratories of our parents companies have innovation products, our company need to pay our parents companies to get the new technology. Then we can make new products by using the new technology and sell them in China. Our company and our two parent companies share new innovation products and technology together, but it costs money. Everything is based on commercial terms. If our parents companies give it to us free, who will pay for their development of new products?*

The strategy manager of JVLM3 (who was based in the innovation department) also expressed a somewhat negative opinion:

*Open innovation is not good to protect innovation. Chinese companies do not have much open innovation. However Chinese companies seldom share their technology with other companies at current development stage. Especially we are the leader in our industry, so if we go to share with other companies, they will copy from us. . . . Western companies usually have innovative ideas first, and then planning takes place, leading to production. Western companies are more open. Some research is repeated in Chinese industry, because companies do not know each other's R&D. Core technology, production skill, design ideas will not be shared with other companies.*

One manager supported open innovation, because he believes that the firm cannot do everything by itself due to the limit of capital and timing. One manager disagrees

with it. Two managers agree with it in principle, but state that it does not happen in practice very much.

### **(3) University-Commercial relationships**

In LM3W/LM3C case, strategy and marketing managers have supported the idea of firms and universities cooperating in innovation. However, finance and HRM managers agree with it in principle, but state that it does not happen in practice very much; they comment that information is not totally shared with the universities for reasons of commercial secrecy. Universities are therefore partners but only partially so.

The strategy manager of the JV Company JVLM3 points out:

*“When our companies cooperate with universities, we give them our targets, our projects and our products. The universities ask us for money to develop. For example, we have established the cooperation with Wuhan University of Technology. It is a ‘Material Testing’ project. In this project, we get agreement on cost, the research methods and tools, targets and results. The postgraduates who attended this project write their dissertation based on the outcome of this project. And we also employ these postgraduate after they graduate. Because they are involved in this project, we keep the outcome of this project, and we have further research needs to base on this project.”*

Two managers agree with this idea, two manager agree with it in principle, they believe the relation with university is not close at the current stage.

### **(4) Company-research institutions cooperation**

In LM3W/LM3C case, Strategy and finance managers agree that relating closely to research institutions helps to create more innovation. And they have cooperated with different research institutes, and R&D Centres to cooperate on many projects.



However, HRM disagree with this idea. Marketing manager believes that cooperation is an ideal situation, but he observed that some Chinese do not have close relationships with research institutions.

The strategy manager of JVLM3 expresses his view:

*“There are some connections between research institutes and Chinese companies (JV company or State Own Enterprise). Firstly, the Chinese firms cooperate with research institutions on many new projects. The cooperation can create more advanced technology, deeper experience for the firms. Secondly, the research institutes usually organize the workshops to introduce advanced innovation. Through the cooperation projects and presentation, it helps Chinese firms to stimulate their innovative capabilities.”*

Above all, two managers agree with idea, one manager disagrees with it. The rest manager agree with it in principle, but state that it does not happen in practice very much.

### **(5) Developing a social atmosphere for innovation**

In LM3W/LM3C case, four managers have supported the idea. They agree that developing a social atmosphere that encourages innovation create innovative capabilities for JV Company.

The strategy manager of the JV Company JVLM3 points out:

*“We develop a social atmosphere in the company to promote innovative thinking, team work, team spirit, improvement, responsibility and ethics. Employees have a cup of coffee or tea together to exchange their new ideas or new thinking, or have a chat on the grass to communicate information on their new research. A good Social atmosphere encourages innovation.”*

The quotation of HRM manager of JVLM3 illustrates:

*“Each supervisor is asked for a performance goal scorecard. In the scorecard, you have one item to promote innovation. It is a broad term, but means essentially breakthrough in technology. Or it is referring to customer service, how you serve customers and manage the supply chain. So in the score card, every supervisor has to pay attention to this area. Innovation means a lot of things, not just breakthrough in labs. It can also be customer service. Like in Microsoft, they became innovative in the supply chain. They customize the production. Their computer is an innovative company. When people think of their company, they think supply chain. In our company, we ask these supervisors to do just one item. There are 5 tasks, and one of them is innovation. Either make change to something or reward an employee. If you are in charge of the supply chain, and manage it better, then that is innovation.”*

The financial manager and the marketing manager of this JV supported the value of including innovation in employee assessment, with the financial manager emphasising its importance in developing “the social atmosphere encouraging innovation”.

Above all, all managers support that developing a social atmosphere encouraging innovation help JV company to create innovative capabilities.

## **(6) Strategic Planning system important to innovation**

In LM3W/LM3C case, four managers have supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation.

The quotation of finance manager of JVL3 illustrates:

*The Company wants more sales volume, more market share and more profits. Developing a strong strategic planning system with innovation as a focus can help the company to realize its operation objectives. And it brings three beneficial results; economic benefit, social benefit and political benefit. Innovation means the life-force for the company. Developing a strong strategic planning system with innovation as a focus can help the company develop sustainability.*

Four managers support that developing a strategic planning focusing innovation help JV company to create innovative capabilities.

### **(7) Innovation as a primary objective of both partners in a JV**

Four managers disagree that having innovation as one of primary objectives of both partners at the outset of the joint venture. They believe that the objective for the Western partner is to comply with the policy and gain access to the market. The main JV objective for Chinese partner is to obtain western firms' advanced technology.

The quotation of finance manager of JVLM3 illustrates:

*I think all the partner companies have profit as a primary objective; the establishing company needs to invest, and if the company cannot make a profit then it will be a big disaster. Only the government will invest for innovation and care less about repayment, but in the long term even the government expects to be repaid. The government's behaviour helps to encourage an innovative atmosphere in the whole society.*

The human resources manager of JVLM3 backs this up, suggesting that profit is the *objective* for the Western partner, while innovation is “a process, method and tool . . . that can help the company to achieve its objectives”.

Above all, four managers believe profit and business succeed is the primary objective for both partners, innovation is the tool to achieve it.

### **(8) Focussing on IP development create innovative capabilities**

In LM3W/LM3C case, four managers have supported this idea. They agree that focusing on developing IP leads to create innovative capabilities.

The marketing manager of JVLM3 expresses her view:

*When the innovative activity contains value, we apply for a patent. And when we need to share our patent with the third party, we will. We own our IPR and we have the initiative. We can decide which other companies can use this technology or this product, and decide to share the patent and our technology with them at cost or freely. If some companies make a contribution to the patent, we can give it to them to use freely, but they cannot share it with other companies.*

Above all, four managers support that developing IP help JV Company to create innovative capabilities.

## **7.4. Case 9: JVLM4 (Chemical)**

Case 9 describes the joint venture between a Western partner, identified here as LM4W, and a Chinese partner, identified here as LM4C, set up in 1989.

### **7.4.1. JV Company and parents companies**

#### **(1) Western Partner: LM4W**

LM4W combines the power of science and technology with the “Human Element” to passionately innovate what is essential to human progress. The Company connects chemistry and innovation with the principles of sustainability to help address many of the world's most challenging problems such as the need for clean water, renewable energy generation and conservation, and increasing agricultural productivity. Diversified industry of LM4W-leading portfolio of specialty chemicals, advanced materials, agro sciences and plastics businesses deliver a broad range of technology-based products and solutions to customers in approximately 160 countries and in high growth sectors such as electronics, water, energy, coatings and agriculture. In 2009, LM4W had annual sales of \$45 billion and employed

approximately 52,000 people worldwide. The Company's more than 5,000 products are manufactured at 214 sites in 37 countries across the globe.

### **International Joint Ventures**

Joint ventures play an important part in strategy of LM4W. LM4W formed its first joint venture more than 60 years ago. Today, joint ventures make up a significant part of earnings of LM4W. Joint ventures can provide LM4W with access to capital, geographic markets, synergy opportunities, risk sharing, technology and advantaged feedstock.

Joint ventures play an integral role in the strategy of LM4W to dampen earnings cyclicity and improve earnings growth. In recent years, the financial contribution of its joint ventures has grown significantly. In 2007, equity earnings rose to \$1.1 billion, exceeding \$1 billion for the first time in the Company's history, while cash distributions from joint ventures topped \$800 million, setting another record for the Company. In 2007, these principal joint ventures accounted for over 90 percent of total equity earnings of LM4W and cash distributions from nonconsolidated affiliates. As LM4W pursues a strategy focused on improving earnings growth and consistency, joint ventures are a crucial enabler, creating opportunities to accelerate the Company's strategic agenda across several different dimensions.

LM4W has established a number of joint ventures with upstream partners focused specifically on developing highly competitive, world scale production facilities with access to cost-advantaged feedstock. LM4W brings technology, operational know-how, global reach and product diversity. Its partners bring cost-advantaged feedstock, upstream expertise, local market presence and/or regional perspective. This combination delivers a significant competitive edge to each joint venture. The

Company has formed several joint ventures through the years with organizations both inside and outside the chemical industry, specifically focused on delivering technology breakthroughs that neither party could achieve alone.

LM4W's joint venture portfolio has tremendous global reach. In 2007, nearly 75 percent proportionate share of joint venture sales went to customers outside North America – with 39 percent in Asia Pacific. Joint ventures also contribute across the breadth of operating segments of LM4W, with 40 percent of equity earnings of LM4W coming from joint ventures in the Performance portfolio.

### **LM4W in China**

LM4W entered China in as early as the 1930s. The Company has invested US\$900 million in China to date. Sales revenue in China was US\$3.7 billion in 2009. China is LM4W's second largest country in terms of sales, with 5 business centres, 20 manufacturing sites and approximately 3,900 employees.

LM4W is committed to development in China through enhancing local capabilities and building the regional business into a global hub. In June 2009, a new propylene oxide-based glycol ethers facility under the LM4W Oxygenated Solvents Business came on line in Zhangjiagang, Jiangsu province, where LM4W is already operating its world-scale Latex, Epoxy and Polystyrene plants. LM4W Epoxy Systems has recently established its first manufacturing asset in Wuhan, China, supporting the growing demand in market segments such as composites, wind energy and infrastructure.

A new LM4W Centre opened in June 2009 in Zhangjiang High-Tech Park in Shanghai. Powered by 500 leading scientists and engineers working in over 80 integrated laboratories, the Centre brings together under one roof Corporate R&D

expertise with market-focused application development capabilities – an integration that enables them to act locally against the needs of their customers while drawing upon and contributing to LM4W’s proven global expertise.

## **(2) Chinese Partner: LM4C**

LM4C is a state-owned enterprise, founded in October 1995 with the approval of the State Council. LM4C is a diversified energy enterprise with major businesses concentrating on coal production, sales, electricity & thermal generation, coal liquefaction & coal chemicals, railways and port transportation.

LM4C is the most competitive unified energy company in China. Pursuing a multi-faceted strategy, it has integrated segments of coal, railway, power and ports, and has integrated its coal production, transportation and sales. It owns 54 coal mines with a total capacity of 200 million tons, 1369 kilometres of dedicated railways with a total transportation capacity of 128 million tons/kilometre, and power plants with a total installed capacity of 16080 MW. The CTL and coal chemicals project are progressing on schedule.

## **(3) IJV Company: JVLM4**

The IJV motivation for LM4W is to create a mechanism for effective commercialization. Joint venture has helped LM4W to build its presence in China, providing access to areas that were either restricted by regulation or constrained by well-established supplier relationships. Partnering with LM4C, the Company has been able to swiftly develop brand and market presence.

LM4W has strengthened the market position and future growth potential of several of its commodity businesses by placing existing assets into newly formed joint venture.

For LM4W, joint venture can retain the value of integration, while reduce capital investment and further shift its portfolio balance towards the Performance businesses. Additional value is also derived by working with LM4C that brings specific strengths, such as back integration to feedstock and an expanded market in China.

The IJV motivation for LM4C is that joint ventures can provide a vital platform for its technology development, and can derive significant value from technology and operational expertise of LM4W because LM4W has gained a tremendous amount of respect within the world of global chemical companies for its know-how, technology, operational excellence, global reach, cultural understanding, product breadth, and market positions/channels. This makes LM4W an attractive partner to companies around the globe that wish to get into the chemicals arena.

## **7.4.2. Findings**

### **(1) Innovation networks**

Four managers emphasise the importance of innovation networks and describe how they have become part of a wide innovative network in their industry, thereby helping to create innovative capabilities.

The strategy manager of JVLM4 mentions:

*“We cooperate with other Chemical company and form a cooperation team to take part in some research project, from executives, technological experts to operators; nearly everyone is involved in this project. Both companies place importance on this project. It shows that we take part in the innovative network in the Chemistry industry to push ahead the Chinese Chemistry industry.”*

Above all, four managers support wider network is vital to innovation.



## **(2) Open innovation**

In LM4W/LM4C case, only finance manager support taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry but are less inclined to give away technology secrets. However, strategy, HRM and marketing managers have supported the concept of open innovation but with some reservations as to its practicality.

The financial manager provided a positive overview of the role of open innovation:

*An open innovation system helps provide more innovation. Companies cooperating together collect more ideas from different companies, and this is much better than one company's in-house R&D, because it saves the investment and escapes the danger of repeat research. A few companies generating ideas together are better than individual company in-house R&D. Our parent companies take part in open innovation.*

Above all, one manager agrees with this idea, the rest three managers agree with the proposition in principle, but state that it does not happen in practice very much.

## **(3) University-Commercial relationships**

In the LM4W/LM4C case, only HRM managers have supported the idea that companies work closely with Universities help JV companies to create innovative capabilities. However strategy and finance managers disagree with it. Marketing manager comments that information is not totally shared with the universities for reasons of commercial secrecy. Universities are therefore partners but only partially so.

The human resource manager of JVLM4 supported this opinion:

*If we cooperate with another company, they may know our weakness. There is no conflict of interest between universities and companies, so we can cooperate closely and establish the research project. We cooperate with many universities, for example, we cooperate with Shanghai University on some projects. Some Masters students based their dissertations on these projects. When the project finishes, they also finish their dissertation. We share the research results and may cooperate with further research.*

The above evidence shows how Chinese firms relate to universities, particularly their research laboratories in helping to create more innovation for firms. Whereas the strategy manager slightly disagree this proposition, pointing out:

*In case of our company, there was a lot done with universities. My observation is that for some new companies, they are still in the survival stage. There is not much to be done with universities. But once these new firms mature, and have more products and resources, then they can cooperate with universities.*

The financial manager of JVLM4 backed this up:

*Normally there is cooperation between a big company and a university. Our company is an example; we cooperate with Shanghai University on some projects and a material analysis project, and with Xi'an University on chemical projects.*

Above all, one manager agrees with this idea, two managers disagree with it, the rest manager agrees with it in principle, but state that it does not happen in practice very much.

#### **(4) Company-research institutions cooperation**

Only finance manager agree that relating closely to research institutions helps JV companies to create innovative capabilities, however, strategy, HRM and marketing managers agrees with it in principle, but state that the relationship is not close in practice.

The strategy manager of JVLM4 noted that some companies do not relate closely with research institutions, and supported the need for closer cooperation. The human resources manager of JVLM4 had reservations about the value of cooperation with research institutions, pointing out that the motivation of institutions was very different from that of the company. This particularly arose in relation to the ownership of intellectual property rights:

*For the research institution, the goal of publishing a paper is very normal; however, the company does not want to expose its core technology. So issues arise about whether the research institution can publish a paper on the project and how much information can be published in the paper.*

Above all, one manager agree with it, the rest three managers believe the relationship between JV Company and research institutes need to be improved.

#### **(5) Developing a social atmosphere for innovation**

In the LM4W/LM4C case, four managers interviewed have supported that developing a social atmosphere that encourages innovation in a JV create innovative capabilities.

The quotation of strategy manager of JVLM4 slightly illustrates:

*"It is obvious that there needs to be a working culture to encourage innovation. We have a system to reward people to find new ways to save money. If you save energy, save cost, etc, then we have a way to promote and reward you. That is a very natural and obvious way in our industries. Innovation is at the heart in high-tech industries."*

Above all, four managers believe that social atmosphere conducive to innovation is important.

## **(6) Strategic Planning system important to innovation**

In the LM4W/LM4C case, four managers have supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create innovative capabilities.

The quotation of strategy manager of JVLM4 illustrates:

*We agree with this proposition. All companies have sales targets, marketing targets and waste reduction targets. Our company has very clear sale targets and product targets, but we also need strategic plans that lead to innovative thinking; it helps to achieve our targets. For example, our company has 400million products, but our products targets is 700million, how can we increase our sales? We need to increase the products target, at the same time, we need to improve product efficiency, and decrease costs. We need to create innovation to achieve these things. Innovative thinking in the strategy plan is very vital.*

Above all, four managers believe strategic planning focus on innovation is important.

## **(7) Innovation as a primary objective of both partners in a JV**

In the LM4W/LM4C case, only marketing manager agree that having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation. However, strategy, HRM and finance managers disagree with it, they believe The JV objective for Western partner is to satisfy the Chinese government requirement and at the same time to make profits. The primary JV objective for Chinese partner is to absorb western firms' advanced technology and experiences.

The quotation of marketing manager of JVLM4 illustrates:

*"We have innovation as one of primary objectives of both partners at the outset of the joint venture, it leads to more innovation. We have the strong demand for innovation from customers and markets, Innovation exists anywhere. Innovation is*

*the key factor to the successful firm. The success of company means profit, the reputation of our products and customers satisfaction.”*

Above all, only one manager agreed with this idea, the other three managers disagree with it.

### **(8) Focusing on IP development increases innovation**

In the LM4W/LM4C case, four managers all agree that focusing on developing IP leads to create innovative capabilities.

The quotation of the marketing manager of JVLM4 illustrates:

*“I support this opinion strongly. Applying for IP (Intellectual Property) protection helps to protect innovation and help to create more innovation. This is a sense of security because every company which tries to invent new technology or new products must spend on assets, resources, time, and the employee needs to receive training. The patent can protect the innovation created by firms.”*

Four managers believe developing IP help to create innovative capabilities.

## **7.5. Summary**

This chapter has reviewed the finding for the traditional industries. The next chapter considers the services sector.

# Chapter 8: Findings of One Case in Service

## Industry

This chapter sets out the events involved in a study of alliances, structured with joint venture companies with two partners in service industry, which are identified in this thesis as JVS1, and further presents the findings of the service case.

### 8.1. Case 10: JVS1 (Port Services)

Case 10 describes the joint venture between a Western partner, identified here as S1W, and a Chinese partner, identified here as S1C, set up in 1994.

#### 8.1.1. JV Company and parents companies

##### (1) Western Partner: S1W

S1W is the world's leading port investor, developer and operator with interests in a total of 308 berths in 51 ports, spanning 25 countries throughout Asia, the Middle East, Africa, Europe, the Americas and Australasia. S1W also owns a number of transportation-related service companies. In 2009, the S1W handled a combined throughput of 65.3 million TEU worldwide.

The history of S1W began in 1866 when it was established in Hong Kong. For over 100 years, it provided ship construction and repair services before diversifying into cargo and container handling operations in 1969 when its flagship operation was established. In 1994, S1W was founded to manage the growing international port network.

Drawing on the flagship operations' extensive experience, S1W has expanded worldwide. The Group now has ports and related operations that span the entire logistics chain, providing customers with a full range of value-added benefits that include container storage and repair, container tracking, general and bulk cargo transfer, warehousing, marine shuttle services, and other related services.

With the open policy, China's economy began to develop, and China began to build its own port (referred to in this thesis as Port A). For S1W, JVS1 has been a remarkable success story. Port A has provided S1W a unique opportunity; from nothing more than a green field site, S1W has developed Port A to a world-class container terminal. With 35 years experience in container port operations, S1W has managed to re-create the success of its flagship operation in Shenzhen. S1W has fitted out the terminal with state-of-the-art equipment and infused staff of JVS1 with industry's leading management expertise.

S1W has expanded its market from Hong Kong to China successfully. It has gained business experiences on how to operate and develop in China environment from establishing JVS1, and it will also help S1W develop similar JVs in the future.

## **(2) Chinese Partner: S1C**

S1C is responsible for the development and management of Port A. An independent entity, S1C operates the port, railways, roads, tunnels, real estate, commerce, customs, and ship repairs within Port A. Now the main business of S1C involves in logistics related business including warehousing, container yards, consolidation of export cargo, distribution of import cargo, customs clearance for newly-manufactured containers, simple processing, transportation, customs clearance and quarantine,

and customs documents processing. When S1C expedites its development pace to meet its goal of becoming an international port by accomplishing forecasted annual throughput of 12 million TEU, and it strengthens its step to integrate its logistics industry.

In late 2008, the S1C joined the S1W in constructing a new terminal at Port A with three new container berths and an expansion of the older berth. The terminal will have capacity to handle 1.8 million TEUs of containerized cargo per year.

Located in Shenzhen east, Port A is adjacent to the international financial centre of Hong Kong (just 53 nautical miles from Victoria Harbour). With a wide calm basin, Port A provides natural shelter and deep berths to accommodate the largest vessels. Port A is now South China's main container port and is engaged in major expansion efforts. In 2004, Port A handled more than 6.4 million TEUs of containerized cargo, making it one of the world's biggest container ports. The Port A has more than 80 international trade routes, including 35 with North America and 31 with Europe.

In 2005, Port A covered 2.5 square kilometres, 1.8 of which was developed. Port A contains three bonded warehouses covering a total of 36 thousand square meters, one 31-thousand square meter customs warehouse, one bonded 10-thousand square meter container yard, and general container yards of 140 thousands square meters. Plans are underway to add 500-thousand square meter logistics centre.

S1C operates the Port A. In addition to handling cargo, the company builds and operates facilities that support the maritime activities of the port, including providing transportation, storage, industrial, and service facilities. The company also repairs containers and manages duty-free trade. The Port A is planning and constructing



three new areas that will add over 30 berths, 14 of them deep-water container berths.

Port A was designed to be a comprehensive port, mainly devoted to international transshipment of containers as well as bulk and general cargo. Container throughput of Port A in 2008 reached 10.02 million TEUs of containerized cargo, and 2009 container throughput was 9.68 million TEUs.

### **(3) IJV Company: JVS1**

In 1994, S1W and S1C signed the joint venture contract establishing JVS1. The JV motivations for the S1W include: firstly, using local knowledge to enable entry to new Chinese market; secondly, using the land, infrastructure provided by Chinese partner to develop Port A; thirdly, setting up JV in China will accumulate the experiences for S1W establishing similar JV in the future. The motivations of the S1C include: firstly, import the foreign investment into China to build Chinese own port. Secondly, learn the advanced knowledge and advanced technology from foreign partner to build up China container port.

JVS1, a joint venture between S1W and S1C, commenced operations in mid-1994. The company is responsible for operating and managing Phase I, II and III, the Expansion Project and the West Port of Port A. Port A is a preferred port of call for mega container vessels in South China. More than 30 major shipping lines operate around 80 weekly services at Port A, establishing an extensive shipping network that spans the globe. To provide premium services, JVS1 continually develops the terminal by implementing state-of-the-art operational equipment and computer systems. At the same time, JVS1 applies Six Sigma methodology to promote

process innovation initiatives and enhance staff training and qualification, thus improving overall customer service quality.

JVS1 is one of the most important and convenient port for exports from China to the America. Here at JVS1, every four hours there will be one container vessel heading to the Americas and one to Europe every eight hours. According to statistics from PIERS Global Intelligence Solutions, up to 28.7% of the total US-bound containers from China were shipped via JVS1 from August 2006 to July 2008. The fact that JVS1 is called “Port of Toys”, “Port of Shoes” and “Port of Electronic Products” by the port industry really makes sense.

Operating around the clock, JVS1 provided port services to numerous well-known shipping lines including the world’s top 20. Spearheaded by the top 20 shipping lines, there are close to 40 liner companies calling at JVS1. Several international logistics operators and exporters have set up warehouses and offices near the port—to take advantage of efficient services of JVS1.

Since commencing operations in 1994, JVS1 has registered annual throughput from 13,000 in 1994 to 8.865 million TEU in 2006 with a total length of containers it has handled over these years adding up to six circles around the globe. As a major port in Shenzhen for ocean-going shipment, JVS1 has made substantial contributions to Shenzhen for confirming its ranking as the world’s fourth largest port.

### **Process Innovation**

Unlike the joint ventures described in chapters 6 and 7, which all involve some element of manufacturing, the main focus of innovation in this service-industry joint venture was expected to relate to processes. Process innovation makes the processes for operations in established markets more effective or efficient.

- **The Next Generation Terminal Management System.** JVS1 uses the leading-edge information technology to improve the terminal core processes and benefits customers, the Next Generation Terminal Management System, entered a trial run simultaneously with the first berth opening. Operations of JVS1 were further enhanced on October 2003 as is the new terminal management system, swinging into action. Replacing the existing terminal operation control system, the Next Generation Terminal Management System provides JVS1 with a super-power Central Processing Unit (CPU). Jointly developed by S1W in Hong Kong and JVS1, the system is designed for the operating mode of JVS1, and it will be applied gradually to other S1W subsidiaries.
- **Tracking Container Movements-Port Community System:** Increasingly importers and exporters around the world are beginning to expect 24/7 real-time access to information, detailing the exact location of containers within the global supply chain. As the region's major container port, located in China's largest export city, JVS1 has provided its customers with the most convenient and efficient way to check in real-time container movements within the terminal.

In recognising shipping lines, shippers, trucking companies and the Customs Authority pay close attention to container movements, JVS1 developed a real-time information platform to monitor container movement within the terminal.

### **8.1.2. Finding**

#### **(1) Innovation networks**

In the S1W/S1C case, all four managers of JVS1 agree with the importance of networks.

The financial manager of JVS1 points out:

*We have established the deep cooperation with other ports within S1W (our parent company), which has big influence in logistic industry and runs 51 ports around the world. It is also the biggest port group as a whole, and ST is the best single terminal in the world. This is one type of innovation network. There are many communications and much learning within the group. There is a group of researchers in engineering, equipment design and process within S1W group, we cooperate with S1W's research centre researchers, and new technology and innovation are shared with the port operators within the group, such as the Next Generation Terminal Management System, which is an operation system to computer mode.*

The strategy manager of JVS1 strongly agrees stating why he believes that an innovation network is crucial:

*Before there was no port, but now we have an efficient port. We cannot develop it by ourselves, but an innovation network can help the company to save investment, and to share advanced technology, and better operation systems. When other companies have made some mistake, we can escape making the same mistake and learn from other companies' experiences through the network.*

The marketing manager of JVS1 describes their industry innovation network:

*I agree with this proposition. [Port A] has developed very well through the innovation network, which can provide the infrastructure and platform. The innovation network includes the port community, port associations such as Logistics Chain, the World Customs Organization (WCO), and conferences, including port conference, shipping conference. We trust other companies, cooperate together, and have common benefits. We regularly share the experiences and good practice on equipment, new technology and new products. Managers from different ports exchange ideas. Other ports can learn from us. Associations also arrange port visiting, we can visit each other.*

The HRM manager of JVS1 introduces how Port A establishes formal and informal cooperation within the industry:

*We have formal and informal cooperation outside S1W, including customs, governments, organizations, ports, shipping companies and customers. It is full cooperation. We connect with other ports and harbour bureaus through our customers, including shipping companies. For example, we cooperate with USA's east and west ports and European ports, including Port of Long Beach in California, Port of New York and New Jersey, etc. We signed contracts with them on environment protection and marketing innovation projects, and exchanged the market information and technology information. We get agreement on cooperation, each party makes their contributions. The cooperation takes place at the operation level, engineering level, marketing level, environment protection, technology, customs security and good safety.*

The finance manager states that a JV Company can exchange information and learn from the networks, and companies can know how they can do well and why they do well:

*We have cooperation with other organizations in engineering, equipment enhancement, and process enhancement, including computer companies on hardware and software projects. And we have cooperation with suppliers and our customers; this is the best way to improve ourselves. The company needs to know the best expectations of customers. And what has been given to customers by the company? Then it can help the company's critical thinking.*

He also points out:

*On the other hand, suppliers can improve their products according to our requirements. For example, we cooperate with [a Chinese company] that makes cranes for ports. After the improved products are produced, they will not only sell the new products to us, but other ports in this industry can also buy them from suppliers and use them, which will help the whole industry develop.*

Above all, four managers all believe wider network is important to innovative capabilities.

## **(2) Open innovation**

In S1W/S1C case, only marketing manager agrees that taking part in an open innovation system in its industry to help to build up innovative capabilities and create more innovation both for the firm and their industry. However, strategy and HRM managers disagree with it, finance manager agrees with it in principle; he comments that technology secrets could prevent open innovation.

The strategy manager of JVS1 points out:

*It is a closed innovation system in our industry because of the commercial secrets. And every firm wants to protect its intellectual property. It may be not practical to be too open. We exchange the experiences with other companies, for example, we have consultancy arrangements. However, we do not reveal commercial secrets.*

The human resource manager took a similar view, commenting that a mixed approach (neither totally open nor totally closed) operated. He observed that a totally open system meant no secrets:

*In real business, open innovation is not good for technology, investment or motivation. If a JV Company is total open without condition, then in the end nobody will do it [i.e., innovate], because they are waiting for other company to do first. We did some innovation and then we gave it to our industry.*

The marketing manager supported the concept of open innovation systems, particularly the benefits for companies that are not the main innovators:

*Taking part in an open innovation system, where ideas come from one company and bounce back to other companies, ideas will get better and better, and this definitely helps more innovation. However, companies with closed innovation are blind and do not know what the market is doing. And market information challenges your status score, if a company does not know what its competitors are doing, and what services the competitors are providing. The company needs to catch up with them. This is the driving force for the company, which challenges its existing*

*process and the reflection on the current status. A company gets pressure from its competitors, which should lead to better services. What is the company going to do next? Update its services until they are as good as its competitors, and then overtake them.*

Above all, one manager agree with it, two managers disagree with it, the other manager agree with the proposition in principle, but state that it does not happen in practice very much.

### **(3) University-Commercial relationships**

In the S1W/S1C case, strategy and HRM managers have supported the idea that companies should work closely with Universities on innovation. However, marketing and finance managers comment that information is not totally shared with the universities for reasons of commercial secrecy.

The strategy manager of JVS1 expressed a strong element of reliance on universities as a source of research:

*Our company has the objective to produce products and make profit. We do not do research. Instead, we gain some ideas, and then we cooperate with a university, who creates some prototype and researches it for us. For example we cooperate with University of Southern California (USC), we have 3 or 4 cooperative programs with USC, including marketing innovation.*

The human resources manager of JVS1 supported this:

*This company may not spend enough in innovation, especially laboratory research; we do not have investment in a test laboratory, so cooperating with a university helps us a lot. For example, we cooperate with Hongkong Polytechnic University on logistic related, process related projects. The role of the university can be providing a third party's opinion to companies. And also it is good for companies to have the opportunity to test products in a controlled environment. Once the tests mature, the processes can be shared with our company.*

The human resources manager also pointed out the value of cooperation in educating employees, who were often “stuck with some task”, but could learn from cooperation with universities. He noted how cooperation was a two-way process, with benefits for the university as well as the company:

*We offer internships for students to come along and conduct projects for us during summer time. Some students spend 2 or 3 months carrying on projects for us. They also can transfer new ideas and new technology to our employees.”*

A manager of JVS1 actively involved in finance backed up his colleagues, noting the way in which universities could be regarded as extra resources for companies: “We do not rely on universities, we use their professional knowledge”. He compared the relationship between companies and universities in China unfavourably to the relationship in the USA:

*China needs to cultivate more PhD candidates, and there are lots of researches going on in University where the relationship between company and university is not close enough. We can describe this as ‘the baby stage’, and a lot of policies need to be developed. In the USA, companies have funding to donate to universities every year, especially pharmacy companies. In China, some companies do it, but not all of them.*

Above all, two managers agree with this idea, two managers agree with it in principle, but state that it does not happen in practice very much.

#### **(4) Company-research institutions cooperation**

In S1W/S1C case, strategy, finance, marketing managers agree that relating closely to research institutions helps to create more innovation. And they have cooperated with different research institutes, and R&D Centres to cooperate on many projects. However, HRM manager believe some Chinese JV company do not have close relationships with research institutions.



The strategy manager of JVS1 points out:

*We cooperate with research institutions and consultancy organizations; we have close relationships with quite a few universities. For example, Motorola University, they provide services for us. They have the resources of Intellectual Property. They have the resources for research and new understanding and process innovation. We can improve our research capabilities and innovative capabilities through cooperating with them.*

The financial manager also referred to cooperation with Motorola University (MU), and with other consultants: “MU focuses on production innovation, and as we are in a service industry, we focus on process innovation.” He particularly noted how this cooperation had helped the company with the introduction of the 6 Sigma management methods.

The marketing manager supported this position. However, the human resource manager was less convinced, particularly about the informal nature of some cooperation arrangements, where “responsibilities for both sides are not well defined and duties are not clear.” He saw cooperation with research institutes as an area where China lagged behind the USA and Europe, and also thought that cooperation was more likely to involve big companies.

Above all, three managers agree with this idea, one manager agrees with the proposition in principle, but state that it does not happen in practice very much.

### **(5) Developing a social atmosphere for innovation**

In S1W/S1C case, all four managers of JVS1 agreed with the idea. The strategy manager of JVS1 was particularly proud of the contribution of the 6 sigma methodology, noting that it had provided a valuable framework for “getting better through innovation”. He pointed out:

*Firstly, we emphasise the sense or idea of innovation and change among our employees, middle level managers and senior managers. We create the awareness of innovation and the expectation of innovation inside our company. We educate our employees through process innovation seminars. This is also one of the key aspects of the 6-Sigma methodology. Secondly, innovation is the source of competitive advantage: how do we compete and how can we win from the competition – the viewpoint is to improve the process of operation. We encourage employees to learn more about techniques of process improvement, including conducting “green belt” training, “black belt” training through Motorola University, which are basically process innovation techniques. Learning and training are becoming a very important part of creating an innovative social atmosphere.”*

The marketing manager noted how people are conservative and dislike change.

Innovation is, in his view, necessary to meet market pressures:

*We need to create an innovation culture and develop the necessity of an innovation culture for employees. Through the senior manager to the junior managers, the employees will realize there is a need for innovation. After employees are aware of innovation, we need to promote how to change and provide innovation methods. And we have awards for the employees who create innovation, which encourages them to try to do more innovation.”*

The human resource manager saw innovation as something that was not restricted by the boundaries of the organization:

*To work with our partners, our suppliers and customers, we will “sell” to them how we do things innovatively. From this angle, we also educate our suppliers, partners, customers. When they want to do business with us, they may think the same way as we do. Then the whole industry becomes more open.*

Above all, four managers all believe developing a social atmosphere is important to create innovative capabilities for JV companies.

## **(6) Strategic Planning system important to innovation**

In S1W/S1C case, strategy, finance and marketing managers have supported this concept they agree that firms should develop a strong strategic planning system with innovation as a focus, and that this helps them to create more innovation. However, HRM manager disagrees with it.

The strategy manager of JVS1 points out:

*We put process innovation into our strategic plan every year. We put resources behind innovation through our strategic plan, it is very important. We allocate budgets, investment, technology, etc to support innovation. We focus on services. We use the Process Innovation Initiative (PII) department to achieve high productivity. We improve the detailed processes of engineering operations. We introduce new ideas into our operation area, save the cost and we do it in a better way.*

Some examples of strategic innovation were provided by the marketing manager, who referred to the introduction of a short sea feeder service between the JV's port and Hongkong, the establishment of a rail service to extend the company's cargo catchment area, and the beginning of marketing direct to end-user companies such as Wal-Mart and Nike.

The HRM manager of JVS1 expressed a slightly different view:

*"It must be noted of course that the strategic plan may set out innovative targets. However what is actually achieved will inevitably be different. The one thing that is certain about a plan is a different outcome is almost inevitable. Thus although innovation may be given priority in a strategic plan, this is the important fact. The actual innovatory outcomes are not by their very nature predictable."*

Above all, three managers agree with this idea, one manager disagrees with it.

## **(7) Innovation as a primary objective of both partners in a JV**

In S1W/S1C case, only HRM manager agrees with this idea. However, strategy, finance and marketing managers disagree with it, they comments that the JV objective for Western partner is to satisfy the Chinese government requirement and at the same time to make profits. Obtaining advanced technology is the primary objective for the Chinese partner.

The strategy manager of JVS1 points out:

*I don't think innovation is the primary objective for our Western partner. The primary objective for the Western partner is to get into the Chinese market. The primary objective of the Chinese partner in setting up the IJV is to build up their technology. The primary objective for the JV Company is to survive.*

This view was endorsed by the financial manager, who emphasised the priority of survival over innovation. The marketing manager's views were similar. He stated: "We will not create innovation for innovation's sake. Companies pursue profit." To the marketing manager, the motivation for the Chinese partner in this port JV was to "get investment, experience how to build the ports, and [gain access to] the networks and reputation of the Western partner, its relationships with shipping companies and good owners, because they do not know how to start a port business."

Above all, one manager agrees with this idea, three managers disagree with it.

## **(8) Focussing on IP development increases innovation**

In S1W/S1C case, four managers agree that focusing on developing IP leads to more innovation, they noted that intellectual property often related to processes rather than to products, and hence it was more difficult to protect.

The finance manager was happy for the company to share general ideas but not specific applications, while the marketing manager commented on the difficulty in keeping information about good experiences secret, especially when representatives of other ports would visit the JVS1. He referred to the company's proprietary computer software as "our core competence", which the company would not want to sell, even though competitors tried to imitate the technology. The human resources manager described IP as "your baby, no one can take it away from you", and emphasised the importance of protecting IP.

The manager responsible for the Process Innovation Initiative saw IP rights as both helping and hindering innovation:

*I need to put resources into innovation, but if our competitors can copy our innovation, patents provide protection. Other people have to pay money when they need to use the innovation. We need to recover our investment. On the other hand, giving innovations freely to the whole industry will be against the company's interest. There is no tradition of applying for patents in the port industry.*

Above all, four managers believe that developing IP is very crucial to help JV Company to create innovative capabilities.

## **8.2. Summary**

Chapter 6, 7 and 8 have reviewed the finding from the interviews case by case. Chapter 9 summarises these finding into some overall conclusions in regard to the eight propositions for conditions most likely to lead to high innovation in the JVs examined.

This Chapter discuss the findings of the research from the semi-structured interviews. These were structured around the propositions contained in chapter 4 of

this thesis. Chapter 9 then conducts a content analysis and reviews the evidence to support or refute the propositions sequentially.

# Chapter 9: Cross Case Analysis

## 9.1. Introduction

This chapter provides a qualitative content analysis of each of the propositions and, combined with the findings in chapters 6 to 8, draws conclusions as to the degree to which the research supports or refutes the propositions. Chapters 6 to 8 focused on recording the responses of the interviewees to the semi-structured interview questions. This chapter analyses the individual propositions at a more general level.

Following the case-by-case analysis, reported in the previous three chapters according to broad industry sector, a cross-industry analysis was undertaken. This analysis demonstrated that, with the exception of Proposition 5, there were no statistically significant differences in responses between industries. As a result, this section focuses on the generic findings across industries for the eight propositions. Each proposition is discussed. To support the case analysis, a content analysis was performed. The results of the content analysis, proposition by proposition, and a summary of the overall findings from the ten cases are provided.

## 9.2. Content analysis

Through the 40 interviews with senior executives in ten major Sino western JVs, eight propositions were tested and content analyzed. This involved the researcher reaching a judgement, based on the interviews, of the attitude of each interviewee to the eight propositions. Because of the semi-structured nature of the interviews, interviewees were not asked to rate their attitude on a numerical scale, but rather their general responses were analysed in order to arrive at such a rating.

**Table 9.1** is the content analysis; responses are coded on a scale of 1-5 as follows:

1 - Strongly agree

2 - Agree

3 - Agree with the proposition in principle, but state that it does not happen in practice very much

4 - Disagree

5 - Strongly disagree

The eight propositions were scored according to the scale of 1-5, according to the total of 40 interviews.



**Table 9.1: Content Analysis of the interviews**

JV company	Manager	P1	P2	P3	P4	P5	P6	P7	P8
<b>High-tech Industry</b>									
Partners of Case 1: H1W/H1C <b>JV Company: JVH1</b>	Strategy	1	2	1	3	1	1	5	1
	Marketing	1	3	1	1	1	1	4	1
	Finance	1	3	3	3	2	2	2	1
	HRM	1	3	2	3	2	1	5	1
Partners of Case 2: H2W/H2C <b>JV Company: JVH2</b>	Strategy	1	3	1	2	2	1	1	1
	Marketing	2	2	3	3	2	1	1	1
	Finance	1	3	3	1	2	1	4	2
	HRM	1	3	2	2	1	1	5	1
Partners of Case 3: H3W/H3C <b>JV Company: JVH3</b>	Strategy	1	3	3	1	2	1	5	1
	Marketing	1	2	2	3	3	1	5	1
	Finance	1	3	3	3	2	1	4	1
	HRM	1	3	4	2	2	1	5	1
Partners of Case 4: H4W/H4C <b>JV Company: JVH4</b>	Strategy	1	2	3	3	3	1	5	1
	Marketing	2	3	1	2	1	1	1	1
	Finance	1	3	2	2	2	1	4	1
	HRM	1	3	3	4	2	1	5	1
Partners of Case 5: H5W/H5C <b>JV Company: JVH5</b>	Strategy	1	3	2	2	1	1	5	1
	Marketing	2	3	3	3	1	1	4	1
	Finance	1	3	3	3	1	1	1	1
	HRM	1	3	2	3	2	1	5	1
<b>Medium-and Low tech Industry</b>									
Partners of Case 6: LM1W/LM1C <b>JV Company: JVLM1</b>	Strategy	1	2	1	3	1	1	2	1
	Marketing	1	3	3	2	2	1	2	1
	Finance	1	5	2	1	2	1	5	1
	HRM	1	3	4	3	1	1	4	1
Partners of Case 7: LM2W/LM2C <b>JV Company: JVLM2</b>	Strategy	1	3	2	3	1	1	4	1
	Marketing	1	1	3	2	1	1	5	2
	Finance	1	3	2	3	1	1	5	1
	HRM	1	4	2	2	1	1	4	1
Partners of Case 8: LM3W/LM3C <b>JV Company: JVLM3</b>	Strategy	2	5	1	2	1	1	4	1
	Marketing	1	3	2	3	2	2	4	1
	Finance	1	3	3	2	1	1	5	1
	HRM	1	2	3	4	1	1	4	2
Partners of Case 9: LM4W/LM4C <b>JV Company: JVLM4</b>	Strategy	1	3	4	3	1	2	4	1
	Marketing	1	3	3	3	2	1	1	1
	Finance	1	1	4	2	1	1	4	1
	HRM	1	3	2	3	2	1	4	1
<b>Service Industry</b>									
Partners of Case 10: S1W/S1C <b>JV Company: JVS1</b>	Strategy	1	4	2	1	1	1	5	1
	Marketing	2	2	3	2	2	1	5	2
	Finance	1	3	3	2	2	1	4	1
	HRM	1	4	2	3	1	4	2	1
<b>Total Score</b>		<b>45</b>	<b>116</b>	<b>98</b>	<b>98</b>	<b>62</b>	<b>46</b>	<b>153</b>	<b>44</b>
<b>Average Score</b>		<b>1</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>1.5</b>	<b>1</b>	<b>4</b>	<b>1</b>

### **9.2.1. Individual propositions**

**Proposition 1: Becoming part of a wide innovative network in its industry helps to create innovative capabilities. (Powell and Grodal, 2005)**

The average score is 1. This result shows that the executives interviewed believe that a wide network is necessary for innovation. Interviewed executive managers agreed that the company needs to participate actively in the industry's innovative network, industry alliances, and industry associations. In their view, through the industry innovative network, the company can see itself clearly and see its strengths and weaknesses, and make judgements on the future. These JV firms have already been involved in many innovative cooperation programmes within their industries. They benefit from becoming part of a wide innovative network, which helps them to create new ideas, new operating concepts, new sales methods, new sale channels, and new products.

The other reason why most executive managers strongly agreed with proposition 1 is because they believe that one enterprise cannot do everything by itself because of their limited resources and capital. Secondly, managers need to judge market trends, and the company needs to know their competitors in the market. Through a wider network, the company can differentiate itself from other companies and know its strength in its industry according its own resources and capital.

Shared multi-party relationships provide the technical standards for high-tech Industries. Multi-party relationships connect technical professionals across organizations. R&D collaborations in high-tech industries generate attention that attracts other partners who collaborate in developing ideas. Network experience has a positive influence on patenting. The rate of increase diminishes with additional

experience. This is the “cycles of learning” process in which R&D collaborations generate attention that attracts other partners, who collaborate in developing ideas.

As recorded in Chapters 6-8, the interviewees emphasised that both formal ties and informal ties are vital to the process of innovation. Networks can provide different kinds of sources of information and capabilities than can be achieved by the firms without collaboration relationships. Both direct and indirect ties have positive influences on innovation. The informal ties within organizations have the potential to make an important contribution. In other words, keeping both strong relationships and weak relationships is vital to the process of innovation.

The interviewees describe four reasons to support the idea that becoming part of a wide innovative network in the industry helps to create innovation:

Firstly, it helps companies to create new ideas, new operating concepts, new sales methods and channels, and new products. Both formal ties and informal ties are important, the formal ties being strongly supported by informal connections.

Secondly, JV companies cannot achieve all their goals by themselves; the innovative networks in the industries help the division of innovative labour so that all the firms can accomplish their goals together. The innovative network pushes ahead the development of the whole industry.

Thirdly, a network can help JV companies to see where the industry is going. Firms can exchange information and learn from the networks how to do well and why they can do well. If JV companies want some special technology, they will need to join the association that provides them with the special technology.

Fourthly, it is very important to establish a united technology standard for a given high-tech industry through an industry-based innovative network. In particular the mobile phone industry is very big and standardized. The interviewees describe how the innovative network operates; the industry association is one type of innovative network. Many associations are related to technology. The associations bring in many members, operators, vendors and manufacturers. Some associations are global rather than just domestic.

**Proposition 2: Taking part in an open innovation system in its industry helps to build up innovative capabilities and create more innovation both for the firm and their industry. (Chesborough, 2004)**

The average score for this proposition is 3. This implies some substantial basis of disagreement for the proposition. The reason for this is probably an understandable split in the interviewees' minds. They recognise that open innovation certainly benefits China, but it does not necessarily benefit their own company if their competitors are able to take ideas generated by the interviewee's own company and develop these ideas faster and better than they can themselves. Open innovation is generally supported as an ideal; however, most firms confess that in reality competitors are reluctant to share secrets as these are often the source of their competitive advantage. The service case emphasised that its industry was a closed innovation system.

As shown in Chapters 6-8, the interviewees strongly agreed that taking part in an open innovation system in its industry helps to build up innovative capabilities and to create more innovation for both the firm and their industry. And they also suggest

that open standards means that the firm is doing R&D together with other firms; there will be many companies who are also involved in creating and developing the technology. But the firm can share the technology or products with other firms in the industry. No single company can do it by itself. All firms research together and share the outcome of innovation, which also creates many standards. The outcome is not held back or owned by any company; and any firms can use these standards at no cost. This is basically what the open innovation system means.

The interviewed managers from the communication industry identified some open innovation resources in their industry that they considered to be particularly good. An example is Bluetooth, which can be made open to any other companies in the industry. Another example is GSM and GPRS, a widely accepted technology in the telecommunication industry. It is jointly produced by several big firms as it is an open innovation technology. All companies in the telecommunication industry own it. The managers in this industry state that there are three reasons for this. Firstly, the firm cannot do everything by itself because of a limitation on capital and time for the venture. Cooperative R&D activities can solve this problem. The firms take part in an open innovation system to cooperate with other firms in the industry to develop a certain technology or product for all the firms or for their industry. This cooperative process can save the individual firm's time, resources and investment, and the outcome of innovation is owned by everyone.

Secondly, in most cases, JV companies undertake in-house innovation. Interviewees suggested that the JV companies must have their own particular "edge": something unique to the firm that makes it stand out and attracts customers. At the same time, the whole industry is a network, and it is crucial to join the open innovation system in

the industry. This is one of the ways that JV companies learn from each other, particularly from the leaders of industry, and acquire knowledge of advanced technology.

Thirdly, JV companies in the industry share the open innovation resources, which can help JV companies to satisfy different customers' requirements. Several interviewed managers agreed that open innovation involves the use of both inside and outside sources. Open innovation can bring valuable ideas to the company and these ideas can also reach the market from inside or outside the company. This expands the markets for the external use of innovation. The interviewed JV companies use both external ideas and internal ideas, and internal and external paths to market in order to advance their technology. For example, they use ideas from their suppliers. Through the open innovation system, JV companies can achieve their objectives more innovatively, more efficiently and with better resources and less time.

Most interviewed JV companies already takes part in an open innovation system to share new information and technology, and to learn what other companies are doing in the whole industry. Methods of sharing include conferences, meetings, and training, In conferences, JV companies share open innovation outcomes, for example, they give PowerPoint presentations about what they are doing and in what way they are doing it. Based on these open innovation systems, JV companies can improve their quality and their company's capabilities.

Interviewed JV companies also join industry societies or institutes. They contribute their own innovation to open innovation resources, and introduce their new innovative products to the industry. They also write papers and send them to the

industry society or institute. The society or institute publishes the paper, and other companies in the same industry and customers will know these JV companies' new products. Or the institute invites these JV companies to deliver a seminar. In the seminar, JV companies list the information on innovative products. This is how JV companies contribute to the open innovation system in their industry.

However, some managers disagreed with this proposition. Such managers pointed out the importance in principle of JV companies taking part in open innovation systems, as this helps all the firms and their industry to move forward. Such participation was, however, limited in practice because JV companies can only contribute to the open innovation system to some degree because of commercial secrets. They are unwilling to give too many details about their new technology, new products or new functions, because they have invested significant resources in inventing new products independently. Interviewees suggested that, in business, companies need to compete with other companies, and need to keep their key technology and core competence to themselves instead of sharing with other companies.

One executive manager went further, agreeing with the proposition in principle, but claiming that in practice open innovation did not happen. He stated that in the real world, even if JV companies share technology and information with other companies, they always impose terms and conditions on this. Other companies will be prepared to pay money to use an innovation developed by another company, because they save time and investment in R&D. Then these other companies can make new products by using the new technology and sell these new products. In the opinion of this manager, there is no absolutely open and free technology: everything is based

on commercial terms. If JV companies give their new technology to other companies free, then who will pay for the development of new technology or products?

The manager from the service industry disagreed with this proposition strongly, stating that his industry is a closed innovation system because of commercial secrets. No firm wants to share these with each other. And every firm wants to protect its intellectual property. Hence it may be not practical to be too open.

The open innovation system or open innovation standards are the opposite of patenting. Companies can join the open innovation system, and at the same time they still have the opportunity to register their intellectual property (IP).

**Proposition 3: Relating closely to universities, and particularly their research laboratories help to create more innovation. (Link and Siegel, 2007)**

The average score for this proposition is 2.5 which mean that there is only partial support for this proposition. The result shows that in general firms agree that collaboration with research universities is important. However such collaboration is regarded as limited, does not involve revealing commercial secrets and is mainly undertaken by large companies. Smaller companies tend to perceive fewer opportunities for collaboration with universities.

As shown in Chapters 6-8 the interviewed executive managers that supported this proposition explained why relating to universities helps to create more innovation. Three reasons were suggested; firstly, they strongly believe that employees have industry thinking, which is as they say “inside the box.” The university however is outside the industry. Researchers and scholars in universities are not constrained by



normal industry thinking, and therefore are more likely to be able to “think outside the box.” Researchers and scholars in universities are likely to be innovative, and have fresh ideas and very different approaches which are very valuable.

Secondly, in most cases JV companies choose universities for innovation partners because universities are specialized institutes for research. JV companies have the capital, advanced equipment and worldwide network; they want to expand external resources for innovation and try to obtain the talent in universities, and obtain the researchers’ local knowledge of the local market. In the meantime universities need the research funding; JV companies cooperate with universities, which lead to a win-win situation. Cooperation will not only benefit the company’s R&D but also the whole industry.

Thirdly, the laboratories in universities may have the most advanced facilities to do research and tests, and also have researchers who have the knowledge to do the tests. Outstanding scholars and researchers have the knowledge to invent new products. Universities are very important institutions for fostering talent and scientific research. JV companies can share expertise and laboratory facilities with the universities.

The interviewees state that JV companies already cooperate with many universities. They have agreements with universities that deal with cost, the research methods and tools, targets and results for every project. JV companies give targets to universities relating to specific projects and products. Universities also ask companies for research funding to develop new products and processes. There are postgraduates in the universities involved in the projects and who write their dissertations based on the outcome of the projects. JV companies then employ

these postgraduate after they graduate. After the cooperation project is complete, JV companies retain the results of the project, and carry out further research based on the project. Some JV companies have their research centres in universities or set up their R&D centre close to universities.

Two managers disagreed with this proposition. One manager believes that in most cases JV companies and universities do not carry out full-scale cooperation; only one or two products are involved in cooperation. The universities are not the companies' own research department, these managers state, and JV companies' R&D cannot depend on universities. Every year, the company usually selects one or two key products in which to cooperate with universities. The companies cannot do business by relying on universities. The companies share some of their technology with the universities, but never all of it.

The other dissenting manager points out that many large and well-established companies have extensive cooperation with universities, but new companies, which are still in the survival stage, cooperate much less with universities. But once these new firms mature, and have more products and resources, then, in his view, they will probably establish cooperation with universities.

**Proposition 4: Relating closely to Research Institutions helps to create more innovation.**

The average score is 2.5, which means the proposition is generally supported. The evidence suggests that interviewees believe companies should relate closely to

research institutions but currently only large firms do so, and their relationship is not very close. This is very similar to the situation in relation to Universities.

AS recorded in Chapters 6-8, JV companies actively engage in innovation through selective and deep research collaborations with world-leading research institutions. Interviewees suggest that, by sharing resources, leveraging ideas, and tapping each other's expertise they are able to create vibrant innovation ecosystems, multiply their efforts, enhance innovation speed and efficiency, and derive more value for their organizations and ultimately for their end-customers.

The evolution of the academia-market interface in the Chinese economy will impact the Chinese innovation system strongly, with 'academia' covering not just universities but also research institutions. Relationships are not just bipartite, involving JVs and research institutions: in addition, tripartite university-research institute-industry linkages can help Chinese firms to build up more innovative capabilities. The evolving institutional relationship between academia and industry is very important, such as the roles which Chinese research institutes have played in the growth of high-tech industries in China. But it is important to note that this applies currently mainly to the larger companies.

The interviewees point out the three reasons why cooperating with research institutions helps to create more innovations: Firstly, JV companies are actively engaged in innovation through selective and deep research collaborations with world-leading research institutions. By sharing resources, leveraging ideas, R&D results, research data and tapping each other's expertise, they can learn from other research institutions and are able to create vibrant innovation ecosystems, multiply their efforts, enhance innovation speed and efficiency, and derive more value for

their organizations and ultimately for end-customers. Collaborating with research institutions is expected to achieve product innovations, process innovation and methods innovation.

Secondly, the cooperation with research institutions is not just a matter of creating more advanced technology: it can provide a deeper experience of cooperation more generally for the firms. The research institutes usually organize the workshops to introduce the advanced innovation. JV firms can stimulate their innovative capabilities through the cooperation projects and workshop presentations.

Thirdly, the research institutions have the resources of intellectual property, the resources for research, new understanding of innovation. They can provide services for JV companies.

An interviewee who agreed in principle with the proposition but was less sure of its applicability in practice suggested that relating closely to research institutions is the ideal situation; he observed that in practice, some JV companies do not have close relationships with research institutions. China has an 'establishing innovative country' strategy, and emphasizes science and technology as the first productive force in national innovative capabilities. Since the late 1970s China has implemented an open door policy involving interaction between research institutes and companies. But the relationships between JV companies and research institutes still need to improve. The interviewee insisted that more research fruits need to turn into commercial use.

Another interviewee who disagreed with this proposition pointed out that not all companies relate closely to research institutions. Big companies have close connections with research institutes. But small companies seldom have such links.

The big companies have links with many research institutes and universities, and the Chinese government and education department will send researchers or graduates to these companies to do the research. Large companies recognise that it is an obligation and social responsibility to accept researchers or graduates from research institutes or universities. So there are many cooperative research projects between big companies and research institutes. They will never be short of a project. It only depends on how many projects they can arrange and manage. But the interview observed that this doesn't happen with newer smaller companies.

Another interviewee who disagreed with this proposition stated that in many cases whether or not a JV company cooperates with research institutes to improve its innovative capabilities or develop new products depends more on its executive managers than on the firm. If the manager of a JV Company has no interest or awareness to link with research institutes, there will be no cooperation. The manager can decide everything. It is interesting that this interviewee implied that it was up to JVs to take the initiative in cooperating with research institutes, while the previous interviewee saw initiating cooperation as more of a two-way process, at least for large companies.

**Proposition 5: Developing a social atmosphere that encourages innovation in a JV brings good results (Fragerberg et al, 2005)**

The average score for this proposition was 1.5 which means it is strongly supported by the majority of those interviewed. The figures show that everyone agrees that a social atmosphere encouraging innovation is a good thing and the interviewees claim such an atmosphere exists in their firm.

Most executive managers describe JV companies as trying to find out the cleverest methods, the most innovative atmosphere and the most efficient systems to create more innovations and solve any problems during R&D. As shown in Chapters 6-8, they always look for new methods in marketing, product promotion, cooperation with customers, and satisfying customers' requirements. Innovation is at the heart of high-tech industries. These JV companies have developed a social atmosphere, or a social system to encourage more innovation, in various ways:

Firstly, they establish a *free innovative environment*: most executive managers in high tech industries say that their employees have flexible hours, relaxed environments and individualized environments. JV companies, according to managers, do not believe in strict structures at all and do not create such structures, they create many different ways of operating or they may even have no structure at all. They try to create a free environment, and promote free and innovative thinking, team work, team spirit, improvement, responsibility and ethics. Managers talk of employees' having a cup of coffee or tea together to exchange their new ideas or new thinking, or chatting on the grass to communicate information on their new research, which, it is hoped, will bring more innovation outcomes for companies.

Secondly, they *create an awareness of innovation*: the JV companies emphasise the sense or ideas of innovation and change among their employees, middle level managers and senior managers. They create an awareness of innovation and expectation of innovation inside their companies. Innovation is presented as the source of competitive advantage, of how to compete and how to win against the competition.

Thirdly, *communications with partners or agents*: before marketing a new product, JV companies will have formal and informal meetings to communicate with agents about R&D, design, manufacture, management and market promotion relating to the new product. Companies are often able to improve new products through taking on board the suggestions of agents. In this way the companies integrate good experiences from their partners.

Fourthly, *learning and training*: JV companies usually have processes such as specific training courses, regular training, e-learning, comments, and feedback, in which the employees are involved and can express their opinions. Through such mechanisms, employees can also share their thinking with other employees. Employee learning is particularly related to the advanced technology and advanced products. These mechanisms also encourage employees to discuss innovative thinking, share and exchange information inside the firm, and develop an atmosphere for employees in which constructive criticism is encouraged.

Fifthly, establish *excellence awards systems*: JV companies often develop excellence awards systems, which also function as a means of information sharing about best practices. The companies look at reports submitted on a yearly basis and they have awards for their employees in different categories. JV companies also award recognition to outstanding employees who initiate good marketing methods, excellent marketing operation concepts and so forth. An interviewee went so far as to assert that it was obvious that a JV Company needs a working culture that encourages and rewards innovation. There is generally a system to reward people to find new ways to save money. If the employees save energy, and save costs, then

JV companies have a way to promote and reward them. Excellence awards are another way to develop a social atmosphere for innovation.

Sixthly, have a *scorecard*: this is a very common way of developing a social atmosphere to encourage innovation in low and medium technology industries. Each supervisor is asked for a performance goal scorecard, which includes a total of five tasks, one of which is to promote innovation. In this context, innovation means essentially a breakthrough in technology. It also includes how to serve customers and manage the supply chain. Every supervisor has to pay attention to this task in the score card.

**Proposition 6: Developing a strong strategic planning system with innovation as a focus encourages innovation (Taylor, 1984)**

The average score is 1. Most interviewed managers stated that many companies include innovation as one important component of their strategy plan. There are three reasons for this. Firstly, innovation is regarded as so important that companies would die if they cannot do well in innovation. The strategic plan and tactics which focus on innovation are amongst the key factors for success of the business. So the company has a very systematic and scientific way to develop innovation through a strategy plan. Managers claimed in their interviews that they develop innovative thinking in the early stage of formulating their strategy plan. These JV companies formulate the key strategic actions and set out the action plan and organisation structure. Especially in high tech industry, systematic innovation in strategic plan is not something new. According to one interviewee, it is the “lifeblood” of the industry.



Secondly, developing a strong strategic planning system with innovation as a focus can help the company to realize its operational objectives. To make sure it achieves these objectives, good processes and very clear performance goals in the firm's strategic plan need to be developed.

Thirdly, in addition to having an innovative culture and innovative atmosphere inside the firm, developing a strong strategic planning system with innovation as a focus can help the company develop sustainability. This brings two beneficial results: economic benefit, and benefit to society. Another interviewee defined innovation as the "life-force" for the company.

As shown in Chapters 6-8, the interviewed executive managers also pointed out that the Chinese government emphasises that Chinese firms need their own innovative capabilities. Most interviewed JV companies devote 10% of their sales revenues to R&D. Managers also emphasise that innovation is a big part of their strategy plan. Here, innovation refers not only to the technology, but applies to the whole business process, including the supply chain. Through their strategic plan companies use innovation and the best innovative methods in the finance department, the HRM department, the marketing department, and the sales and promotion department.

Only one manager disagreed with this proposition. He pointed out that the strategic plan may set out innovative targets. However what is actually achieved will inevitably be different. The one thing that is certain about a plan is that a different outcome is almost inevitable. Thus, although innovation may be given priority in a strategic plan, the actual innovatory outcomes are not by their very nature predictable.

**Proposition 7: Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)**

The average score is 4, which means that the interviewees tend to disagree with the proposition. In general the western partners are concerned with commercial success and making profits for shareholders. The Chinese partners are likely to be more concerned with innovations through technology transfer.

As recorded in Chapters 6-8, some interviewees agree with this proposition, commenting that both parties have to be actually innovative to be able to make this statement true. It probably allows them to invest a lot of money to create innovations if they are confident that they will be getting the benefit and earnings out of it for a while and recoup all the money in the end. They also point out that having innovation as one of primary objectives of both partners at the outset of the joint venture is very important, firstly, because it is common sense for both JV partners; with innovation, they can achieve a win-win strategy situation or multi-win strategy situation, while without innovation they cannot be a competitive force in the market. Secondly, both JV partners face strong demand for innovation from customers and markets, including product innovation and channel operation innovation: as an interviewee noted, innovation can exist anywhere. Innovation is the key factor to the successful firm. Success is seen as implying profit, product reputation and customer satisfaction.

However, most interviewees disagree with this proposition, pointing out innovation is in practice not a primary objective. The Western partner and the Chinese partner have some primary objectives in common but they also have different primary objectives. Common primary objectives include organizational survival, generation of

profit and creation of value. Innovation is seen as a tool to achieve profit, not an objective in its own right. Profit is given priority because it is necessary to generate the resources for investment by an establishing company. Some managers believe that only the government will invest for innovation and will care less about repayment, but in the long term there is still a need to repay. Government behaviour can help to encourage the innovative atmosphere in the whole society. Whereas for both JV partners, profit is very crucial, once having the money, they can think about other things, including creating innovation, high productivity, cost reduction, operation efficiency, team work, team spirit. JV partners do not create innovation just for the sake of innovation. They create innovation because they pursue profit maximization, efficiency maximization and asset utilization maximization.

The main primary objectives for the Western partner are to satisfy the requirements of the Chinese government and comply with the policy of the country, to gain access to the Chinese market, and reduce the risk of trading in China. However, the main objective for the Chinese partner is to absorb Western firms' advanced technology and experiences and to build up their own technology in the end. The best benefit for the Chinese firms from having Western JV partners is actually having a stronger competitive capacity and learning what to do. China in 21<sup>st</sup> century is very similar to Japan and Korea back in the 70s and 80s. In these countries, there are very successful and innovative companies, because they started by copying and then developed their own technology. Chinese firms have different characteristics and services and Chinese firms take and copy from Western partners. Chinese firms started with copying what western firms were doing, but actually Chinese firms have become much better and actually developed their own things and their own way of doing things. So they are learning because they are associating themselves with

Western partners. But they actually learned first by copying what Western firms were doing and then improved on it.

By the time the JV comes to an end (whether it breaks up prematurely or survives until the contractual termination date), the Western firm has already lost its advantage. An interviewee suggested that innovation coming from Western firms has already pretty much expired because all Chinese firms have acquired the available knowledge and technology. Chinese firms are going to outright copy the technology through international JVs. There are many copies of Western products in the Chinese market. Chinese firms are basically going to end up making what the Western firms made two years ago. And then, according to the manager, what Chinese firms need to be doing is to jump to the more advanced technology. The Chinese company now becomes the Western firm's competitor. They have learned from the Western Company how to do sales-marketing and how to design, and they actually become even better than Western firms in the end.

**Proposition 8: Focusing on developing IP (Intellectual property) leads to more innovation (Granstrand, 2005)**

The average score for this proposition is 1. Both western and Chinese firms in JVs are enthusiastic about getting IP patented. Interviewed executive managers agreed that firms' focusing on developing IP leads to more innovation. There are three main reasons. Firstly, they believe that intellectual property can stimulate innovation and lead the industry to good development. Secondly, IP can bring profit to the JV companies. Thirdly, the interviewed executive managers also believe that innovation has risk and IP can protect innovation. Most companies are applying for IP rights to

protect their innovations, which include key breakthroughs. This gives a company a sense of security because every company which tries to invent new technology or new products must spend money on assets, resources, time, and their employees need to receive training. A patent can protect the innovation created by firms. Then the firms can go on to get more innovations. Fourthly, innovation can help the firm to keep its core competitive advantage. Intellectual property can also help a nation to develop sustainability.

All the JV companies have their own R&D department or R&D centres. Some of them have their own research institute and have many researchers. All the JV companies have a set of integrity processes and systems to develop intellectual property and have a set of integrated systemic organizational procedures to operate intellectual property rights (IPR), and they own hundreds of IPR and some of the top secrets.

As emphasised in Chapters 6-8, it has to be recognized of course that the movement towards the development of IP and that towards Open Innovation push in different directions. A company therefore has to be very clear when it will take part in open innovation and when it will focus on IP development. Applying for the IP (Intellectual Property) protection helps to create innovation. But it does not mean that a company does not share its innovation with other companies in the industry. Other companies can pay the innovator of the technology through the royalty system.

### **9.2.2. Summary**

The content analysis table shows that the average scores of Proposition 1 “*Becoming part of a wide innovative network in its industry helps to create innovative capabilities* (Powell and Grodal, 2005)” and Proposition 8 “*Focusing on developing*

*IP (Intellectual property) leads to more innovation (Granstrand, 2005)*” are 1, which means they are strongly supported by all 40 interviewees. The average score of Proposition 6 *“Developing a strong strategic planning system with innovation as a focus encourages innovation (Taylor, 1984)”* is also 1.

The table also shows that Proposition 5 *“Developing a social atmosphere that encourages innovation in a JV brings good results (Fragerberg et al, 2005)”* is also strongly supported; its average score is 1.5, which means that there is also very strong support for the proposition. The average score of Proposition 3 *“Relating closely to universities, and particularly their research laboratories helps to create more innovation (Link and Siegel, 2007)”* is 2.5. And that of Proposition 4 *“Relating closely to Research Institutions helps to create more innovation (Link and Siegel, 2007)”* is also 2.5. This implies that they are generally supported but with reservations as to their actual implementation and importance currently.

The average score of Proposition 2 *“Taking part in an open innovation system in its industry helps to build up innovative capabilities and create more innovation both for the firm and their industry (Chesborough, 2004)”* is 3. This suggests that interviewees support the idea in principle, but are sometimes reluctant to share their secrets with their competitors in practice.

The average score of Proposition 7 *“Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)”* is 4, which is not generally supported. This is presumably because of the different motivations of the partners. Generally the Chinese partner is motivated towards innovation development, but the Western partner is more profit orientated and is motivated primarily by the low labour cost in China and the large market size.

### **9.3. Comparison of High-tech and Low/Medium-Tech Companies**

The content analysis table shows the assessment of the responses of the 40 managers who were interviewed in the 10 joint ventures. In order to investigate whether the responses are affected by industry, the mean responses of the 20 managers of high-tech industries were compared with the mean responses of the 16 managers of manufacturing industries (because there were only four managers from service industries, their responses were omitted from the analysis as the sample was too small to use as a basis of meaningful results). The t-test for comparing two sample means was used.

We have a sample of 20 managers in high-tech industries and a sample of 16 managers in manufacturing industries. We want to investigate the opinions of the population of managers of high-tech industries and the opinions of the population of managers of manufacturing industries.

The key question for each proposition is this: do the managers of high-tech industries have a different opinion from the managers of manufacturing industries?

If we have a relatively low value for the t-statistic (if the probability is greater than 0.05), we cannot reject the hypothesis that the opinions of the population of managers of high-tech industries are the same as the opinions of the population of managers of manufacturing industries.

The only proposition where we can reject this hypothesis, and hence conclude that the opinions of the population of managers of high-tech industries are different from the opinions of the population of managers of manufacturing industries, is proposition 5. Managers of high-tech industries appear to be less supportive of

proposition 5 than managers of manufacturing industries. It should be noted that none of the managers in either sample went so far as to disagree with proposition 5, although two of the high-tech managers expressed slight reservations about the impact of atmosphere in practice.

## **9.4. Conclusion**

Managers generally supported the value of innovation networks (and also the importance of reflecting innovation in the strategic plan they also considered that a focus on developing and protecting intellectual property would encourage innovation. Collaboration with both universities and research institutions was considered to be valuable in principle (and some managers described particular collaborations that had been very successful in practice), but there was some doubt as to whether collaboration was working as effectively in China as it did in western countries.

Although managers could see benefits to open innovation, they were in practice reluctant to engage in this approach, as they feared that sharing commercial secrets would lead to a loss of competitive advantage. There was agreement over the role of a supportive social atmosphere for encouraging innovation and managers tended to endorse this in principle.

The main area of disagreement was with the proposition that having innovation as a primary objective of both JV partners at the outset was likely to lead to more innovation. Here, managers simply questioned whether innovation was even an objective, for Western partners seeing the generation of profit as a common objective of both partners. Western partners were regarded as seeking access to the Chinese market, while Chinese partners were seen as searching for access to



new technologies and processes. Innovation itself was regarded by some managers as a means towards achieving the organisation's objectives rather than as an objective in its own right.

In this chapter, the responses of the managers have been coded using a numerical scale, and have been analysed in both a "qualitative" and a more "quantitative" manner, including an examination of whether there are systematic differences between the responses of managers in high-tech JVs as compared with managers in low and medium-tech JVs.

In the next chapter, the findings of the current research with the existing literature have been compared. Some interesting issues raised by interviewees have been identified, although these have been left for future research.

# Chapter 10: Discussion

## 10.1. Introduction

The previous chapters discussed the findings based on single case analyses and content analysis. The aim of this chapter is to compare the findings of the current research with the existing literature. Also, findings beyond the scope of the research model that emerged in the study are presented and discussed. At the end of the chapter, there is a summary table of findings, the empirical results for each proposition of the research are summarised.

## 10.2. Comparison between findings and existing literature

In general the interviews provided support for the propositions. However, some reservations were expressed. Executives were reluctant to engage in open (collaborative) innovation, preferring to seek patents for developed intellectual property. They also perceived the main objective of the Western partners to be commercial success rather than innovation, although the Chinese partners were very much innovation-orientated. Respondents remarked that most of the propositions would apply also to self-standing companies in China, and suggested that joint ventures could stimulate innovation in indigenous Chinese companies. This provides an opportunity for further research.

**Proposition 1: Becoming part of a wide innovative network in its industry helps to create innovative capabilities**

As discussed in Chapter 3, Powell and Grodal (2005) suggest that wider networks help create innovative capabilities because they can collect new ideas, new operating concepts and new technologies, access resources and enhance knowledge transfer. All firms in an industry can cooperate to achieve their goals rather than working by themselves. Collaboration also helps the division of innovative labour and mutual learning. Powell and Grodal (2005) go a stage further to argue that wider networks create more innovation. The relationship between wider networks and innovation is considered to be a positive cycle. Shan, Walker and Koput (1994) had already expressed a similar view to this in relation to the biotechnology industry.

Powell et al (1999) state that the attention generated by R&D collaborations attracts other partners. Powell et al. (1996) also point out that firms can develop their technology quickly through wider networks. The firms with more experience of collaborations will become leading firms in their industry. More collaboration and partners help firms to acquire a leadership position (Powell and Grodal, .2005). Eisenhardt and Schoonhoven (1996) describe how firms can obtain finance and resources to develop innovation through different types of networks and alliances, a view supported by Chesbrough and Teece (1996) and by Upton and McAfee (1996). This cycle of learning has a positive effect on financial performance (Powell et al.1999). Powell and Grodal (2005) state that firms within networks gain more sources of information, technology and capabilities than firms lacking collaboration. Rosenkopf and Tushman (1998) point out a similar view. Sarkar, Echambadi and

Harrison (2001) also suggest that when the environment is uncertain, the managers are more likely to build alliances.

Proposition 1 is strongly supported by all of the 40 interviewees. All interviewed JV companies have been involved in their industry innovative network and benefit from it. Interviewees believe that companies can learn new ideas, new methods and new products, find out their strengths and weaknesses through the industry network, and further develop their own research.

More particularly, the managers strongly support the claims and findings of the existing literature. For example, they endorse the views of Powell and Grodal (2005) and Shan, Walker and Koput (2004), that an innovative network helps to create more innovation. The managers said that an innovation network helps companies to create new ideas, new operating concepts, new sales methods and channels, and new products. Secondly, the managers note that a company cannot do everything by itself as it has limited resources and capital (endorsing the views of Rosenkopf and Tushman,1998; Powell and Grodal, 2005; Eisenhardt and Schoonhoven,1996, Chesbrough and Teece, 1996, Upton and McAfee,1996). Thirdly, a company can enhance its knowledge of where the industry is going, learn more from its competitors and know its own strength and weaknesses when it is part of a network (compare Powell et al., 1999, Powell et al., 2005, Sarkar, Echambadi and Harrison, 2001). Going beyond the main existing literature, managers also note that, an innovative network can help to establish industry standards.

Above all, the claims and findings of the existing literature on the role of a wide innovative network in creating innovative capabilities are strongly supported by interviewed IJV managers in China.

**Proposition 2: Taking part in an open innovation system in its industry helps to build up innovative capabilities and create more innovation both for the firm and their industry**

This proposition is supported in principle, but it is rarely carried out in practice by the Chinese. Most interviewees support this proposition as a statement or an ideal, they recognise open innovation can benefit China. The interviewees strongly agreed that taking part in an open innovation system in its industry helps to build up innovative capabilities and to create more innovation for both the firm and their industry.

As discussed in Chapter 3, Pryor (2007) suggests five benefits of open innovation: (1) leveraging the R&D budget; (2) extending the reach and capability of new ideas and technologies; (3) refocusing internal resources to develop new products, technologies and services; (4) reducing risk and resources needed for R&D; and (5) creating an innovative atmosphere in the industry and an innovative culture in the company.

The managers largely endorse these potential benefits in principle. They note that cooperative R&D activities can overcome the problem of limited capital and investment for the venture (Pryor's first and fourth benefits); that companies can learn from each other, the leaders of industry, and acquire knowledge of advanced technology (Pryor's second benefit); and that, because JV companies in the industry can share the open innovation resources free, through the open innovation system, JV companies can achieve their objectives more innovatively, more efficiently and with better resources and less time (Pryor's third and fourth benefits). The creation of an innovative culture is the subject matter of Proposition 5.

Most High-tech industry companies and some manufacturing industry companies already take part in an open innovation system to share new information and technology. Methods of sharing include conferences, meetings, and training, JV companies share open innovation outcomes. Interviewed JV companies also join industry societies or institutes. They contribute their own innovation to open innovation resources, and introduce their new innovative products to the industry.

However, in China it is more common for manufacturing companies and service companies to have a closed innovation system. Interviewees pointed out the importance in principle of JV companies taking part in open innovation systems, as this helps all the firms and their industry to move forward. However such participation was limited in practice because JV companies can only contribute to the open innovation system to some degree because of commercial secrets. They are unwilling to give too many details about their new technology, new products or new functions, because they have invested significant resources in inventing new products independently.

In discussion, many interviewees expressed the views that Chesbrough (2003) has identified as common in closed innovation systems, for example that it is necessary to control IP so that competitors do not profit from ideas developed by the business. Overall, despite the examples given in the existing literature of the beneficial use of open innovation systems in countries such as the USA, the empirical findings of this research demonstrate that Chinese JV managers are still unconvinced that open innovation is workable in practice.

### **Proposition 3: Relating closely to universities, and particularly their research laboratories help to create more innovation**

As discussed in chapter 3, various institutions and agents are involved in the process of innovation and entrepreneurship. At the regional level, universities are engines of regional economic growth, because they can commercialize their intellectual property through technology transfer (Link and Siegel, 2007). Pavitt (2005) describes four benefits of cooperating with the universities. (1) Business firms provide professionalized innovative activities, and the university provides specialized researchers. (2) Firms benefit from long-term research programmes in universities. Researchers make discoveries and business companies turn the discovery into a product or service to generate profits. (3) The researchers are familiar with the latest research techniques and part of worldwide research networks. The graduates bring their new theoretical thinking and skills to the firms, and these skills cannot be obtained from industrial firms alone. (4) The collaboration process links the university research with industrial innovation. Firms provide industrial funding and university-based consultants for university research. The exchange of researchers between industry and academia are very useful for the company. Martin and Salter (1996) agree with the greatest benefits provided by the universities.

The managers largely endorse these potential benefits in principle. They believe both internal and external factors have led many firms to set up stronger linkages with universities; these linkages promote and strengthen the firms' innovative capabilities and their contributions to innovation and economic growth (compare Link and Siegel, 2007). These long term cooperative relationships also show new

structural features of the national universities systems and their industrial environments.

Interviewees believe relating closely to universities helps to create more innovation. Firstly, employees have industry thinking, which is as they say “inside the box.” Researchers and scholars in universities are able to “think outside the box”, and are more likely to be innovative, and have fresh ideas and very different approaches (the third benefit suggested by Pavitt, 2005). Secondly, universities are specialized institutes for research. JV companies have the capital, advanced equipment and worldwide network, while universities have the talent and researchers’ knowledge of the local market, but need research funding. JV companies cooperating with universities can lead to a win-win situation (compare Pavitt’s first, third and fourth benefits). Thirdly, the laboratories in universities may have the most advanced facilities to do research and tests (compare Pavitt’s first benefit).

However, interviewed managers supported the concept of cooperation between company and university only with some reservations as to its practicality. Firstly, many large and well-established companies have extensive cooperation with universities, but smaller companies tend to perceive fewer opportunities for collaboration with universities. New companies, which are still in the survival stage, cooperate much less with universities. But once these new firms mature, they will probably establish cooperation with universities. This is consistent with the findings of Link and Siegel (2007), who describe how the informational and cultural barriers between universities and firms are especially significant for small firms.

The interviewed managers note that cooperation does not involve revealing commercial secrets, because their firms’ commercial interests stop information



sharing among scientists. They believe that the desire of universities to commercialize research findings inhibits the innovative benefits of scientific communities. This is again consistent with the existing literature, where researchers have observed that firms' commercial interests sometimes limit information sharing with university scientists (Powell and Owen-Smith 1998 and Owen-Smith 2003).

Interviewees also believe that in most cases JV companies and universities do not carry out full-scale cooperation; only one or two products are involved in cooperation. Interviewees mention that the universities are not the companies' own research department. Managers emphasise that older universities with a long history find it easier to accept the notion of cooperation with companies in an entrepreneurial way than newly founded universities, because of their strong research capabilities and academic reputation. These views are consistent with the findings of Franklin, Wright, and Lockett (2001), who observed that old universities accept entrepreneurial ideas easier than new universities because they have excellent and established research reputations and world-class professors.

The empirical findings of this research demonstrate that Chinese JV managers consider university-industry relationships to be vitally important in principle; however the relationships need to be improved in reality.

**Proposition 4: Relating closely to Research Institutions helps to create more innovation.**

This proposition is supported by interviewees in principle, but in practice such close relations did not happen very much. Interviewees believe companies should relate

closely to research institutions but currently only large firms do so, and their relationship is not very close. This is similar to the situation in relation to universities.

As discussed in Chapter 3, Link and Siegel (2007) state that research partnerships involve firms, nonprofit organizations, and government agencies. Licensing and sponsored research agreements involve research institutes, universities, government laboratories, and firms, and university-based start-ups.

Interviewees did not give consistent responses to the issue of whether JV companies in China were active collaborators with research institutions. Some interviewees believe that a number of other JV companies are actively engaged in innovation through selective and deep research collaborations with world-leading research institutions, even though their own company is not so actively engaged. (Compare Link and Siegel, 2007) Managers tended to recognise that, by sharing resources, leveraging ideas, R&D results, and research data and tapping each other's expertise, they can learn from research institutions and multiply their efforts, enhance innovation speed and efficiency. Managers also believe that the research institutions can provide additional services for JV companies because they have the resources of intellectual property, the resources for research.

However, some interviewees who agreed in principle with the proposition suggested that, in practice, most JV companies do not have close relationships with research institutions. Other interviewees commented that it is mostly big companies that have close connections with research institutes. Large companies recognise that it is an obligation and social responsibility to accept researchers or graduates from research institutes or universities. But small companies seldom have such links.

Some interviewees observed that the manager of a JV company has power to decide whether or not to set up cooperation with a research institution. If the manager has no interest or awareness of the possibilities of linking with research institutes, there will be no cooperation.

The finding that large companies are more likely to be involved with research institutes is consistent with the suggestion made by Pavitt (2005) that there are more resources involved in innovation in large firms than in small firms. In large firms, innovation involves a lot of employees in specialized functions. Mostly big companies have close connections with research institutes. Pavitt (2005) points out the recognition of chance, resources allocation, and functional activities are decided by executive managers.

Overall, despite the benefits of cooperation between firms and research institutes given in the existing literature, the empirical findings of this research demonstrate that Chinese managers believe the linkage with research institutes need to be improved in China.

**Proposition 5: Developing a social atmosphere that encourages innovation in a JV brings good results**

This proposition is strongly supported by the majority of those interviewed. Everyone agrees that a social atmosphere encouraging innovation is important and most interviewees claim such an atmosphere exists in their firm. This is consistent with the findings of Fragerberg et al (2005). However, some managers in high-tech industries thought that developing a social atmosphere was a positive factor in principle, but

were less sure that it worked in practice. This reservation was not shared by managers in manufacturing industries.

The interviewees describe JV companies as having developed many ways to encourage an innovative atmosphere: firstly, setting up a *free innovative environment*, employees have flexible hours, relaxed environments and individualized environments; secondly, *creating an awareness of innovation*, JV company cultivate an awareness of innovation and expectation of innovation inside their companies; thirdly, *communicating with partners or agents*, they can improve new products by adopting the suggestions of agents and good experiences from their partners; Fourthly, through *learning and training*, employees can share their thinking with other employees. And learning is particularly related to the advanced technology and advanced products; *sixthly, developing excellence awards systems*, JV Company needs a working culture that encourages and rewards innovation; *seventhly, having a scorecard*, each supervisor is asked for a performance goal scorecard, one of which is to promote innovation.

**Proposition 6: Developing a strong strategic planning system with innovation as a focus encourages innovation**

This proposition is strongly supported; most interviewed managers stated that many JV companies include innovation as one important component of their strategy plan.

As seen in the existing literature discussed in Chapter 3, Taylor (1984) describes innovative strategic planning as providing a framework for the generation of new products and processes and new entry to markets. He states that innovative

strategic planning encourages creativity and innovation, which is needed by growth businesses.

Interviewees put forward various reasons for supporting this proposition. They noted that companies will not survive if they cannot do well in innovation, so a strategic plan focusing on innovation is amongst the key factors for success of the business (compare Taylor, 1984). They also believed that an innovative strategic planning system can help a JV company to realize its operational objectives efficiently. Moreover, an innovative strategic planning system can help the company develop sustainability and retain its “life-force”.

The strategic plan may set out innovative targets; however, an interviewee pointed out that, even though the strategic plan may focus on innovation, a JV Company cannot predict the actual innovatory outcomes. A different outcome from what was expected in the planning process is almost inevitable.

**Proposition 7: Having innovation as one of the primary objectives of both partners at the outset of the joint venture leads to more innovation**

This proposition is disagreed with by most interviewees. The primary objectives for western partners are commercial success and making profits for shareholders it is contended. The Chinese partners are likely to be more concerned with innovations through technology transfer.

Some interviewees agree with this proposition. They believe that having innovation as one of primary objectives of both partners at the outset of the joint venture is very important, firstly, because with innovation, they can achieve a win-win strategy

situation while without innovation they cannot be a competitive force in the market. Secondly, both JV partners face strong demand for innovation from customers and markets, innovation is the key factor to the successful firm. This is consistent with the findings of Powell (1996).

Many interviewees pointed out that the western partner and the Chinese partner have some common primary objectives, for example, organizational survival, generation of profit and creation of value. Innovation is a very important tool to achieve these objectives.

The main primary objectives for the Western partner, however, are to satisfy the requirements of the Chinese government and comply with the policy of the country, to gain access to the Chinese market, and reduce the risk of trading in China and to make profit for its shareholders. The main objective for the Chinese partner is to absorb Western firms' advanced technology and experiences and to build up their own technology in the end. They actually learn first by copying what Western firms are doing and then improve on it. The interviewees believe what Chinese firms need to be doing is to jump to the more advanced technology. The Chinese company now becomes the Western firm's competitor, and can be better than Western firms in the end.

**Proposition 8: Focusing on developing Intellectual property (IP) leads to more innovation**

This proposition is strongly supported by most interviewees. As seen in the existing literature discussed in Chapter3, Arrow (1962) suggests that a patent can protect

innovation through controlling imitation. Granstrand (2003), Nordhaus(1969), Fisher (2001) and Helpman (1992) express a similar view. Chen and Puttitanum (2002) state that strong intellectual property rights encourage more innovation in developing countries.

Interviewees believe that intellectual property can stimulate innovation and lead the industry to good development; innovation has risks attached and IP can protect innovation, and IP can keep company's core competitive advantage and bring profit to the JV companies. Hence, interviewees endorse the general view of the literature that IP, both in itself and as defended by strong legal rights, is likely to lead to more innovation. Interviewees confirmed that all the JV companies have processes and systems to develop intellectual property.

Developing IP and participating in open innovation drive in two different directions to a degree. However, as managers observed, a JV Company will know when take part in open innovation and when it will focus on IP development.

### **10.3. Other issues raised by interviewees**

During the course of the interviews, managers often raised other issues relating to innovation. Among these issues were the following:

#### **(1) JV companies need people who are self-motivated, creative and open-minded.**

One strategy manager commented on the desirability of employing people with particular personal characteristics that would be more likely to lead to innovative thinking and practices. Interestingly, this manager pointed to a leading US company well-known for its innovation over several decades as an exemplar of good practice.

*“We need to employ self-motivated people, the creative and open-minded, who can influence their colleagues and help our company to create more innovation. For example, there are many creative inventors in IBM, and this is why IBM is very innovative.”* (Strategy manager of JVH3)

**(2) Leaders play a crucial role in encouraging and supporting innovation.**

In many cases, whether or not a firm cooperates with research institutes to improve its innovative capabilities or products depends more on its managers rather than the firm. In LM1W/LM1C case, the strategy manager of the JVLM1 points out:

*For our company, a joint venture company, it will be decided by me (a deputy general manager) to work with research institutes to test our material and develop the new products etc. I decide to cooperate with research institutes. If the manager in another company has no interest or awareness in linking with research institutes, there will be no cooperation between that company and research institutes. Everything is decided by the managers.*

In LM3W/LM3C case, the marketing manager of JVLM3 points out:

*Managers need to encourage innovation within the company, as innovation may succeed or may be a mistake, and it is difficult to reduce the mistake. But even when innovation is not immediately successful, managers should still support the innovation, and so the employees still can carry on innovation rather than be fired, which is very important.*

**(3) Innovation in a JV company is stronger when both parent firms are committed to innovation. Some innovation in the JV Company will follow from innovation in the parent companies.**

Both parties of JV have to be actually innovative to be able to lead to more innovation. In H5W/H5C case, the finance manager of JVH5 expresses his view:



*“Both parties have to be actually innovative to be able to make this statement true. It probably allows both partners to invest a lot of money to create innovations and they know that they will be getting the benefit out of it and getting earnings for a while, so they can recoup all the money in the end and share the innovation with their Child JV company.”*

**(4) An innovative JV Company needs to regard innovation as part of its ‘DNA’.**

The strategy manager of JVH4 expressed his opinion:

*Our employees have their own characteristic; H4W-DNA is our company’s gene. It decides our future and cultivates corporate culture and people. H4W-DNA means ‘challenge’, ‘creativity’ and ‘teamwork’. We develop it to achieve our aims and objectives. ‘Challenge’ is the DNA for ‘drive’. It pushes employees to achieve higher goals and stimulates aspiration, determination, and joy in excellence.*

**(5) Innovation is stimulated by “innovative demanding” for the JV company’s products or services from creative customers. And innovation needs to add value for the customer.**

The marketing manager in the service industry JV included in the sample of cases commented on the various “triggers” for innovation. Interestingly, this manager noted the important role played by customers, talking about the idea of “innovative demanding”. Possibly because this JV is a service firm rather than a manufacturer, there is less natural opportunity to innovate in the sense of developing new or improved products, but this JV was conscious about the importance of innovation because it operated what it called a “Process Innovation Initiative” (PII).

*“Demanding customers who require higher standards of product are the drivers of innovation for companies, because bringing maximum satisfaction and meeting the customer’s requirements is our goal. On the other hand, innovation must bring*

*better products or better services to our customer.”* (The marketing manager of JVS1)

## **10.4. Summary of findings**

**Table 10.1** below provides a summary of the findings from the research. For each proposition, the main topic of the proposition is set out, together with the most important source for the proposition in the existing literature. Then, for each proposition, the empirical results of the research are summarised. Overall, all propositions except for Proposition 7 were supported at least in principle, although interviewees commented on practical limitations in respect of four of the propositions.

**Table10.1: The contributions of 8 propositions**

<b>Proposition</b>	<b>Topic</b>	<b>Conclusion</b>
1	Becoming part of a wide innovative network in its industry helps to create innovative capabilities. (Powell and Grodal, 2005)	Strongly supported
2	Taking part in an open innovation system in an industry helps to build up innovative capabilities and create more innovation both for the firm and their industry. (Chesborough, 2004)	Supported in principle but rejected in practice
3	Relating closely to universities, and particularly their research laboratories helps to create more innovation (Link and Siegel, 2007)	Supported in principle but not well developed in practice
4	Relating closely to Research Institutions helps to create more innovation (Link and Siegel, 2007)	Supported in principle but not well developed in practice
5	Developing a social atmosphere that encourages innovation in a JV brings good results (Fragerberg et al, 2005)	Generally supported, but with reservations in high-tech industries
6	Developing a strong strategic planning system with innovation as a focus encourages innovation (Taylor, 1984)	Strongly supported
7	Having innovation as one of primary objectives of both partners at the outset of the joint venture leads to more innovation (Powell, 1996)	Rejected
8	Focusing on developing Intellectual property (IP) leads to more innovation (Granstrand, 2005)	Strongly supported

In summary, this chapter discusses the empirical findings of the research against existing literature, and presents other issues emerging during interviews. The final chapter of the thesis provides overall conclusions, identifying the main contributions of the research, discusses limitations to the research, and sets out some suggestions for further research stimulated by the interviews with JV managers. Some policy implications are also set out at the end of the final chapter.

# Chapter 11: Conclusions

## 11.1. Aims of this thesis

The main aim of the research was to investigate the contribution of Sino-Western joint ventures to innovation in China. Innovation is a means of achieving competitive advantage for a firm, and a joint venture is often an effective vehicle for its development. Although JVs and other business alliances have been studied in other contexts, the pioneering aspect of the thesis is to explore how JVs between Chinese and Western companies can create innovation. The existing literature has given relatively little attention to the innovation aspect of international JVs operating in China.

In order to examine the research question “What is the contribution of Sino-Western JVs to the development of China’s innovative capabilities?” two sub-questions were identified:

- What particular qualities should these JVs possess to achieve good innovation?
- What are the key factors for success in a JV that will lead to a good innovation record?

This chapter summarizes several important contributions of this study to the existing literature on Sino-Western joint ventures and innovation management. It is organized into four main sections. Section 11.2 reviews the methods and data of this study; Section 11.3 describes the original contributions to knowledge and the content analysis. Section 11.4 investigates the limitations of the research and Section 11.5

suggests directions for future research. Section 11.6 describes policy and managerial implications.

## **11.2. Methods and data**

The thesis has both theoretical and empirical parts. The theoretical part of the thesis involves the development of an overall model of innovation appropriate for international JVs. This is based in part on models of innovation reflected in the literature. From the review of existing literature, and the formulation of the model proposed in this thesis, eight propositions about innovation in international JVs were developed, and these were investigated in the empirical research. The research followed a multiple case-study design, and the thesis is based on both primary and secondary data.

The primary research took the form of 40 semi-structured interviews carried out in ten major Sino-western JVs with senior executives of the JVs. The interviews were tape recorded. In addition to the interviews, material was collected about the JVs and the partner companies from public sources and was also provided by some interviewees. The secondary data took the form of publicly available material and was largely obtained from the China National Statistics Bureau. The Bureau provided data on the current and recent past performance of the Chinese economy and its constituent parts with regard to innovation, patent applications and R&D investment. Sources of international statistical data include the World Intellectual Property Organization (WIPO) and the Organisation for Economic Co-operation and Development (OECD), and other secondary data relate to publicly available material (in both printed and electronic form) about the joint venture companies themselves.

In the thesis, the statistics obtained from public sources were critically analysed and the role of JVs was specifically highlighted. The interviews, which were mainly conducted in Mandarin, were transcribed, partially translated into English, and subjected to qualitative content analysis.

### **11.3. Contributions of the research**

The research largely justified the theoretical model or framework, although wider grounded research would probably have enabled a researcher to identify further key factors for the development of innovative capabilities.

The research made a number of important contributions to an understanding of the role of Sino-western JVs in China, especially:

#### **(1) Development of generic innovation process model**

The thesis develops a generic innovation process model that as such can be considered a contribution to literature on innovation management. The model of innovation does various things that previous models omit. The researcher's own model involves a number of factors

- It incorporates the international dimension in the framework, something that other innovation frameworks in the literature tend to ignore
- it deals with different levels: national innovation system level; policy, society level; knowledge base level; industry level and company level;
- The key innovation factors (represented by the eight propositions underlying the research) are split between industry and company level.

There is no need to change the model in the light of pilot or further research findings, because most of the propositions were supported in principle, even though not totally so in practice. As the model is normative (tells what should be done) rather than empirical (describes what actually happens), the fact that some propositions were not empirically supported does not reduce the usefulness of the model as a way of conceptualising innovation in an international context.

## **(2) Use multiple case study method to study innovation in the Chinese context**

The research has developed research methods in the field of innovation studies in a number of ways:

- By gaining access to a number of major Western companies and their JVs in China, and analyzing responses, thereby increasing our understanding of their activities.
- By using a qualitative multiple case study approach rather than a quantitative survey method, it was possible to gain more detailed and nuanced data from respondents, allowing for deeper understanding of the phenomena being researched.

## **(3) Test the innovation process model in the Chinese context**

The propositions were largely supported subject to a small number of reservations. Some reservations were expressed. Executives were reluctant to engage in open (collaborative) innovation, preferring to seek patents for developed intellectual property. They also perceived the main objective of the Western partners to be commercial success rather than innovation, although the Chinese partners were very much innovation and technology orientated. Respondents remarked that most of the propositions would apply also to self-standing companies in China, and suggested

that joint ventures could stimulate innovation in indigenous Chinese companies. This provides an opportunity for further research.

Generally there is no difference between high-tech and low/medium-tech sectors, except for the proposition on social atmosphere (Proposition 5). This finding is interesting and at first sight paradoxical – one would expect high-tech managers to be strongly supportive of the need for an innovative atmosphere/culture. But a possible explanation for the findings may be that high-tech companies regard innovation as their “lifeblood”, their “DNA” (to quote some interviewees), and hence do not consider it necessary to make special efforts to create a culture of innovation. On the other hand, managers in low and medium tech companies consider that their organisations are less likely to have a culture of innovation unless they make a conscious effort to encourage such a culture through an innovative social atmosphere.

#### **(4) Identify cultural characteristics of innovation management in China**

This increases knowledge of the Western/Chinese industrial interface, and particularly its cultural dimensions. For example the research shows that Chinese managers are suspicious about the practical value of open innovation systems.

The literature on innovation is largely based on Western economies, particularly the USA. This study has investigated the extent to which this literature extends to China; currently the world’s largest emerging economy. Overall, the literature is largely robust, but some of the responses reflect the current stage of development of the Chinese economy. In particular, managers are suspicious of open innovation networks, seeing these as potential threats to their ability to exploit firm-specific intellectual property. Managers also see JVs mainly as a means by which the



Chinese partner acquires knowledge from the Western partner, and are sceptical about whether including innovation among the partners' own aims will actually be associated with more innovation in practice. It would be interesting to investigate whether these attitudes simply reflect the stage of development of the Chinese economy when the research took place, or are a more fundamental reflection of Chinese culture.

#### **(5) Historical overview of the development of the Chinese innovation system**

The thesis has provided an up to date analysis of development of innovation in China.

### **11.4. Limitations of the Research**

The contribution to the research is almost exclusively built on forty interviews with executives of Sino-Western JVs. The research was not designed to provide conclusions that could be generalised to all business alliances, or even to all Sino-Western JVs. However, given the strong support for most of the propositions it is probable that these propositions do provide conditions most likely to lead to innovation in JVs in China. A statistically based survey document addressed to a much wider population would be needed to provide conclusions on which a greater degree of generalisability might be grounded.

Furthermore, Chinese traditional discretion is likely to have inhibited interviewees from expressing criticism of their organisations or from describing problems that could emerge in any JV. There is also a tendency culturally to tell the interviewer what the interviewee believes the interviewer wants to hear. This militates against

major interview discoveries. Hence, the fact that the interviews have revealed some interesting and unexpected findings increases the significance of the research.

In addition the opportunistic choice of interview targets based on ease of access runs the risk of obtaining less differentiation of information than would be achieved were access easier and therefore targets able to be selected more 'scientifically'. The limited variation across industry and also geographical location has meant that research conclusions cannot achieve the finest levels of discrimination and nuance in terms of the results.

## **11.5. Suggestions for Future Research**

The research has been limited to JVs in China and as the researcher discovered these are becoming a decreasing, although still important, part of the Chinese economy. It is suggested therefore that a future research programme might have the following projects:

- A quantitative study of JVs to extend the work of the present thesis
- Research to test whether the propositions also apply to non JV companies
- Research into the contributions of research universities in China to innovation
- Research into the contribution of research institutions to innovation in China
- A more far-reaching research project to determine how global branded products can be developed in China out of the innovation research set out above
- A greater emphasis on the importance of Chinese culture in the ability of JVs to enhance innovation capabilities.

As a result of the semi-structured interviews a number of other potential ideas emerged that would be worthy of future research attention, namely:-

- How far do JV companies need people who are self-innovative, self-motivating and creative?
- How far does innovation need innovative executive managers and innovative leadership to support innovation inside JV companies?
- How important is the combination of two talented parent firms to stimulate innovation in JV companies, given that some innovation will come out from the parents companies first?
- To what extent should JV companies regard innovation as part of their “DNA”?
- How can cooperation with universities and research institutes be increased?
- What is the role of creative customers in demanding innovative products or services? How does innovation bring value to customers?

Some of these ideas relate to the human resources area and others to systems development. The final point focuses on the demanding customer element which, particularly in the west, stimulates innovation activity.

## **11.6. Policy and managerial implications**

Because of the exploratory nature of this research, it was not an explicit aim to develop policy implications. However, three issues are worth considering:

- How can the negative attitude to open innovation and industry collaboration be addressed? The role of government is important here – encouraging innovation

networks could be achieved through formal government involvement in establishing and maintaining such networks, and possibly the provision of incentives for companies to share their knowledge. For example, the government could sponsor awards targeted towards companies that have benefited from shared innovation.

- How can links between industry and universities/research institutions be strengthened? One possibility may be the increased use of alumnus networks whereby graduates working in industry develop and maintain contacts with the institutions where they studied, agreeing to share ideas and sponsor relevant research. Most of the managers interviewed were university graduates, often from leading Chinese universities, and they were conscious that better institutional structures for maintaining links with their universities could be beneficial.
- How can companies encourage an atmosphere that supports innovation? This may require specific company-level activities to ensure that employees are encouraged to put forward ideas, but also may need initiatives at national level to stimulate a “culture of innovation” throughout China. One of the most significant cultural changes in China over the past 100 years has been a growing openness to change and innovation, and building on this trend should have positive results. As part of this process, international joint ventures will continue to play an important role.

# References

- Ahuja, G. 2000a, Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study, *Administrative Science Quarterly* 45:425-55.
- 2000b, The Duality of Collaboration: Inducements and Opportunities in the Formation of Interfirm Linkages. *Strategic Management Journal* 21:317-43.
- Aitken, B., J., and Harrison, A. 1999, Do domestic firms benefit from direct foreign investment? Evidence from Venezuela, *American Economic Review*, 89, 605-618.
- Akera, A. 2001. The IBM User Group, Share. *Technology and Culture* 42: 710-36.
- Allen, R. E. 1990 (ed.) *The Concise Oxford Dictionary of Current English*, Oxford: Clarendon Press.
- Ames, E & Rosenberg, N. 1963, Changing technological leadership and industrial growth, *Economic Journal* 74:13–31.
- Angwin, D. 1999. *Post Acquisition Management of Corporate takeovers in the UK*. PhD Thesis, Warwick.
- Aris, S. 1998, *Arnold Weinstock and the Making of GEC*, London: Aurum Press.
- Arora, A., Fosfuri, A., & Gambardella, A. 2001. *Markets for Technology : The Economics of Innovation and Corporate Strategy*, Cambridge, Mass. : MIT Press.

- Baldwin, R., Braconier, H., and Forslid, R. 1999, MNCs, growth and location externalities, CEPR working paper.
- Baum, J. A. C. Calabrese, T. & Silverman, B. S. 2000, Don't Go It Alone: Alliance Network composition and startups' Performance in Canadian biotechnology. *Strategic Management Journal* 21: 267-94.
- Beamish, P. W. 1987, Joint ventures in LDCs: Partner selection and performance. *Management International Review*, 27: 23-37.
- Blomstrom, M. and Kokko, A. 1998, Multinational corporations and spillovers, *Journal of Economic Surveys* 12: 247-277.
- Blumer, H. 1956, Sociological Analysis and the "variable". *American Sociological Review*, December
- Bozeman, B. & Link, A.N. 1983 *Investments in Technology: Corporate strategies and Public Policy Alternatives*. New York: Praeger.
- Bruland, K. and Mowery, D.C.(2005), innovation through time, *The Oxford handbook of Innovation*, Oxford University Press, New York
- Bryman, A. 2001, *Social research methods*, Oxford: Oxford University Press, pp.282.
- Bryman, A., and Burgess, R.G., (1994), *Analyzing Qualitative Data*, Routledge: New York.
- Bryman, A., 1989. *Research Methods and Organization Studies*, Unwin Hyman.
- Bryman, A. (1988), *Quantity and Quality in Social Research*, London: Unwin Hyman.

- Burrell, G. and Morgan, G. 1979. *Sociological Paradigms and Organizational Analysis* 249-252 London: Neiman. in bryman 1989
- Campbell, D.T., (1955), the informant in Quantitative Research, *American Journal of Sociology*, the University of Chicago Press, pp.339-342
- Cantwell, J. and Colombo, M. G.(2000), "Technological and Output Complementarities, and Inter-firm Cooperation in Information Technology Ventures," *Journal of Management and governance* 4:117-47.
- Cao, C., Suttmeier, R.P. and Simon, D. F. (2006), China's 15-year science and technology plan, University of Oregon.
- Chandler, A. (1997), *The Visible Hand : The Managerial Revolution in American Business*, Cambridge, Mass. : Belknap.
- (1997), "The United States: Engines of Economic Growth in the Capital Intensive and Knowledge Intensive Industries," in A. Chandler, F. Amatori, and T. Hikino (eds.), *Big Business and the wealth of Nations*, Cambridge: Cambridge University Press.
- Chen, Y., and Puttitanun, T.,(2002), "Intellectual Property Rights and Innovation in Developing Countries" *DISCUSSION PAPERS IN ECONOMICS*, Working Paper No. 02-06
- Chesborough, H. 2004. "Managing Open Innovation: Chess and Poker". *Research & Technology Management*, 47(1) :13-16,23-26
- Chesbrough, H. (2003), *The Era of Open innovation*, Boston: Harvard Business School Press.

- Chesbrough, H. Vanhaverbeke, W. & West, J. 2006. *Open Innovation: Researching a new Paradigm*. Oxford University Press
- Chesbrough, H.W. and Teece, D.J. (1996), When is virtual virtuous? Organising for innovation, *Harvard Business Review* 1 (1996), pp. 65–73
- Cheung, K., and Lin, P., (2003), Spillover effects of FDI on innovation in China: Evidence from the provincial data, *China Economic Review* 15 (2004) P.25-44
- Child, J. and Yan, Y., (1999), Investment and control in international joint ventures: the case of China,
- Child, J & Tsai, T. 2005 The Dynamic between firms: Environmental Strategies and Institutional Constraints in Emerging economies. *Journal of Management Studies*, 42, 95-125
- Child, J., Faulkner, D., and Tallman, S., (2005), *Cooperative Strategy: Managing Alliances, Networks, and joint Ventures*, Second Edition, Oxford University Press
- Child, J. & Mollering, G. 2003 Contextual confidence and active trust development in the Chinese business environment, *Organization Science*, 14: 69-80.
- Child, J. & Rodrigues, S. B.1996 *The Role of Social Identity in the International Transfer of Knowledge through Joint Ventures*, in Clegg, S. R. &Palmer, G.(eds), *Producing Management Knowledge* .London :Sage
- Child, J. & Yan, Y.2003 Predicting the performance of International Joint Ventures, *Journal of Management Studies*



- China Ministry of Science and Technology (MOST) 2006 Report, *China Statistical Yearbook on Science and Technology*, China Statistics Press, Beijing.
- China Ministry of Science and Technology (MOST) 2009 Report, *China Statistical Yearbook on Science and Technology*, China Statistics Press, Beijing.
- China Statistics Yearbook on high-tech technology industry, 2004-2006. National Bureau of Statistics, *China Statistical Abstract*, China Statistics Press, Beijing.
- Chinese State Drug Administration (1998), 1998 data, Chemical Industry Press, Beijing
- Cicourel, A. (1964), *Method and Measurement in Sociology*, Free Press, New York
- Cicourel, A.V. (1982), Interviews, surveys, and the Problem of Ecological Validity, *The American Sociologist*, Vol.17, No.1, Feb.,1982, pp.11-20
- Clark, K., and Fujimoto, T. (1992), *Product Development Performance*, Boston: Harvard Business School Press.
- Clarke, B, R. 1998. Creating Entrepreneurial Universities, *Organizational Pathways of Transformation*, New York: IAU Press
- Cohen, W. M. & Levinthal, D. A. 1989,1990 Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Science Quarterly*, 35: 128-52.
- Cohen, W. M., Go To, A., Akiy, A., Nelson, R.R., &Walsh, J.P.2003. *R&D Information Flows and Patenting in Japan and the United States*. In Granstrand, 123-54
- Collis, J. and Hussey, R (2003), *Business Research*, Second Edition, Palgrave Macmillan

- Contractor, F. J., and Lorange, P., (1988), *Cooperative Strategies in International Business: Joint ventures and Technology Partnerships between Firms*, Elsevier Science Ltd
- Cooper, D.R., and Schindler, P.S., (1998), *Business research methods* (6<sup>th</sup> ed.), Irwin McGraw-Hill, Boston, USA
- Crane, D. 1972. *Invisible College: Diffusion of Knowledge and Scientific Communities* Chicago: University of Chicago Press.
- Cross, R., Borgatti, S., & Parker, A. 2002 Making Invisible Work Visible, *California Management Review*, 44(2):25-46.
- Currall, S.C. Inkpen, A.C. (2004), 'The Coevolution of Trust , Control, and Learning in Joint Ventures', *Organization Science*, 15:586-99.
- Dahlman, Carl J. and Aubert, Jean-Eric (2001), *China and the Knowledge Economy: SEIZING THE 21<sup>ST</sup> CENTURY, Promoting knowledge and learning for a better world*, World Bank Institute, A joint publication of the World Bank's East Asia and Pacific Region and the World Bank Institute, The international Bank for Reconstruction and Development/THE WORLD BANK, Washington.
- Devlin, G. and Bleakley, M. (1988), "Strategic alliances: guidelines for success", *Long Range Planning*, Vol.21 No.5, pp. 18-23
- Dhanaraj, C. & Parkhe, A. 2006 Orchestrating Innovation Networks, *The academy of Management*, July, Vol.31, No.3: 520-659.
- Dillon, W.R., Madden, T. J., and Firtle, N.H., (1994), *Marketing research in a Marketing Environment*. St. Louis: Times Mirror.

- Doblin Inc, *the Innovation Strategy Consulting Company*. 2007. *Ten Types of Innovation* [www.doblin.com/ideas](http://www.doblin.com/ideas), Chicago, USA
- Doz, Y. L. 1996. The Evolution of Cooperation in Strategic Alliances: Initial Conditions or Learning Processes? *Strategic Management Journal*, 17:55-83
- Dutton, H.I. 1984, *the Patent System and Inventive Activity during the Industrial Revolution, 1750-1852*, Manchester: Manchester University Press.
- Easterby-Smith, M, Thorpe, R. and Lowe, A, (1991:24) *Management Research: An Introduction* (Sage, London).
- Edquist, C., (1997), *Systems of Innovation: Technical Change and Economic Theory*, A Cossell imprint
- Eisenhardt, K. M. & Schoonhoven, C. B. 1996, Resource-base View of strategic Alliance Formation: Strategic and Social Effects in Entrepreneurial Firms. *Organization Science* 7:136-50.
- Eisenhardt, K. M., (1989), Building Theories from case Study research, *the Academy of management Review*, Vol.14, No.4, Oct., 1989, pp.532-550
- Evered, R. & Louis, M.R. (1981) Alternative Perspectives in the Organisational sciences: "Inquiry from the Inside" and "Inquiry from the Outside". *Academy of management Review* 6(3): 385-95
- Fagerberg, J., Mowery, D.C. & Nelson, R.R. (2005), *The Oxford handbook of Innovation*, Oxford University Press, New York

- Farley, J. U., Hoening, S., & Yang, J .Z. 2004, Key Factors Influencing HRM Practices of Overseas Subsidiaries in China's Transition Economy, *International Journal of Human Resource Management*, 15: 688-704.
- Faulkner, D. O. (1993) *International Strategic Alliances: Key Conditions for Their Effective Development*, Published PhD Thesis, University of Oxford, Templeton College.
- FIAS (a joint service of the international Finance Corporation and the World Bank), (2005), FIAS 2005 Annual Report
- Fisher, W. (2001), "Intellectual Property and innovation: theoretical, empirical, and historical perspectives" the Programme Seminar on *Intellectual Property and Innovation in the Knowledge-based Economy*, May 2, 2001, The Hague.
- Floyd, C. (1997), *Managing Technology for Corporate Success*, Hampshire: Gower
- Flick, U. (2009) *An Introduction to Qualitative Research*. 4th edition, Sage, London
- Forrest, J. E. (1991), "Models of the Process of Technological Innovation," *Technology Analysis and Strategic Management* 3(4): 439-52
- Fraggerberg, J., Mowery, D.C., and Nelson, R.R. (2005), *The Oxford Handbook of Innovation* (eds), Oxford University Press Inc. New York.
- Franklin, S., Wright, M., & Lockett, A. 2001, Academic and Surrogate Entrepreneurs in University Spin-Out Companies, *Journal of Technology Transfer*, 26:127-41
- Freeman, C., and Perez, C., (1998), "Structural crises of adjustment, business cycles and investment behaviour," pp.38-66 in: Giovanni Dosi, Christopher Freeman,

Richard Nelson, Gerald Silverberg, and Luc Soete (eds.), *Technical Change and economic Theory*. London: Printer.

Freeman, C. & Soete, L. 1997, *the Economics of Industrial Innovation, 3rd Edition*, the MIT Press

Freeman, C. (1982), *The Economics of Industrial Innovation*, London: Frances Pinter.

-----and Louca, F. (2001), *As Time Goes By: From the Industrial Revolutions to the Information Revolution*, Oxford: Oxford University Press.

Freeman, C. (1987) *Technology Policy and Economic Performance: Lessons from Japan* (London: Pinter).

Galagan, P. A. 1990. Executive Development in a Changing World, *Training and Development Journal*, June: 23-41.

Gallaher, M.P. Link, A.N & Petrusa, J. E. 2006 *Innovation in the U.S. Service Sector*. London: Routledge.

Glaser, B. G & Strauss, A.L. (1967) *the discovery of grounded theory*, Chicago: Aldine

Glaser, B., and Strauss, A., (1967). *The Discovery of Grounded Theory*. Aldine Publishing Company, Hawthorne, NY

Goode, W.J. & Hatt, P.K. (1952) *Methods in Social research*, New York: McGraw-Hill.

- Granstrand, O. (2005), 'Innovation and intellectual property rights', in Fagerberg, J., Mowery, D. C. and Nelson, R. R. (eds.), *the Oxford Handbook of Innovation*, Oxford: Oxford University Press.
- Guilloches, Z. (1990), "Patent Statistics as Economic Indicators", *Journal of Economic Literature* 28:1661-707.
- Grossman, G.M. and Helpman, E. (1991), *Innovation and Growth in the Global Economy*, MIT Press, Cambridge, MA
- Gu, G.Z. I.2005. *China's Competitiveness in a Strong-Yuan World*, Financial sense University, Shenzhen, China.
- Gulati, R. and Westphal, J. D. (1999), Cooperative or Controlling? The Effects of CEO-Board Relations and the Content of Interlocks on the Formation of Joint Ventures, *Administrative Science Quarterly*, 44/3: 473-506.
- Gulati, R., (1999). "Network location and learning: The influence of network resources and firm capabilities on alliance formation." *Strategic Management Journal*, 20/5: 397-420.
- Gulati, R., Nohria, N. and Zaheer, A., (2000). "Strategic networks," *Strategic Management Journal* 21/3: 203-215.
- Hagedoorn, J. 1995. Strategic Technology Partnering During the 1980s: Trends, Networks, and Corporate Patterns in Non-Core Technologies, *Research Policy* 24:207-31.

- Hansen, M.T.1999. The Search-Transfer Problem: the Role of Weak Ties in Sharing Knowledge across Organization Subunits. *Administrative Science Quarterly* 44:82-111.
- Helpman, E.,(1992), "Innovation, Imitation, and intellectual property rights", *NBER Working paper* No. 4081, Cambridge, MA 02138.
- Helpman, E., (1998), *General Purpose Technologies and Economic Growth*, Massachusetts Institute of Technology, USA
- Hicks, D. (1995), "Published Papers, Tacit Competencies and Corporate Management of the Public/private Character of Knowledge," *Industrial and Corporate Change* 4: 401-24
- Hindle, T., 2008, "The Economist Guide to Management Ideas and Gurus" *The Economist*, Aug 25th 2008, P322
- Hu, A., and Jefferson, G. (2001), *FDI, technological innovation, and spillover: Evidence from large and medium size Chinese enterprises*, mimeo, Brandeis University: Waltham, MA.
- Husserl, E. (1964), *The Idea of Phenomenology* (W. Alston& G. Nakhikan, trans.). Nijhoff, The Hague.
- Inkpen, A.C. & Currall, S.C.2004 the Coevolution of Trust, Control and Learning in Joint Ventures, *Organization Science*, 15:586-99
- Intarakumnerd, P.2005. *Proceedings of Seminar on National Innovation System: Experience of Select Asian Countries*, organised by RIS, Friday, January 14

- International Monetary Fund, World Economic Outlook Database, April 2011:  
Nominal GDP list of countries. Data for the year 2010
- Joseph, K. J. 2005. *Proceedings of Seminar on National Innovation System: Experience of Select Asian Countries*, organised by RIS, Friday, January 14
- Kaufer, E. 1989. *The Economics of the Patent System*, New York: Harwood academic publishers
- Keat, R. and Urry, J. (1975), *Social Theory as Science*, London: Routledge and Kegan Paul.
- Kinney, W. R., Jr. 1986, Empirical Accounting Research Design for Ph. D. Students, *The Accounting Review*, 61: 338-350.
- Kreiner, K., & Schultz, M. 1993. Informal Collaboration in R&D, the Formation of Networks across Organizations, *Organization Studies* .14: 189-209
- Lane, H. W. & DiStefano, J. J. 1994, *the Global Manager*, in Beamish, P. W., Killing, J. P., LeCraw, D.J., & Morrison, A.J.(eds.). *International Management: Text and Cases*. Burr Ridge, IL: Irwin, Chapter10.
- Larson, A. 1992, Network Dyads in Entrepreneurial Settings: A Study of the Governance of Exchange Processes. *Administrative Science Quarterly* 37: 76-104.
- Leonard-Barton, D. (1995), *Wellsprings of Knowledge*, Boston : Harvard Business School Press.
- Lerner, J. 2000. 150 Years of patent Protection, *NBER*, working paper No.7478.



- Leung, K. 2008. Chinese culture, modernization, and international business, *A International Business Review* 17 (2) 184–187
- Levin, R.C., Klevorick, A.K., Nelson, R., R., & Winter, S.G. 1987. Appropriating the Returns from Industrial Research and Development, *Bookings Papers on Economic Activity*, 3: 783-831
- Link, and Albert, N. 2006, *Public/Private Partnerships: innovation Strategies and Policy Alternatives*. New York: Springer
- Link, A. N. & Siegel, D. S. 2007. *Innovation, Entrepreneurship, and Technological Change*, Oxford University Press
- Liu, X. and Buck, T., (2006) Innovation performance and channels for international technology spillovers: Evidence from Chinese high-tech industries, *Research Policy*, Volume36, Issue3, April, 2007, Pages: 355-366.
- Liu, X. and White, S. (2001) Comparing innovation systems: a framework and application to China's transitional context, *Research Policy*, 30(7), pp. 1091–1114.
- Lundin, N., Sjöholm, F., and Qian, J. 2006, The Role of Small Firms in China's Technology Development, Working Paper 227, Stockholm School of Economics.
- Lundvall, B. (2000) 'Introduction', in Edquist, C. and McKelvey, M. (eds) *Systems of Innovation: Growth, Competitiveness and Employment*, An Elgar Reference Collection, Edward Elgar, Cheltenham, UK, p8. 112.
- Lundvall, B.-A°. (Ed.) (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

- Luo, Y. (1997). Partner selection and venturing success: The case of joint ventures in China. *Organization Science*, 8(6): 660-676.
- Mansfield, E. (1995) *Innovation, Technology and the Economy*, Aldershot: Edward Elgar.
- Mansfield, E. 1986, Patents and Innovation: An Empirical study, *Management Science*, 32(2) : 173-81.
- Martin, B., and Salter, A. (1996), "The Relationship between Publicly Funded Basic research and Economic Performance: a SPRU Review," *Report for HM Treasury*, SPRU, University of Sussex.
- McDaniel, Jr., C. and Gates, R. (1999), *Contemporary Marketing Research*, 4<sup>th</sup> Edition, Cincinnati, South-Western College Publishing
- McTavish, D. G., and Loether, H. J. (2002), *Descriptive and inferential statistics: an introduction*, Allyn and Bacon, Boston
- Miles, M.B.1979. *Qualitative data as an attractive nuisance: the problem of analysis* .ASQ 24: 590-601
- Miles, M. B., and Huberman, A. M., (1994), *Qualitative data analysis: a sourcebook of new methods*, *Business Administration*, Sage Publications, Page: 263
- Moore, G.A .2004. *Innovating within Established Enterprises*, HBR 82, 7/8, 87-92
- Morgan, G. and Smircich, L. (1980) 'The Case of Qualitative Research', *Academy of Management Review*, 5, pp. 491-500.

- Mowery, D.C. (ed.) (1998), *International Collaborative Ventures in US Manufacturing*, Cambridge, Mass: Ballinger.
- Mowery, D.C., Oxley, J.E., and Silverman, B.S. (1998), "Technological Overlap and Interfirm Cooperation: Implications for the Resource-Based View of the firm," *Research Policy* 27(5): 507-24.
- Mytelka, L. (2000) "Local Systems of Innovation in a Globalized World Economy", *Industry and Innovation* 7(1): 15–32.
- (2001) 'Promoting Scientific and Technological Knowledge for Sustainable Development', paper for the Third UN Conference on Least Developed Countries, Round Table: Education for All and Sustainable Development in LDCs, May.
- (2004) "Catching-up in New Wave Technologies", *Oxford Development Studies* 3 (September): 389–406.
- Narin, F., Hamilton, K., and Olivastro, D. (1997), "The Increasing Linkage Between U.S. Technology and Public Science," *Research Policy* 26:317-30.
- Narula, R. and Zanfei, A., (2005), Globalisation of innovation: the role of multinational enterprises, in Jan Fagerberg, David Mowery, and Richard R. Nelson (editors), *handbook of innovation*, Oxford University Press
- National Bureau of statistics (NBS), *Statistical Yearbook of China*, various issues, Beijing, China Statistical Press (2010)
- National Institute of Standards and Technology (NIST) 2005, *Measuring Service-Sector Research and Development*, NIST Planning Report 05-1

Nelson, R. R. (1993), *Technical Change and Economic Theory*, National Innovation Systems

----- (Ed.), (1993) *National Innovation Systems: A Comparative Analysis*, Oxford: Oxford University Press.

----- 2004, The Market Economy and the scientific commons, *Research Policy*, volume 33, pp.455-471

Niosi, J. (2002) 'National Systems of Innovations are "X-Efficient" (and X-Effective): Why Some are Slow Learners', *Econpapers Research Policy*, vol 31, issue 2, p31.

OECD 1981, *The Measurement of Scientific and Technical Activities*, OECD, Paris.

----- 1999, *Managing National Systems of Innovation*, OECD, Paris.

-----2006, *OECD Reviews of Innovation Policy: CHINA Synthesis Report*, Organisation for Economic Co-operation and Development *in collaboration with* The Ministry of Science and Technology, China.

----- 2008, *Compendium of Patent Statistics*, 2008.

*Ontario 2002: A report of the Task Force to Review the Ontario Technology Fund in the Context of an Innovation-Based Society*, 1993, Economic Renewal

Orlikowski, W.J.,(2000) "Using Technology and Constituting Structure: A Practice Lens for Studying Technology in Organizations," *Organization Science* (11:4)

- Orlikowski, W.J., and Gash, D. (1994) "Technological Frames: Making Sense of Information Technology in Organizations" *ACM Transactions on Information Systems* (12:2), pp. 174-207
- Owen-Smith, J. 2003, From Separate Systems to a Hybrid Order: Accumulative Advantage Across public and Private Science at Research One Universities. *Research policy*, 32(6): 1081-104.
- Pavitt, K. (2005), "Innovation Processes", *the Oxford Handbook of Innovation*, Oxford University Press: Part 1 P86-115
- Porter, M., and Schwab, K., (2008), *the global Competitiveness Report 2008-2009*, the World Economic Forum
- Porter, M.E.(1985), *Competition in Global Industries*. Boston, MA: Harvard Business School Press
- and Fuller M.B. 1986. *Coalitions and Global Strategy*, in M. E. Porter (ed.). *Competition in Global Industries*, Boston, MA: Harvard Business School Press.
- Pothukuchi, V., Damanpour, F., Choi, J., Chen, C.C., & Park, S. H. 2002, National and Organizational Culture Differences and International Joint Venture Performance, *Journal of International Business Studies*, 33:243-65
- Potter, B.C.(1993), China's equity joint venture law: a standing invitation to the west for foreign investment? *University of Pennsylvania Journal of International Law*, Vol. 14:1
- Powell, W. W (1996), "Inter-Organizational Collaboration in the Biotechnology Industry", *Journal of Institutional and Theoretical Economics* 120(1): 197-215.

- Powell, W. W and Grodal, S.,(2005) , Networks of innovators, Chapter 3, *The Oxford Handbook of Innovation*, Oxford University Press Inc., New York.
- Powell, W. W., Koput, K.W, & Smith-Doerr, L. 1996, Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology, *Administrative Science Quarterly*.
- Powell, W.W& Smith, O. 1999.Network Position and Firm Performance, in S. Andrews and D.Knoke (eds.) *Research in the Sociology of Organizations* Greenwich, Conn: JAI Press, 16: 129-59.
- Powell, W.W. & Grodal, S. 2005. Networks of Innovators, *the Oxford Handbook of Innovation*, P. 57-85
- Powell, W.W. and Owen-Smith, J. (1998), "Commercialism in Universities: Life Sciences Research and its Linkage with Industry," *Journal of Policy Analysis and Management* 17(2): 253-77.
- Prahalad, C. K., and Hamel, G. (1990), "The Core Competence of the Corporation," *Harvard Business Review*, 90(3): 79-91.
- Pryor, J., (2007), Industry Collaboration: A new era of open innovation. White Paper Contents, Data Solutions at CPA.
- Ring, P.S. & Van de Ven, A. H. 1994, Developmental Processes of Cooperative Interorganizational Relationships, *Academy of Management Review*, 19:90-118.
- Robson, C., (2002), *Real World Research* (Second Edition), Blackwell Publishing
- Rogers, E.M. (1983) *The Diffusion of innovation*, free Press, New York, NY

- Rosenkopf, L., & Tushman, M. 1998. The Coevolution of Community Networks and Technology: Lessons from the Flight Simulation Industry. *Industrial and Corporate Change*, 7: 311-46.
- Rothwell, R. (1994), Industrial innovation: Success, strategy, trends. In M. Dodgson and R. Rothwell (Eds), *The handbook of industrial innovation*, Aldershot: Edward Elgar Publishing, pp.40-50
- Rothwell, R. (1992), "Successful Industrial Innovation: Critical Success Factors for the 1990s," *Research Policy* 22(3), 221-39.
- , Freeman, C., Horsley, A., Jervis, V., Robertson, A., and Townsend, J. (1974), "Sappho Updated---Project Sappho Phase II," *Research Policy* 3(3), 258-91.
- Ruef, M. 2002. Strong Ties, Weak Ties and Islands: Structural and Cultural Predictors of Organizational Innovation, *Industrial and Corporate Change*, 11: 427-49.
- Salter, A., D'este, P., Martin, B., Geuna, A., Scott, A., Pavitt, K., Patel., P., and Nightingale, P. (2000), *Talent Not Technology : Publicly Funded Research and Innovation in the UK*, CVCP, SPRU, and HEFCE.
- Sandoz, P. (1997), *Canon: Global Responsibilities and Local Decisions*, Penguin, London.
- Santangelo, G. (2000), "Corporate Strategic Technological partnerships in the European Information and Communications Technology Industry," *Research Policy* 29:1015-31

- Sarkar, K.B. Echambadi, R., & Harrison, J.S. 2001, Alliance Entrepreneurship and Firm Market Performance, *Strategic Management Journal* 21:369-86.
- Schnaars, S., and Berenson, C. (1986), "Growth Market Forecasting Revisited: A Look Back at a Look Forward," *California Management Review* 28:71-88.
- Schutz, A. (1962). On multiple realities, *Collected Papers* 1 207-259, Martinus Nijhoff, The Hague, The Netherlands
- Shan, W., Walker, G., & Kogut, B. 1994. Interfirm Cooperation and Startup innovation in the Biotechnology Industry, *Strategic Management Journal* 15 :387-94.
- Shenkar, O. (1990). International joint ventures' problems in China: Risks and remedies. *Long Range Planning*, 23: 80-90.
- Science & Technology Programmes: National High-tech R&D Program (863 Program), (2006), The Ministry of Science and Technology of the People's Republic of China (MOST)
- Sinh, B.T. 2005. *Proceedings of Seminar on National Innovation System: Experience of Select Asian Countries*, organised by RIS, Friday, January 14.
- Smarzynska, B. K., (2002) Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages, *Policy Research Working Paper* 2923
- Smith, J. K. 1983, Quantitative versus Qualitative Research: An Attempt to Clarify the Issue. *Educational Researcher*, 12: 6-13.



- Smith, K. (2006), Measuring Innovation, in Jan Fagerberg, David C. Mowery, Richard R. Nelson, the Oxford Handbook of Innovation, Oxford University Press, pp. 148-180
- Smith, N. C. (1989) *The Case Study*. Cranfield working Paper, WP4/89
- Spencer, J.W. 2003.Global gatekeeping, representation, and network structure: a longitudinal analysis of regional and global knowledge-diffusion networks. *Journal of International Business Studies*, (2003)34, 428-442.
- Stern, C.W. and Deimler, M.S. (2006), The Boston Consulting Group on strategy, Boston Consulting Group (BCG),John Wiley& Sons, Inc.
- Stuart, T.E. 2000.Interorganizational alliances and the Performance of firms: A Study of Growth and Innovation Rates in a high-technology industry. *Strategic Management Journal*, 21: 791-811.
- Tassey, G. 1997, *the Economics of R&D Policy*, Westport, CT: Quorum
- (2005). Underinvestment in Public Good Technology, *Journal of Technology Transfer*, 30:89-113
- Taylor, B.,(1984), "Strategic Planning-which style do you need?"Long Range Planning, Vol.17.No.3,pp.51 to 62,1984, Pergamon Press Ltd.
- Tidd J, Bessant J, & Pavitt K. 2005, *Managing Innovation: Intergating technological market and organizational change*, NY, Wiley
- Tsai, W. and Ghoshal, S.1998, Social Capital and Value Creation: The Role of Intrafirm Networks. *Academy of Management Journal*, 41:464-76.

- Tunzelmann, N., and Acha, V., (2005), *Innovation in "Low-tech" Industries*, in Fragerberg, J., Mowery, D.C., and Nelson, R.R. (2005), *The Oxford Handbook of Innovation* (eds), Oxford University Press Inc. New York.
- Tushman, M. L. & Anderson, P. 1986. 'Technological Discontinuities and Organizational Environments', *Administrative Science Quarterly*. 31:439-65
- Upton, D.M. and McAfee, A., 1996. The Real Virtual Factory, *Harvard Business Review* 74 4, p. 123.
- Uzzi, B. 1997, Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. *Administrative Science Quarterly*, 42: 464-76.
- Van Maanen, J. (1983) *Qualitative Methodolgy*, London: Sage.
- Van Wijk, R., Van Den Bosch, F. A.J., & Volberda, H.W. 2003, Knowledge and Networks, In M.Easterby-Smith and M.A. Lyles (eds.), *Handbook of Organizational Learning and Knowledge Management*, Oxford: Blackwell.
- Vinding, A. L. 2002, *Interorganizational Diffusion and Transformation of Knowledge in the Process of Product Innovation*, PhD Thesis, Aalborg University
- Von Hippel, E. (1987), "Cooperation between Rivals: Informal Know-how Trading," *Research Policy* 16: 291-302.
- (1998), "Economics of Product Development by Users: The Impact of 'Sticky' Local Information," *Management Science* 44:629-44.
- Von Zedtwitz, M., (2006), *International of R&D, Perspectives from outside and inside China*, presentation at MOST/OECD Conference, Chongqing, October 2006

Wang, C., and Liu, X., (2005) Does Foreign Direct Investment facilitate technological progress: evidence from Chinese industries. *Research Policy* 32, 945–953.

Warner, M. 2003. China's HRM Revisited: a Step-wise Path to Convergence? *Asia Pacific Business Review*, 9:15-31.

Whetten, D. A., (1989), What Constitutes a Theoretical Contribution? *Academy of Management Review*, 1989, Vol.14, No. 4, 490-495

Willemse, I. 1990, *Statistical Methods and Financial Calculations*. Cape Town: Juta.

World Intellectual property Organisation (WIPO), (2007), *Statistics on Worldwide Patent activities*, 2007 Edition

----- 2008, *The World Patent Report - A Statistical Review* .

----- 2010, *Statistics Database June 2010*.

----- 2010, *World Intellectual Property Indicators 2010*.

Yin, R. K. (1981) the case study crisis: some Answers. *Administrative Science Quarterly*, March, 26: 58-65.

Yin, R. K. (2004), *Case Study Research*. 4<sup>th</sup> edition, London: Sage.

# **Appendix**

## **Interview Outline**

### **INNOVATION IN CHINA: THE CONTRIBUTION OF SINO- WESTERN JOINT VENTURES**

#### **THE INTERVIEW OUTLINE**

The aim of this research is to gain a greater understanding of what innovation takes place in firms as a result of international joint ventures between China and Western companies

ALL INFORMATION IN THIS QUESTIONNAIRE WILL BE TREATED AS COMPLETELY CONFIDENTIAL AND THE NAMES OF THE COMPANIES WILL NOT BE PUBLISHED WITHOUT PRIOR AGREEMENT

Thank you for your help.

**Name of Alliance Executive completing Questionnaires:**

**Post:**

**Address:**

**Telephone number:**

**Date:**

**Alliance Partner:**

**Date of formation of JV:**

**Industry served by JV:**

**Purpose of alliance:**

## IJV Questions

1. Purpose of JV
2. Please give me a brief history of the JV.
3. What are the key events of the JV?
4. Could you describe the three stages of JV? (Formation-Implementation – Evolution)
5. What have been the major achievements?
6. What have been the major problems?
7. How has your company benefited from the JV?
8. How are relationships with the parents conducted?
9. What are the key motivations for the JV?
10. What are the long term goals for both partners?
11. How is the success of JVs?
12. How is the reputation of JVs?
13. What are the key successful factors for IJVs?
14. How IJVs help Chinese Firms to create innovative capabilities?

## **Innovation Questions**

1. Purpose of Innovation?
2. Please give me a brief history of the Innovation.
3. What are the key events of the Innovation?
4. Could you describe the develop stages of Innovation in JVs? (Formation-Implementation –Evolution)
5. What have been the major innovation achievements?
6. What have been the major innovation problems?
7. How has your companies (Both partners and JV company) benefited from the Innovation?
8. How are relationships with the parents conducted in innovation?
9. What are the key motivations for the innovation?
10. What are the long term goals of innovation for JV Company and both partners?
11. How is the success of innovation?
12. How can innovation improve the reputation of the JV companies and partners in the industry (s)?
13. What is the purpose of creating innovation for JVs Company and both partners?
14. How can Western joint ventures create transferable innovation for Chinese firms?

15. What are problems in JVs company need innovation to solve them?
16. What are the successful factors for creating innovation through IJVs? Why are these factors?
17. What kinds of innovation have come about as a result of the IJV?
18. How innovation is important to competitive success in global markets?
19. What is best innovation for company?



## Proposition Questions

1. Becoming part of an innovative network in its industries is the key factor to create the innovative capabilities. How? Why? (Powell and Grodal, 2005)
2. Taking part in an Open Innovation System in its industries is very important factor to create innovative capabilities for your company. How and why? (Chesborough, 2004)
3. Why relating closely to universities, particularly their research laboratories help to create innovative capabilities for your company? How? (Link and Siegel, 2007)
4. How close are the connections between research institutes and companies? Why relating closely to research institutes help to create innovative capabilities for your company? (Link and Siegel, 2007)
5. Developing in the JV a social atmosphere that encourages innovation. How? Why? (Fragerberg et al, 2005)
6. Develop system in its strategic planning that leads to innovative thinking. Why? How? (Taylor, 1984)
7. Have innovation as a primary objective of both partners at the outset of the joint venture is the key factor to create innovative capabilities for company. Why? How? (Powell, 1996)
8. How does developing IP (Intellectual Property) help to create innovation? Why? (Granstrand, 2005)