ENTRY MODE STRATEGIES AND TECHNOLOGY TRANSFER OF JAPANESE HIGH-TECH COMPANIES IN CHINA

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Table of contents

Summary

This dissertation discusses choices for hierarchical entry modes and ownership adjustments from a technology and knowledge transfer-linked productivity growth perspective using Japanese high-tech companies in China as examples. A quantitative analysis of panel data from the *Toyo Keizai Kaigai Shinshutsu Kigyo Soran* comprising data of 1881 Japanese companies' subsidiaries from the high-tech industry in China which covers intervals of 17 years is linked with qualitative findings.

Several important contributions to the research on entry mode choice, ownership structures, and quantitative modeling using econometric and qualitative approaches are made.

Motivation for the research

In order to upgrade internal technological capabilities, the Chinese government has frequently made it mandatory for foreign companies to transfer new technologies and managerial knowledge to China by giving incentives in the form of favorable tax treatment and more liberal ownership structures to those foreign companies that were willing to transfer the highest technologies. In order to judge the utility of foreign technology transfer, the Chinese government required newly implemented technology, knowledge, production or managerial processes to raise the productivity of domestic input factors. However, no specific framework on how productivity growth that is due technology transfer was provided. This is where the dissertation follows up on.

In transferring new technologies, however, foreign companies face the problem of leakage of proprietary technologies and knowledge. They must therefore balance the need to transfer enough technologies to meet the requirements set by the Chinese

government while protecting proprietary know-how and minimizing transaction costs in setting up and maintaining subsidiaries. Using the example of Japanese high-tech companies in China, the dissertation also addresses the concerns of companies that transfer technologies abroad by proposing that high productivity growth that is due to new technologies and knowledge can be achieved if ownership structures in subsidiaries are set or adjusted over time in order to remain at optimal levels.

The dissertation utilizes a residual measure for productivity growth that is unexplained by changes in labor and capital and must therefore be due to other factors such as the presence of new knowledge, new technologies, or new production and/or managerial processes.

Contributions

With regard to quantitative modeling, the dissertation introduces an econometric approach to business research by using the concept of residual productivity growth within a statistical application of panel data comprising 17 yearly intervals from 1986-2003. Existing business research rarely incorporates econometric approaches. Likewise, the field of economics rarely applies its theoretical concepts by using concrete data.

A quantitative framework that measures the degree of efficiency in technology and knowledge transfer in the form of a residual productivity growth variable is developed and linked to ownership structures in subsidiaries. Since knowledge transfer, and increasingly, technology transfer can be a two-way process between both foreign and local partners in equity-based subsidiaries (i.e. joint ventures), ownership structures are viewed as a tool to control them and a price to pay in order to obtain them. The quantitative model can thus be considered a framework for assessing transaction costs of those assets. Furthermore, hierarchical entry modes and subsequent ownership structures are discussed with respect to transacting them most efficiently.

Previous research has addressed subsidiary performance mainly on the basis of financial measures (e.g. profitability, return on assets - ROA, return on equity - ROE, return on investment - ROI, etc.), instability, and lifespan. This dissertation extends existing research by providing a specific quantitative framework for optimizing technology/knowledge-based productivity growth and indirectly minimizing transaction costs. This is an important contribution to both business research and economics.

Another important contribution of the dissertation is the linkage of the quantitative results to their potential for practical implementation by discussing case studies of Japanese subsidiaries in China. Additionally, other factors important in the implementation and internalization of new technologies and knowledge, such as employee structures, have also been analyzed quantitatively and linked to specific cases qualitatively.

Furthermore, an important contribution to existing qualitative business research is made in a framework which categorizes Japanese majority-owned joint ventures into types of relationship structures with Chinese partners and provides links to corresponding productivity growth values and therefore information about transaction costs.

Using these approaches the dissertation concludes that indeed shared equity entry modes yield the highest rates of technology and knowledge transfer, but optimal ownership structures need to be chosen and adjustments to ownership structures should be made over time in order to account for learning effects.

List of tables

List of figures

List of abbreviations

CAS	Chinese Academy of Sciences
EJV	Equity joint venture
FDI	Foreign direct investment
IJV	International joint venture
JETRO	Japan External Trade Organization
JV	Joint venture
SOE	State-owned enterprise
TC	Transaction cost
TFP	Total factor productivity
WOS	Wholly-owned subsidiary

1. Introduction

Foreign high-tech firms in China have long faced the trade-off between transferring and protecting technologies more so than in other countries. The legal framework for foreign investment (FDI) in China has long been geared towards obtaining new technological and managerial knowledge through foreign joint venture partners and allowed for sole ownership only with great difficulty. In setting up subsidiaries in China, foreign companies face several dilemmas. Those companies that are required to set up joint ventures are faced with the choice of a local partner and how to structure a joint venture with regard to optimizing its performance while keeping key technological know-how safe.

Despite government pressure or legal frameworks defining FDI, many foreign companies choose to set up joint ventures with local partners because they realize they need to obtain certain complementary assets that they may not possess, and that the perceived cost of obtaining them through a local partner justifies the set up of a joint venture (JV).

Several problems for companies transferring technologies arise from the aforementioned. First, they need to balance the risk of leaking proprietary technological knowledge with the need to obtain complementary assets. Second, they need to determine ownership structures that are best suited to obtain complementary assets and protect proprietary technologies. Third, they need to find a local partner and decide which areas of the subsidiary to involve the local partner in, which can be achieved through ownership structures and/or the degree of management involvement in the joint venture by the local partner. Fourth, a foreign company needs to understand that the learning process by both partners may increase technological capabilities of the local partner on one hand, while allowing the foreign company to absorb and process knowledge on the other. The learning process may affect the type of complementary assets needed by both partners over time, which the entry mode and ownership structures need to reflect. Fifth, these processes take place under exogenous constraints such as government influence, which may have an impact on learning processes.

The dissertation addresses the issues of entry modes choice and ownership structures from a quantitative and a qualitative aspect.

Motivation for research

The motivation for selecting this topic is the phenomenon that Japanese companies have historically assumed a lower ownership share in their subsidiaries compared to their counterparts from western countries. Moreover, the history between China and Japan has tended to be more complicated. Even though the thesis does not explore historic implications in greater detail, the motivation to find reasons for existing ownership structures of Japanese companies' subsidiaries in China has been one focal point. Even though ownership structures allowed by the central government in China depend on the type of technology and knowledge transferred, bias has existed on the part of Chinese officials when negotiating with Japanese companies for higher ownership structures, impacting the type of technology and knowledge transferred by Japanese companies.

1.1 Short background of issues concerning entry modes in China

Economic reforms in China began in 1978, when Deng Xiao Ping proclaimed the *Open Door Policy*. The first law on foreign direct investment (FDI) under the *Open Door Policy* was the *Law on Equity Joint Ventures* passed in 1979. Legislation for wholly-owned subsidiaries (WOS) was not passed until 1986. Even when the *Open Door Policy* was amended to allow WOS, requirements remained ambiguous, and joint ventures (JVs) remained the clearly favored entry mode until 2001 when China entered WTO (Wang, 2006). The decisive factor for the under-representation of WOS has been China's policy of learning new technologies and managerial know-how from foreign companies in industries with a high degree of proprietary knowledge. The main vehicle to accomplish this goal has been joint ventures.[1] Wholly-owned subsidiary status was granted only under exceptional circumstances.

The Chinese economy has gradually been steered away from being assembly-based to developing its own technological capabilities with the help of new technologies and processes from abroad. Since the *Open Door Policy* of 1978, subsequent amendments were implemented that favored the development of key industries in promoting national development through the extraction of new technologies and managerial knowledge from foreign companies in specific industries.

The importance of technology transfer can be seen by the words of Li Peng, formerly the Vice Premier of China, who predicted: 'In future, one of China's key criteria in evaluating a potential partner will be whether he is willing to transfer technology through design and production' (Li, 2006).

Initially, joint ventures were subject to approval by the central government based on the degree of their benefit with respect to the amount of foreign funds invested and local employment created. However, the central government has since taken incremental steps to amend conditions for FDI to include wholly-owned

[1] This dissertation refers to joint ventures and international joint ventures as JVs and IJVs, respectively. The usage of the terms 'joint venture(s)', 'international joint venture(s)', and the acronyms 'JV(s)' and 'IJV(s)' normally refers to equity joint ventures, unless cooperative (contractual) joint ventures are specifically mentioned. International joint ventures have at least one foreign partner. The main focus of the dissertation is equity joint ventures.

subsidiaries (WOS), but made the type of entry mode dependent on the amount of technologies and new knowledge transferred. Higher foreign ownership has often been allowed only in exchange for higher technology transfer, and WOS required the transfer of very advanced technologies and high potential levels of productivity growth in local factor inputs due to their transfer.

Even though the government has required productivity growth in local factor inputs as a result of technology imports, it has not specified any quantitative method for such measurement. Consequently, the process of establishing a subsidiary in China has remained opaque and left the Chinese government with a considerable amount of discretion in deciding entry modes and ownership levels of foreign subsidiaries. Even though WOS were allowed on paper, China has promoted the learning of new technologies through the use of international joint ventures (IJVs) with local partner companies - mostly state-owned enterprises (SOEs) - and discouraged the set-up of wholly-owned subsidiaries (WOS). In response to the lack of a quantitative performance criterion by which the Chinese government measures the amount of productivity growth achieved through technology and knowledge transfer, this dissertation develops a quantitative method to measure the effects of the implementation of new technologies and knowledge with data of Japanese high-tech companies' subsidiaries.

Subsidiaries of Japanese high-tech companies have generally shown lower ownership levels compared to subsidiaries owned by companies from western Europe and the United States - partly as a result of Chinese government policies and partly as a result of Japanese companies' own preferences. According to my research, many Japanese companies' subsidiaries have achieved increases in productivity growth levels in local factor inputs - as required by Chinese policymakers - which, to some extent, however, appear to be incongruent with their choice of low-ownership entry modes. The dissertation offers a quantitative and qualitative investigation.

1.2 Contribution and structure of the dissertation

The dissertation provides several important contributions to the research on entry mode choice and ownership structures from both quantitative and qualitative aspects. As the first contribution**,** the dissertation develops a quantitative framework which measures the performance of technology transfer and knowledge exchange, in the form of a residual productivity growth variable that explains the presence of learning and knowledge absorption processes. Ownership is introduced as a medium of exchange for complementary assets (tangible and intangible) while productivity growth achieved from the transfer of technologies and implementation of new knowledge is used as a validating factor for the transaction cost involved in the exchange of complementary assets. Previous research has dealt with performance and whether subsidiaries are managed successfully mainly on the basis of financial aspects (e.g. profitability, ROI, ROA, etc.) or instability and lifespan. In contrast, this dissertation provides a specific quantitative framework for optimizing ownership structures through productivity growth that is due to the transfer and acquisition of complementary assets from both the technology transferor and transferee points of view.

The second important contribution of the dissertation is the linkage of the quantitative framework and results to their applicability and potential for implementation in subsidiaries with a qualitative discussion of initial entry mode choice and ownership restructuring. Four cases of Sino-Japanese IJVs will be discussed. In addition to categorizing IJVs into types of relationships with their

Chinese partners, the case studies provide likely quantitative results for technology transfer and knowledge exchange while discussing the feasibility of implementing the findings of the quantitative chapter in practical terms. The application of the quantitative model to actual examples of subsidiaries is thus an important contribution.

Moreover, the quantitative framework uses the economic concept of residual productivity growth and applies it to panel data. In so doing, I connect an economic concept with quantitative business research, which is another significant contribution to both the fields of economics and business. Economics literature seldom uses data to apply in its theories while business literature does not use enough econometric concepts and theories in its research, relying heavily on statistical methods instead.

1.2.1 Quantitative modeling

With regard to quantitative modeling, the dissertation employs an approach that was previously developed by economists to model macroeconomic progress. However, in most economic literature, the approach has been developed only in theory and actual usage on time-series macroeconomic data has been limited in economic literature. As such, business literature has lacked approaches to econometric modeling, while econometric literature has lacked applications of its own models. This dissertation seeks to bridge the gap.

1.2.2 Structure of the dissertation

The first chapter will provide an overview of China's industrial development, policy of technology imports, and the situation of Japanese high-tech companies' subsidiaries in China.

It is then followed by a theoretical part which is divided into three main chapters - namely a chapter on literature review (Chapter 2), a chapter on quantitative methods (Chapter 3), and a qualitative chapter (Chapter 4). A conclusion (Chapter 5) will form the last chapter.

The quantitative chapter links productivity growth to ownership levels, and discusses the role of ownership adjustments and productivity growth.

The qualitative chapter includes case studies which discuss models developed in the quantitative chapter in the context of actual examples of Japanese high-tech companies' subsidiaries in China.

1.3 China's industrial policy

1.3.1 FDI legislation

The first wave of amendments to the 1979 *Law on Equity Joint Ventures* was made in 1983, which further clarified details on technology transfer. The law designated the Ministry of Foreign Economic Relations and Trade (MOFERT)[2] as a facilitating agent for sourcing raw materials and labor after this ministry had screened a foreign joint venture application. In a second amendment, decisions involving investment of US$ 5 million or less were decentralized and passed on to municipal organs.

A third reform in 1986 allowed wholly-owned subsidiaries for the first time. The *Wholly Foreign-Owned Enterprise Law* and corresponding Article 3 permitted foreign companies to bypass a Chinese partner (Lehman *et al.*, 2001). The law was important for those companies with advanced technologies seeking to invest in China but reluctant to reveal proprietary knowledge or technologies. This law, however, did not come free to foreign investors. In order to be allowed to establish WOS, the law made the transfer of advanced technologies mandatory. A notable and intended ambiguity of this law, however, was its non-specification of advanced technologies. It therefore left the Chinese government with significant control in deciding which foreign companies to grant wholly-owned subsidiary status because it was able to compare technologies to be transferred against one another and select among several foreign companies' applications. Although considered high-tech or advanced in their home and other countries, many foreign companies were not able to gain WOS status because other foreign companies pledged to transfer more or higher-valued technologies. As a result, most companies still had to set up joint ventures, even

[2] This Ministry became Ministry of Foreign Trade and Economic Cooperation in 1993 (MOFTEC) and was subsequently consolidated with other agencies into the Ministry of Commerce (MOFCOM) in 2003, a name under which it is still known.

though it was not their preferred choice.

1.3.2 Technology access through FDI and technology transfer

In almost every manufacturing joint venture, transfers of technological, managerial, and marketing-related knowledge form an integral part of the JV contract. A survey of foreign companies in China by China Research Unit (2006) revealed that 72% of US companies and 61% of Japanese companies agree with the statement that a key success factor for entry into China is for the foreign company to "offer latest technology". The same survey also showed that Japanese companies are concerned about the lack of protection of property rights and the motives of the Chinese joint venture partner, which raises the issues of information asymmetry and bounded rationality – aspects I will address in the theoretical chapters. Moreover, Lu and Child (1995) suggest that suspicions towards the *Law of Foreign Joint Ventures* are fuelled by the "inadequacies of Chinese law" (Campbell, 1996). Despite these issues, another factor in the propensity of Japanese companies to seek joint ventures is the result of cultural factors which include an emphasis on relationship building and networking, and thus greater appreciation for the importance of *guanxi* (Campbell, 1996).

Luo (2002) finds that technological capability, foreign marketing power, and international marketing expertise strongly motivate Chinese companies to enter into joint ventures with foreign companies. A traditional reliance on state-owned enterprises (SOEs) and past practices of delegating foreign trade to a small number of specialized SOEs has created little opportunity for Chinese managers to acquire international management and marketing experience. However, weak intellectual property laws have diminished incentives for foreign companies to transfer new technologies and knowledge and to develop technological capabilities locally.

Bishop (2007), in contrast, argues that not every Chinese joint venture partner is motivated by the acquisition of technology and know-how. A study by Young and Lan (1997) found that at least one-third of local joint venture partners did not hope to gain new technology from the joint venture, and instead entered the joint venture to gain access to more capital.

Authorities in China only have a limited set of guidelines to evaluate technology transfer other than those proposed by the '863' and 'Torch' technology programs.[3] However, they make decisions based on a number of other qualitative factors. Factors include the potential of the foreign company to improve the local partner's technological, strategic, organizational and financial capabilities. Furthermore, a foreign company's nationality, localization strategy, and management style also play a role. Therefore, 'Japanese-style management' and its perceived effectiveness in transferring essential knowledge can be subject to preconceptions and possibly prejudice by authorities that approve new investment (Roehrig, 1993).[4] Even if these requirements were met, few Japanese companies managed to obtain full WOS approval before 2001.[5] The only alternative to a JV was an export-oriented WOS, with the major drawback being that the subsidiary had to export at least 50% of output, which severely restricted it from entry to the Chinese market. Depending on the time of market entry, this restriction could be more or less significant since early manufacturing-oriented subsidiaries were more export-oriented when purchasing power in China was still weak. The practice of restricting access to the Chinese market was a "fee for not working with a Chinese partner" (Vanhonacker, 1997).

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[3] The '863' Program promoted research in advanced technologies, while 'Torch' program was aimed at applying research conducted under '863' commercially through cooperation with foreign companies. This usually included joint research projects.

[4] Roehrig (1993) states that Chinese authorities have been known to be prejudiced towards Japanese companies in the past.

[5] As a result of China's accession to WTO, investment requirements have gradually been liberalized.

However, many companies now seek access to the market in China. By enacting this restriction, the Chinese government wanted to make JVs more attractive.

1.3.3 Bargaining process for FDI

The bargaining process for the entry mode and thus the ownership share is significantly influenced by perceptions about the nationality, corporate identity, and international reputation of the foreign company (e.g. Roehrig, 1993).

My discussions with managers revealed that there was a strong inclination by the Chinese side to categorize foreign investors according to nationality. In addition, Roehrig (1993) claims that foreign investors are categorized into two other groups: "those who sincerely hope to cooperate with us [the Chinese]," and those who "resort to dishonest means and extort Chinese resources" (Roehrig, 1993: 31). Generally, there has been greater respect towards and desire among Chinese companies to do business with investors from the United States, Europe (mainly France, Germany, and UK), and Australia than with companies from Japan, Korea, and Hong Kong (Pang, 2002).

1.3.4 Categories of FDI in China

The central government's stated intention was to channel FDI into building infrastructure and developing advanced technologies and high value-added products. Chinese city and state-level government agencies have since enforced compliance of FDI with economic development objectives. As a result, the number of large-scale, technologically-advanced, and capital-intensive projects has increased (Luo, 2002; Sigurdson, 2005). The following table lists those industries that are encouraged, restricted and prohibited.

Table 1.1: Categories of FDI in China

Categories	*Encouraged*	*Permitted*	*Restricted*	*Prohibited*
Description	*FDI encouraged in areas in which China is seeking new technologies, higher quality products, assistance in infrastructure, and more efficient use of domestic resources and raw materials*	*Not specified – projects not listed in the other three categories are "permitted"*	*FDI restricted in areas in which China has already developed a degree of domestic capability, usually via previously imported technology*	*Domestic Chinese industry or state monopoly already exists.*
Industries	*Electronics (microelectronics, mobile communications, , transportation, agriculture, light industries, electric power, chemical, medical, construction*	*Not specified*	*Transportation, energy (nuclear and thermal), as of 1997 both changed to "encouraged", Financial services, raw materials (mining, smelting of ferrous materials), changed to encouraged in 1997*	*Public utilities, media, military, futures trade, traditional Chinese medicine, projects considered to endanger public security*
Privileges/treatment	*Financial incentives and tax breaks, swift approval process – vary by economic incentive zone*	*Allowed, without special incentives and no significant hurdles*	*Longer approval process, ltd. monetary contribution by Chinese partner*	*none*

Source: *Own compilation of various sources (e.g. Sigurdson, 1995; Luo, 2000; 2001; 2002)*

1.3.5 R&D policies in China

Before China proclaimed the *Open Door Policy* in 1978, it had already established the Chinese Academy of Sciences (CAS) in 1976. CAS resembled R&D clusters, from which a number of well-known high-tech companies emerged later when CAS-affiliated researchers and engineers started their own companies. The most well-known example is *Lenovo* (formerly *Legend Group*), which has its roots within CAS (Sigurdson, 2005).

The *Open Door Policy* gave rise to a number of other reforms with respect to technological know-how. Further reforms focused on tax incentives for certain types of FDI and the abolition of ministries' direct control of most enterprises. Corporatization and stock exchange listings followed even for state-owned enterprises (SOEs). However, the state retained majority control at virtually every level - national, provincial, and municipal.

The second important contribution of the *Open Door Policy* included the overhaul of the university system in order to upgrade local universities' international competitiveness in the fields of scientific and technological research. It would later make universities attractive to foreign companies as research collaborators and future absorbers of advanced technological knowledge.

The third important contribution of the Policy was the development of cohesive national R&D capabilities. Until the 1980s, R&D had been completely controlled by state institutions. Under the new Policy, the state gave up its direct control over R&D, and many industrial research institutes were transferred to manufacturing plants.

Prioritizing technology transfer and improvements in the knowledge of the workforce through FDI later resulted in an emphasis on the commercialization of research and development (Liu and White, 2001). Between 1990 and 1992, four important plans were implemented: the *National Science and Technology Achievements Spreading Program,* the *Science and Technology Development Loan Program*, the *National Engineering Research Centers Program* – all of which intended to speed up the commercialization of academic research results. Furthermore, collaboration between universities, research institutes and private enterprises was promoted by the *Plan for Joint Development and Engineering Projects*.

In 1996, the Standing Committee of the National People's Congress approved the *Law for the Commercialization of Science and Technology Research Results*, to provide a legal basis for dealing with problems relating to the commercialization of results. Moreover, in 2002, the *Small and Medium Enterprise Promotion Law* came into effect. It specified that relevant government agencies were to promote the establishment of technical services institutions, productivity centers, and provide access to information, consulting, and technology transfer for local companies.

R&D policy was then centralized in the Ministry of Science and Technology (MOST), away from various line ministries. R&D funding has since increased more rapidly than economic growth (Luo, 2002). However, this figure is to be treated with caution since funding has not necessarily been used effectively with many SOEs "still too poorly organized to exploit R&D results efficiently." (Sigurdson, 2005) As a result, most Chinese companies have remained weak even in mature and maturing technologies (Luo, 2002). However, in economic terms, the state sector had been reduced from 80% to below 40% of GDP by 2003 (Sigurdson, 2005).

1.3.6 Tax incentives

Between 1996 and 1999, new policies were implemented that introduced further incentives for investment in high-tech industries. These incentives included priority treatment in obtaining basic infrastructure services in addition to reduced income taxes, land fees, import and export duties. Moreover, high-tech companies could receive further tax benefits by reinvesting profits, which could amount to a full tax refund. Consequently, many foreign high-tech companies adopted strategic plans for China that included the reinvestment of profits for growth and expansion. Tax policies achieved an adjustment of the focus of foreign companies in the 'encouraged' industries to a more long-term, value-added commitment.

Some specific tax policies include the following:

- Exemption from import tariffs and other taxes on equipment and parts (for technological innovation)
- Full value-added tax refunds for foreign companies that buy equipment made locally
- Business tax exemptions for technology transfer
- Exemption from corporate income tax if technologies transferred are advanced[6]
- 50% income tax discount for R&D expenses if they rise by at least 10% versus the previous year

Under the obligations of China's entry into the WTO, these tax incentives have gradually been applied to all companies in the 'encouraged' category, regardless of foreign or domestic status.

1.3.7 A note about WTO

Participation in the WTO has resulted in more liberal investment terms for foreign companies. Requirements for joint ventures have been gradually relaxed since. To some extent, however, accession to the WTO has been in contrast to China's emphasis on preserving social stability while introducing a market-based economic system. Loss-making SOEs had frequently been assigned to foreign companies as local JV partners in order to prevent mass layoffs and social unrest (EIU, 2006).[7,8]

Many SOEs have become more productive as a result of their role as IJV

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[6] This policy was reversed in 2007 – foreign and local companies are now subject to the same corporate tax rates.

[7] As the largest employer in China, the State employed half of China's 750 million workers and controlled over 50% of all assets (Chen and Shih, 2005). SOEs dominate vital industries such as electronics/electrical equipment, telecommunications, power, financial, and automotive industries (Chen and Shih, 2005). SMEs tend to be large by employee numbers. Keeping these employed is a priority for the Chinese government (Desvaux *et al.*, 2004). SOEs must also provide numerous employee benefits that are not required of private firms.

[8] From the point of view of China, making foreign companies enter partnerships with SOEs is a convenient method of keeping the officials and SOE staff employed while receiving capital, technologies, and managerial know-how from the foreign partner.

partners. The important point to note is: when setting up subsidiaries in China, foreign high-tech companies should not automatically eschew joint ventures in which the local partner is an SOE.[9]

Luo (2000) has argued that the technology and skills gap, however, created asymmetry in strategic needs for both sides in partner selection, formation, and management of the IJV. An important method of overcoming asymmetry was to align interests by ownership adjustment (Grossman and Hart, 1986; Luo, 2000).

1.4 The role of shared-equity entry modes

Three features of China's rapid economic growth have been especially noteworthy. First, the benefits of growth have been widely shared among China's country-sized provincial economies. Although FDI has mostly concentrated in the coastal regions, enabling them to grow at an average rate of 9.7% a year, other provinces also fared well. In fact, if China's thirty provinces were counted as individual economies, twenty of them would be among the fastest growing in the world (Desvaux *et al.*, 2004).

Second, Chinese economic development has coincided with a sharp cyclical pattern of economic growth. The economic growth cycles have been accompanied by similar fluctuations in the rate of inflation, revealing faults in macroeconomic management resulting from partially completed reforms in the fiscal, enterprise, and banking systems.

Third, China's growth has been less dependent on volume increases in inputs of capital and labor than on productivity growth (Desvaux *et al.*, 2004). This

[9] The type of local company to partner with a foreign company will likely depend on the foreign company, including the foreign company's reputation, technological sophistication, size of investment, and proposed ownership share, and to some extent the foreign company's nationality. The competition among industrialized countries often permits the host country to play one foreign investor off against another to secure terms most advantageous to itself (Wank, 1996; Xin and Pearce, 1996).

suggests that factors other than capital accumulation have been important determinants of China's economic growth. In this dissertation, I will examine the factors of such productivity growth using the example of Japanese high-tech enterprises in China.

Overall, the Chinese economy is still only about halfway through its transition from a centrally-planned economy to a market economy (Luo, 2002). Reforms that are difficult to implement are still in progress. Particularly challenging is the development of a legal, administrative, and regulatory framework, as is the often cited lack of progress in reforming SOEs (Chen and Shih, 2005). However, it is also this system that can lead to certain ownership advantages through shared-equity entry modes that can result in higher productivity growth due to knowledge exchange and technology transfer. On the other hand, significant disadvantages in having an SOE as an IJV partner also exist.

A lack of progress in reforming SOEs has been a major obstacle in reforming the business environment in China overall. The delay in SOE reforms has largely been responsible for delays in fiscal, financial, and trading-system reforms. Liberalization of bank interest rates and trade protection has been slow because of a potentially adverse impact on SOEs with capital shortages. The state bank sector is not yet adequately capable of imposing financial discipline on SOEs, and government agencies continue to interfere with SOEs' management. Even so, several SOEs have successfully been restructured into limited liability stock companies.

A challenging task has been deciding who will efficiently manage state assets. Currently, of those SOEs that have not been privatized, the State Management Asset Commission and its sub-commissions have been managing state assets. They have managed inefficiently, however, due to a lack of professional knowledge, organizational responsibility, and managerial incentives. The key to solving this problem has been to gain access to the professional, managerial, and technological knowledge of foreign companies. With an SOE as local IJV partner, foreign companies would likely face the aforementioned issues.

There are also substantial benefits to forming IJVs with SOEs, however. Foreign companies can gain access to land, factory space, labor, and intangible assets such as *guanxi* with relative ease.

1.5 Investment options[10]

The following section will provide and overview of the main investment options available to foreign companies in China and discuss advantages and disadvantages of wholly-owned subsidiaries and joint ventures in more detail. Chinese law defines five basic company structures:

• **Sino-foreign equity joint ventures (JVs):**

These are limited-liability firms in which profits are distributed in proportion to the partners' equity stakes. Traditionally, this has been the most common type of foreign business structure in China, encouraged by the central government as a method of transferring cash and expertise to domestic enterprises.

• **Contractual (or cooperative) joint ventures:**

They offer more flexibility, but are protected by a less comprehensive set of regulations and guidelines. Profits are distributed according to contractual agreement, which can specify an accelerated return on investment for the foreign investor. A

[10] Information in this section up to section 1.6 is taken mainly from *Economist Intelligence Unit* (2006).

summary of equity and contractual joint ventures is provided in Table 1.2 (below).

• **Wholly-owned subsidiaries (WOS):**

WOS do not require a local partner, and as wholly foreign-owned entities are entirely under the management of the foreign investor.

• **Joint-stock companies:**

Joint-stock companies allow investors' interests to be defined by shares, issued either internally or through a stock market listing. MNCs, such as Kodak of the US, have invested in such joint-stock companies although their numbers are small. More foreign-invested enterprises (FIEs) are expected to convert into joint-stock firms, the first step towards a listing on the domestic stock markets.

• **Holding companies**:

These are also referred to as "investment companies" in Chinese law, offer a convenient way to group together multiple investments. However, they lack many of the advantages of a holding company in the western sense. Capitalization and other requirements are also steep, limiting this option to companies with an extensive presence in China. Group finance companies can be established as adjuncts to holding companies to handle some — but not all — finance functions for subsidiary ventures.

Other structural options in China include:

• **Buying into state-owned enterprises (SOEs)**:

Companies buying into SOEs generally use traditional JV or joint-stock company vehicles to do so. In rare cases, they may be able to purchase the assets of already bankrupt SOEs. Another option for taking a stake in a SOE is acquiring shares in a domestically listed one.

• **Limited-liability companies**:

All FIEs allowed under Chinese company law are limited liability companies. An investor's stake in a limited-liability company, for which no shares are issued, is defined by the amount of capital invested.

Table 1.2: Equity vs. contractual joint ventures

	Equity JVs	Contractual JVs
Legal basis	*Sino-Foreign Equity JV Law* (March 2001); *Implementing Rules* (July 2001)	*Sino-Foreign Equity JV Law* (March 2001); *Implementing Rules* (not updated since 1995)
Form	Legal person status with limited liability	Legal person status with limited liability; or non-legal person status without limited liability
Financing	Capital contributions (both cash and in-kind)	Capital contributions (both cash and in-kind); and "cooperation conditions" (assets made available to JV but not legally contributed)
Profit distribution	In accordance with agreed terms and each partner's respective share in the JV	Foreign partner may recoup its investment during the term of the project
Management	Board of directors is highest organ of authority	Board of directors; or joint management committee
Dissolution	Unanimous board resolutions required in order to apply for approval to dissolve JV	In the event of breach of JV contract by one partner, any other partner may unilaterally apply for approval to dissolve JV

Source: *Economist Intelligence Unit (2006)*

1.5.1 Structural preferences among investment options

Table 1.3 summarizes structural preferences for FDI between 1997 and 2005 by WOS, equity JVs (IJVs), and contractual JVs. Contractual JVs appear to have become obliterated as FDI has been dominated by equity-based entry modes, with an overall tendency among foreign companies towards wholly-owned subsidiaries

(WOS).

Table 1.3: Changes in preferences of FDI structures

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total FDI (billion USD)	45.3	45.5	40.3	40.7	46.9	52.7	53.5	60.6	60.3
Equity joint ventures (%)	43.3	40.2	39.2	35.1	33.5	28.5	28.8	27.1	24.2
Contractual joint ventures (%)	19.6	21.3	20.3	16.2	13.2	9.7	7.1	5.1	3.0
Wholly-owned subsidiaries (%)	35.8	36.3	38.5	47.4	51.0	60.0	62.4	66.3	71.3
Foreign-invested share enterprises (%)	0.6	1.5	0.7	0.3	1.1	1.3	0.6	1.3	1.5
Others (%)	0.7	0.5	1.1	0.9	1.1	0.5	1.1	0.2	0.0

Source: *Economist Intelligence Unit (2006)*

1.5.2 Joint ventures

A joint venture (JV) is often the only investment vehicle permitted for some industries, although the list of industries requiring JVs has shrunk considerably with China's accession to WTO. Wholly-owned subsidiaries (WOS) are still prohibited in certain industries, however. The main types of joint venture formats are discussed below.

1.5.2.1 Equity joint ventures

In equity joint ventures, profits are divided among partners in direct proportion to their equity stakes. In China, equity JVs in which partners share profits and risks according to their respective stakes are similar to those abroad. Foreign participation in an equity JV must be at least 25% in order to qualify for preferential tax treatment. In some industries specified in the *Catalogue for Guiding Foreign Investment in Industries* (including certain types of mining, auto manufacturing, transport related services and medical institutions), the foreign shareholder is limited to a minority stake. Equity can be contributed in the form of foreign currency, equipment, buildings and (subject to certain limits) even intangible assets, such as industrial property, provided their value is recognized by both the approving authorities and the local partner.

1.5.2.2 Contractual (cooperative) joint ventures

Contractual joint ventures allow for profit distribution according to a formula specified in the JV contract rather than according to equity stakes of the partners. The contractual JV structure is most useful for companies that need flexibility in the allocation of returns, such as infrastructure projects. There are two basic models. In one, the Chinese partner makes a limited-equity investment, has little say in management and receives a fixed periodic payment. This arrangement is suited for retail ventures in which a foreign partner seeks maximum control but is required to have a JV partner. In the other, the foreign partner is allowed to retain a disproportionate share of the profits for a fixed period of time, after which most or all profits go to the Chinese partner. This might be used in large infrastructure projects where foreign companies need to recoup their investment on an accelerated time frame and are willing to forego long-term profits to do so. The co-operative form of partnership has been declining in popularity since 1998 when it hit a record high of US$9.3bn in utilized FDI and accounted for 21.3% of the total FDI used (Table 1.3, above). In 2005, they accounted for only 3% of foreign investment.

1.5.2.3 Main reasons for entering into a joint venture partnership

• **Real estate acquisition**:

A JV makes it possible for a foreigner to acquire prime land in China. Local partners can provide land in crowded or expensive development areas. In many cases land is the sole asset of value contributed by the Chinese partner. Investors, however, must also be vigilant when accepting land from a local party, and make sure that the party's allocated land-use rights have been converted into granted rights and have been legally transferred to the JV.

• ***Guanxi* (connections) or brand:**

The most valuable contribution of the Chinese partner in a JV may not be in the assets it contributed to the company, but in its network of connections, sales and distribution clientele, or its strength as a brand name. Equity JVs can be an important method of cementing strategic alliances, particularly in industries which are dominated by one or two major state customers. Although regulations governing JVs have been relaxed, several disadvantages of JVs are still in place:

1.5.2.4 Main reasons for eschewing joint ventures

• **Inflexibility:**

Joint venture operations are governed by the initial JV investment contract, which is quite difficult to change. Changes in the contract require a unanimous vote of the board of directors, which includes representatives of both the local and foreign partners, plus government approval. JVs are therefore often slow in adapting to changes in market conditions.

• **Difficulties in expanding investment:**

Foreign investors seeking to expand their JV operations often meet with resistance from their Chinese partners who are unable to contribute the additional capital. The only useful method to get around this, therefore, is for foreign companies to increase their equity stake in the venture.

• **Conflict of interest between partners:**

The strategic outlook and management philosophies of Chinese and foreign JV partners may differ. While foreign companies are driven by profit, local partners must answer to a complex set of demands and responsibilities, in addition to keeping their workforce employed. Even where interests coincide, differences concerning strategy and management control can be frequent.

1.5.3 Wholly-owned subsidiaries

Wholly-owned subsidiaries (WOS) are no longer bound by as many restrictions as before and their access to the domestic market has improved significantly. Some constraints remain, however. The central government continues to steer foreign investors into areas where it considers foreign funds and expertise useful. In sectors where output capacity has exceeded demand or where they are deemed sensitive, the government will apply restrictions on investment structures and tax breaks. Therefore, certain industries are open to WOS while others are restricted to JVs. Information on new restrictions or the relaxation of existing limits are published in the *Catalogue for Guiding Foreign Investment in Industries*, which is updated periodically.

1.5.3.1 Main advantages of wholly-owned subsidiaries

• **Complete management control:**

Foreign investors opt for WOS structures rather than cede control over critical functions to a partner with fewer skills, or too many competing demands.

• **Simpler establishment procedures:**

The negotiation and approval process may take less time without a partner.

• **Ease of termination:**

A JV can only be liquidated prematurely on the agreement of both parties or through court order. Dissolution of a WOS still requires government approval, but, in principle, it is not difficult to obtain.

• **Protection of intellectual property**:

Proprietary technology is easier to protect at a WOS plant.

1.5.3.2 Main disadvantages of wholly-owned subsidiaries

• **Official hostility:**

Many officials, especially those in inland areas, still prefer to see a Chinese partner involved.

• **Lack of a Chinese "protector":**

As a wholly-owned subsidiary, negotiating with the bureaucracy can be cumbersome and the outcome less predictable. However, this is becoming less of a disadvantage since administrative measures have been codified more clearly and foreign companies have established government relations departments or outsourced this function to public relations firms.

• **Inability to obtain stock market listing:**

Unlike WOS, JVs may convert to joint-stock companies and issue shares on the Shenzhen and Shanghai stock exchanges. WOS may achieve this end, however, by forming JV holding companies that seek a domestic listing and still represent the interests of their subsidiary ventures.

1.6 Selecting an IJV partner[11]

Key areas to examine when selecting an IJV partner are:

• **Industrial plant:**

This includes the type, age and value of equipment, as well as land or existing factory space. In most cases, the foreign partner will prefer to import much or all of the equipment required. Although some Chinese partners may have appropriate equipment, the factory they provide is often used by the venture only during the initial stage. The foreign partner should also verify the nature of the potential partner's land-use rights. Only officially granted land use rights may be transferred to the IJV. There have been instances in which the local IJV partner hid the nature of the land-use rights when they were non-transferable in order to avoid the expense of converting them (Luo, 2002).

• **Labor force:**

Some Chinese companies still expect the foreign partner to absorb redundant

[11] Information in this section is taken mainly from *Economist Intelligence Unit* (2006).

labor. A foreign company needs to negotiate to obtain only the number and quality of workers needed. Identifying the employees worth keeping, however, is difficult, and resistance should be expected from the local partner. As state-owned entities, SOEs are often told by the government to ensure continuous employment for large numbers of workers to minimize the potential for social unrest (Luo, 2002).

• **Strength of management:**

Investors should try to gauge the Chinese partner firm's adaptability to the management culture of the foreign partner, and vice versa.

• **Access to suppliers and customers:**

Few Chinese companies have competent marketing departments (EIU, 2006). Instead, a foreign company should look for existing relationships with suppliers, customers and distributors that would form the foundation of future marketing efforts.

• ***Guanxi*:**

Personal connections are less important now than they used to be. However, they are an integral part of daily life and remain vital in influencing the outcome of negotiations. Many large foreign companies (MNCs) have been in China long enough to have established good relations with local and central-level officials. However, the right partner can still provide valuable political clout with industry officials for any size of company, especially in restricted industries, such as telecoms and automobiles (EIU, 2006).

1.6.1 Chinese side's partner evaluation criteria

Managerial attributes:

In addition to new technological knowledge, a foreign firm's management capabilities are also of great importance to a potential Chinese partner firm. Management capabilities can be grouped into strategic, organizational, and financial capabilities. As for strategic capabilities, a foreign firm's marketing competencies, international marketing expertise and brand strength will be of importance to a prospective local JV partner.

Organizational attributes:

Organizational attributes the local partner may look for in a foreign firm include formal and informal planning systems, controlling systems, as well as informal relationships within the sphere of the foreign firm's activities; such as different groups within a firm and relationships with other firms.

Financial attributes:

Chinese firms have increasingly paid attention to the development of their financial management skills. Financial capabilities sought by Chinese firms include risk management, financial appraisal, investment assessment, budgeting, and the controlling and monitoring of working capital (Luo, 2000).

1.6.2 Japanese side's partner evaluation criteria

To Japanese companies, the Chinese joint venture partner has always retained its relevance despite Japanese companies' increasing experience in China. The high degree of tax law changes, law ambiguity, complex labor relations, and high discretionary powers of local authorities have preserved the importance of a local JV partner and its *guanxi*. Several studies argue that local partners' *guanxi* significantly facilitate IJV's performance including return on investment (ROI), sales growth, and risk reduction (e.g. Shenkar, 1990; Chen and Shih, 2005).

With regard to labor relations, there is higher distrust among Chinese workers towards Japanese companies than towards western companies (e.g. Yeung, 2007). Therefore, a local IJV partner remains beneficial as a proxy.

However, data from *Toyo Keizai Kaigai Shinshutsu Kigyo Soran* (1986-2003) suggests a trend towards upward ownership adjustment by Japanese IJV partners, which may reflect their higher levels of confidence in doing business in China.

Industrial experience and market position:

A local partner's industrial experience is also of importance in the IJV setup process. In China, a local partner's market share, market experience, and knowledge of the industry can enhance an IJV's bargaining power vis-à-vis the government and enable it to achieve greater efficiency.

Strategic orientation:

The consistency of local and foreign partner's goals and behaviors, cooperative culture, and investment commitment are important to the success of an IJV (Miles and Snow, 1978; Luo, 2000). These may pose a challenge with regard to both partners' short and long-term goals. The Chinese partner may be more likely to expect to see higher profits in the short term, whereas the Japanese partner will be more likely to put emphasis on the pursuit of greater market share and network building in the short term.

Organizational level:

Organizational level includes both business level and class in China (Luo, 2000). SOEs are generally ranked into the following levels: national, provincial, city, and county. At the national and provincial levels, SOEs can further be classified into first, second, and third class companies. The higher-class companies usually have higher product quality, better internal management, faster customer responsiveness, and higher organizational performance. Potential local JV partners are likely to be first-tier companies. Moreover, each level entails a certain degree of support from the government. First-class companies receive the most generous financial support but often face high interference from the government (Luo, 2000).

Local partner's learning ability:

IJV literature has noted that complementary needs create interpartner fit which has a synergistic effect on firm performance (Buckley and Casson, 1988). However, asset complementariness and meaningful learning will not materialize unless a certain level of knowledge and skills are already in place (Luo, 2000). Similarly, Kremic (2003) has argued that a large skills gap inhibits technology transfer and weighs on the productivity of IJVs. The success of an IJV will thus largely depend on the local partner's ability to acquire and internalize new knowledge and skills based on its default knowledge level with which it enters an IJV.

1.7 Japanese investment in China

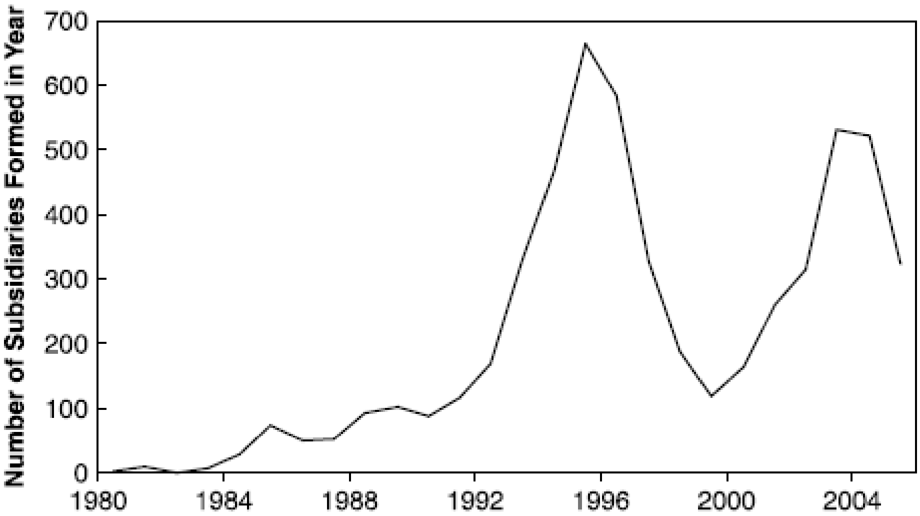
Japanese investment in China has ranked second after Hong Kong since 1988, when Japan surpassed the US as the second-largest investor in China (e.g. Luo, 2002).

Japanese FDI in China peaked in 1995 and 1996, but fell subsequently, until recovering in the year 2000, continuing to do so until 2004. In 1998, for instance, Japanese foreign direct investment in China dropped by 21% to US$2.7 billion. This figure was less than half the FDI rate of 1995 (Figure 1.1). Between 1990 and 1995, Japanese FDI to China increased rapidly and was 10 times higher in 1995 compared to 1990. By the second half of the 1990s, those companies that had already established subsidiaries in China were building more factories, adding local suppliers, and expanding product ranges.

Japanese companies in China also faced increasing competition from Chinese manufacturers. By the early 2000s, Chinese companies had become competitive with their Japanese counterparts in several product categories, notably electrical appliances in the maturing stage of the product life cycle. A case in point is the TV market. China was once a large market for Japanese TV sets, but nearly 80% of TV sets made in China at the turn of the millennium bore Chinese brand names, which was an increase of more than 60% compared to 1995 (Luo, 2000). Japanese companies therefore faced more challenges in gaining local market share. Rising technological capabilities in China that have resulted in globally marketable products have since extended to state-of-the-art high-tech industries. In the microelectronics sector, notable examples of globally recognized brands include *Lenovo*, *Huawei*, and *ZTE* groups.

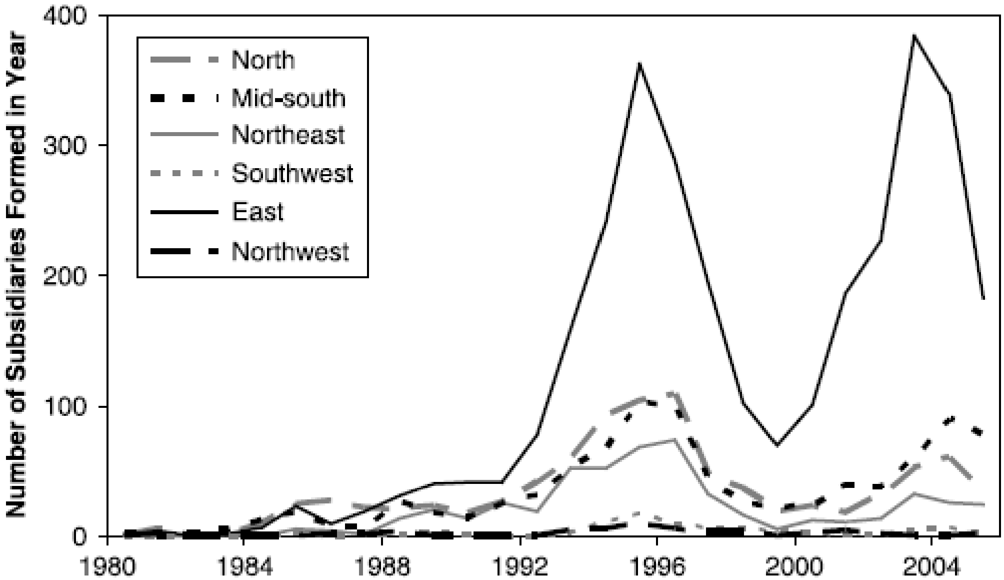
Furthermore, the 1990s recession in Japan affected small and medium businesses particularly adversely since they encountered difficulties in receiving bank loans. In the context of Japanese companies, this was important because small and medium-sized companies account for more than 70% of Japanese FDI in China. Combined with other obstacles such as opaque legal and tax systems, some companies shelved plans for expansion. For instance, Sharp established its first subsidiary in China in 1992 opening five subsidiaries since then, but has had no plans of opening more subsidiaries. Likewise, Hitachi has not opened another subsidiary in China since 1997 (Luo, 2002). Figures 1.1 and 1.2 illustrate the development of Japanese FDI in China from 1980 until recent years.

Figure 1.1: Annual Formation of Japanese companies' subsidiaries in China



Source: Delios *et al.*, 2009, p. 325

Figure 1.2: Annual formation of Japanese companies in China by region (1980-2006)



Note:
North = Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia
Northeast = Liaoning, Jilin, Heilongjiang
East = Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong
Mid-south = Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan
Southwest = Chongqing, Sichuan, Guizhou, Yunnan, Tibet
Northwest = Shaanxi, Gansu, Ningxia, Xinjiang

Source: Delios *et al.*, 2009, p. 332

1.7.1 Structural pattern of Japanese manufacturing companies in China

In the early 1980s Japanese companies committed much less money in China than elsewhere in Asia. The result was that supporting networks were better developed in Southeast Asian countries than in China. For future entry mode choices in China, this meant that Japanese companies had to rely more on Chinese partners. As a result, the proportion of Japanese shared equity companies was higher in China than elsewhere in Asia. In addition, higher resistance from the Chinese government in allowing Japanese companies to set up WOS was also a factor in the high proportion of IJV setups in China.

1.7.2 Sharing of control

Foreign companies continue to prefer strong management control and have taken advantage of China's policies allowing for greater flexibility in establishing wholly-owned subsidiaries. Japanese companies have been an exception. Despite new policies, most Japanese investment has remained in the form of shared ownership.

Equity-based JVs and contractual JVs have been the major forms of investment by Japanese companies in China. They comprised 80% to 90% in the 1980s and still remain an important investment vehicle today at about 70% of all Japanese investment in China. In non-high-tech industries, the vast majority of Japanese companies (approximately 85%) still prefers to take minority positions at below 50% ownership (*Toyo Keizai Kaigai Shinshutsu Kigyo Soran*, 1986-2003).[12]

1.8 Further issues

Many high-tech companies have been reluctant to share ownership in China due to technology protection motives as well as other disadvantages associated with IJVs and potentially strong government involvement. Japanese investment, in particular, has been cautious with regard to taking even majority ownership shares, often preferring to accept minority shares and minimize risk. As a result, Japanese companies have also shown remarkable restraint in transferring value-added activities and preferred to use China as a production base for export more so than western companies.

This dissertation, however, focuses on subsidiaries in which the Japanese

[12] By contrast, other foreign companies (western companies) have preferred strong management control and encountered less government resistance in obtaining approval for higher-control equity arrangements. Since 1996, WOS have become favored entry modes for western companies and now make up more than 50% of FDI in China. Presently, about 34% of total western FDI is made up of equity IJVs.

company holds a majority equity share, and therefore includes majority Japanese-owned IJVs and WOS. Specifically, the dissertation will focus on the transfer of high-value-added activities by Japanese high-tech companies, the performance of which can be affected by the choice of entry mode and subsequent ownership structures.

The next chapter will review the literature on entry modes, ownership structures and subsidiary performance. Furthermore, it will define productivity growth that is due to technology and knowledge transfer as a new type of subsidiary performance measure and establish links between entry modes, ownership structures and measures of subsidiary performance.

2. Literature review

In this chapter, I will review the literature underlying the choice of the general theoretical framework for my model. The chapter begins with a historical overview of trade and FDI theories and proceeds to identify transaction cost (TC) and internalization theories as the foundations for a new model that combines hierarchical ownership with a view to minimizing transaction costs for complementary assets, and tacit knowledge in particular. The main purpose of this chapter is to review FDI and entry mode theories and give a full account of the complexities involved in the exchange of knowledge under different entry modes and ownership conditions within high-tech companies in which a high degree of tacit knowledge is present.

The chapter will start by charting a historical account of FDI and early entry mode theories before discussing internalization and transaction cost theories in more detail. Internalization and transaction cost theories form the foundation for the development of my theory, in which ownership levels are linked to efficiency in transaction processes, particularly for tacit knowledge.

Following a discussion of internalization and transaction cost theories, I will then address equity-based entry modes and ownership levels as a medium for the control and exchange of complementary assets.

The issue of tacit knowledge with respect to levels of ownership is then discussed within the context of knowledge dynamism. In other words, organizational learning may cause knowledge levels present at the time a subsidiary was formed to change significantly over the lifetime of the subsidiary. Therefore, entry modes and ownership levels with which a subsidiary was originally established may need to be adjusted later in order to ensure efficiency in transacting complementary assets. This chapter will discuss the role of ownership in transacting complementary assets and prepare the foundation for a more in-depth discussion of transaction costs and their proxies in the quantitative chapter.

The literature review begins with a historical background of entry modes and proceeds to reviewing internalization and transaction cost theories before linking them to entry modes and ownership levels. This is done in section 2.2 and its subsections. Section 2.3 will talk about hierarchical entry modes in several steps. The section begins with a discussion of equity-based joint ventures and wholly-owned subsidiaries within the context of internalization and transaction cost perspectives and develops into a discussion of ownership levels and subsidiary performance that is attributable to efficient transaction of technology and knowledge as complementary assets. The concept of technology/knowledge-based productivity growth as a proxy for transaction processes will be introduced. This concept will form the basis for a quantitative analysis and further discussions in case studies in chapters 3 and 4, respectively. Finally, the literature review will discuss the concept of knowledge dynamism as an essential element in the adjustment of ownership structures that can cause variations in the growth of technology/knowledge-based productivity.

2.1 Entry modes: historical overview

The following sections will review theories of entry modes and provide a basis for the discussion of the particular contributions this dissertation will make to existing theories on entry modes. Sections 2.1.1 to 2.1.4 will provide an overview of early theories on market entry modes that preceded internalization and transaction cost theories.[13]

[13] Sections 2.1.1 to 2.1.4 are based on an overview of a history of entry mode theories compiled by Zhou Nan (2005) for a graduate research seminar at National University of Singapore.

2.1.1. Vernon's product life cycle

Vernon's Product Cycle (1966) theory distinguishes three main phases in the life of a product: new product, maturing product, and standardized product. Each stage of the cycle requires a different location strategy. His theory successfully explains the post-war acceleration of US foreign investment as a response to either a reduction of lag between innovation and non-standardization or to increasing consumer preferences for new products. However, it cannot explain foreign investment which is not export-substituting, and products which do not follow this life cycle. However, the location advantage of Dunning's (1976) eclectic theory builds on this theory by focusing on host country advantages.[14]

2.1.2 International trade aspect

The International Trade Aspect derives from the traditional international trade theory. This theory views foreign direct investment as capital movement. It therefore explains why there is capital movement across borders. Accordingly, there will be capital flows to the place where the return of capital is higher (e.g. Dunning, 1958; Brash, 1966; Safarian, 1966). This theory, however, is rudimentary and does not recognize different forms or motivations for FDI. For instance, it does not talk about the attributes of different locations, ownership and control forms, nor does it account for other strategic and non-financial decision factors such as expansion of market share or accumulation of knowledge and experience. It also does not take into account the time required in their accumulation. Moreover, the theory also cannot explain simultaneous FDI decisions (e.g. Musgrave, 1969; Freeman, 1971). Therefore, this theory is no longer useful.

[14] Dunning's (1976) eclectic theory is also known as the OLI paradigm. The acronym refers to a firm's ownership, location, and internalization advantages.

Similar to the above theory, Aliber's (1970) theory regards FDI as a currency-area phenomenon. Aliber (1970) argues that American firms can finance more cheaply outside the US because the currency premium on the dollar is lower. In other words, the US dollar is strong in the sense that it is unlikely to depreciate. This theory successfully explained the post-war expansion of US multinationals in Europe in the 1950s and 1960s and Japanese MNEs in Southeast Asia in the late 1960s. However, Aliber's theory cannot explain investment within currency areas or inverse investment (to the US) partly due to the long-term depreciation of the US dollar, while also failing to account for non-financial aspects of international investments.

Another notable early scholar of international trade is Kojima. Kojima (1978) views FDI as an instrument by which the comparative trading advantages of nations may be enhanced. He posits that the home country should invest abroad in sectors that require intermediate products which the host country is capable of producing and supplying. His theory mostly explains Japanese FDI in the 1960s and 1970s. However, his approach is deficient in that his theory cannot explain or evaluate welfare implications of FDI induced by the desire to rationalize production, and he ignores the internalization of the intermediate product market. Therefore, his theory is locked into a neoclassical paradigm of perfect markets and competition and ignores the possibility of market failure.

2.1.3 Behavior and reaction aspect

Early studies on the background of FDI theories focused on the behavior and reaction aspects and later the international trade aspect. Scholars of the former included Aharoni and Knickerbocker. Aharoni (1966) posited that FDI is a behavioral process whose timing depends on chance stimuli and in the process management converts these stimuli into decisions to invest. Therefore, investment decisions may be biased because of the self interests of managers. This self interest of managers is also one of the earliest considerations given to the later concepts of bounded rationality and opportunism in later studies of entry mode decision making processes (e.g. Delios and Beamish, 1996; Daellenbach and Davenport, 2004). As one of the earliest theories on entry modes, the Behavior and Reaction Aspect was flawed in the sense that it was manager-biased and that its underlying sample only included companies that were new to international markets. It was thus a relatively simple attempt at explaining initial causes for a company to invest outside its home market.

2.1.4 Oligopolistic reaction theory

Knickerbocker (1973), another notable representative of the early behavior and reaction aspect theories, extended Aharoni's explanation for FDI in his Oligopolistic Reaction Theory. In it, Knickerbocker (1973) focuses on companies by industry and posits that firms within a given industry tend to follow the industry leader to invest abroad. By contrast, early entry mode studies assumed the foreign market entry of a firm to be an independent decision. Knickerbocker (1973) pioneered the notion of interdependent foreign market entry behavior (Chan *et al.*, 2006: 644). According to Knickerbocker (1973), competing firms will imitate incumbent firms in the same industries as a competitive response to prevent pioneering firms from monopolizing the market. His theory was marked by the achievement that it explained the bunching/agglomeration of FDI in oligopolistic industries. It thus takes the action of competitors into consideration. The theory's weakness, however, is in the fact that the objective of the firm is not clear and the theory offers no explanation of the investment behavior of the initiating firm. However, later studies have used and extended Knickerbocker's (1973) theory into transaction cost-based studies that examine followers' entry mode decisions based on factors such as the ability to acquire experience and understanding of the local market and institutions as intangible assets (e.g. Johanson and Vahlne, 1977; Delios and Beamish, 2001; Chan *et al.*, 2006). With regard to a market follower's behavior, other scholars have noted synergy effects derived from replicating other firm's entry modes such as shared supplier networks and/or economies of scale (e.g. Buckley and Casson, 1988; 1996).

2.2 Entry modes: theoretical overview

Conceptual and empirical work has appeared in studies by Buckley and Casson (1976) and Hennart (1982), who have sought to explain the firm-specific, transaction-related motives for full or shared ownership in foreign subsidiaries (Delios and Beamish, 1999) extending Hymer's (1976) study that discussed the frequency of the transfer of firm-specific advantages when firms make direct foreign investments. Grossman and Hart (1986) discuss links between ownership and control. Delios and Beamish (1999) analyze the relationship between degree of control and protection of proprietary assets on foreign market entries. Acquisition of complementary assets on foreign market entry, the international experience levels of the foreign firm, and the institutional environment in the foreign country exert great influence in a firm's foreign entry mode decision process. I will first discuss the development of entry mode decision theories in the three main categories, namely, OLI, internalization and transaction cost theories. They form a foundation for my own concept which is then developed and put into the broader background of these theories within the quantitative chapter.

2.2.1 Eclectic theory (OLI paradigm) and its origin

Dunning (1976) created the OLI paradigm, which addressed the decisions of companies to invest abroad based on companies' ownership advantages, location advantages, and internalization advantages, hence the acronym. Its origins can be traced to monopolistic advantage theory, also known as the Hymer-Kindleberger Theory (1969). In this theory, the reason why firms invest abroad is that they can earn a higher return than the local firms. Since there are additional costs associated with producing in international markets, there must be some kind of advantage that cannot be obtained by local competitors. This advantage stems from the imperfect competition of goods and factors, internal and external economies of scale, and government limitations (market imperfections).[15]

Dunning's (1976) OLI paradigm successfully explained why a foreign-owned firm is able to compete with local firms in the host country. This theory was based on findings by Johnson (1970), Caves (1971), and Hirsch (1974), all of whom emphasized different sources of a firm's advantage.

Johnson (1970) highlighted the marginal product of education and managerial knowledge inherent to those firms that are able to introduce new techniques of production, giving them their competitive advantage and justification for entering and existing in a foreign market. Caves (1971) afforded several advantages to a multinational firm that established a subsidiary overseas. These

[15] Dunning (1995) segmented imperfect markets into those with structural market failure and those with natural market failure. In the former, participants in or outside the market distort supply and demand conditions, such as government regulations, tax rules, or other legislation relevant to FDI. Natural market failure refers to the difficulty of predicting the behavior of market participants, and includes information asymmetry, opportunism, and bounded rationality.

included economies of scale, brand differentiation, spillover effects from marketing activities, and/or its stock of superior information and experience versus local firms. It was these advantages, he argued, that allowed the foreign firm to overcome its liability of being foreign.

Hirsch (1974) advanced prior theories by developing a model of low-hierarchy entry modes, in which a foreign firm faced the choice of either exporting to another country or manufacturing in that country. He argued that different processes of production would take place where conditions were most suitable, i.e. if costs of knowledge creation, costs of marketing, or costs of exporting were higher than costs of manufacturing and marketing in the host country, the firm would choose to manufacture in the host country, with the idea that marketing costs in the home country would eventually decline as a result. In a multi-product firm, the result was that lower marketing costs would make products that the firm could not export or produce abroad more exportable in the future. Dunning (1976, 1997) blended these theoretical foundations in the OLI paradigm.

Buckley and Casson (1976) explained the rationale behind the existence of multinational enterprises (MNEs). According to them, an imperfect market increases transaction costs and if transaction costs are greater than the cost of internalization, the company will internalize. The importance of their theory is its explanation of the rapid growth of MNEs after World War II by internalization of the market for knowledge. The demand for research and development (R&D) and new knowledge increases while the cost of R&D decreases, therefore resulting in the need for large-scale R&D. Buckley and Casson (1976) posited that the benefits of internalizing knowledge were large and firms thus tended to internalize knowledge and/or R&D before creating an MNE. Their theory also served as one of the pillars for Dunning's OLI theory by focusing on internalization advantages.

Dunning's (1976) OLI paradigm (eclectic theory) provides a comprehensive and testable paradigm to study FDI. In general, it answers the question of why firms invest abroad. Ownership advantage explains who invests, location advantage explains where to invest, and internalization advantage explains how to invest. Ownership advantages may result from the exclusive or privileged possession of or access to particular income-generating assets. Location advantages refer to the beneficial attributes of a host country while internalization advantages refer to the benefits of adding value to assets through their hierarchical management, rather than by selling assets or rights to other firms. In sum, the OLI paradigm synthesizes several theories and can therefore explain various types of FDI.

2.2.2 Internalization theory

FDI has been conceptualized as a firm's response to advantages (e.g. Dunning, 1995). Early scholars, such as Caves (1971) and Hymer (1976) argue that firms that possess advantages invest abroad, while Dunning *et al*. (1977) add that countries with favorable resource endowments and geographical locations become sites of inbound FDI, and where there is market failure in the trade of a firm's proprietary knowledge, the recipient firm that internalized this knowledge will have an advantage (Buckley and Casson, 1976; Rugman 1981; Hennart, 1982). Where market failure, structural and/or natural, requires one (transferring) firm to give up knowledge free of charge, efficiency in knowledge exchange is compromised as the firm will stop transferring advanced technology/knowledge and become cautious towards the partner. Therefore, the internalization-advantage point of view within Dunning's OLI framework would assume that a firm is better off owning the production function (internalizing) if there is a high possibility that market agents would take advantage of the entrant's incomplete knowledge (information asymmetry) and if the firm cannot anticipate all possible future market transactions. As noted by Delios and Beamish (1996), the OLI paradigm melds these views. Location and internalization together with ownership advantages affect multinational companies' actions and patterns of FDI. With regard to the discussion of OLI and Hymer's (1976) thesis, Kogut and Zander (1993) note that the central issues with regard to FDI have been ownership advantages.

Likewise, Casson (1990), an internalization theorist, criticized Dunning's OLI paradigm for double meaning concerning 'ownership advantages'. He argued that ownership advantages were strongly related to internalization; therefore there was ambiguity. Dunning (1995), however, responded in a later paper arguing that ownership advantage was more – it included endogenous and exogenous factors and thus concerned itself with the firm's unique resources and competencies, he argued – a factor which is important in transaction cost theory (TC), particularly with regard to the transfer of intangible assets (e.g. tacit knowledge). The concept of knowledge transfer has been increasingly important with regard to the transfer of technology and managerial knowledge, which are central issues of this dissertation. The OLI paradigm as such has retained its relevance and forms an umbrella for other FDI theories, two of which – internalization and transaction cost theories - are most relevant to my dissertation.

2.2.3 Utility of internalization theory

Internalization theory provides an economic rationale for the existence of MNEs and their tendency to establish local operations to serve a foreign market.

The theory assumes that due to imperfect markets such as those outlined by Dunning (1995), a foreign firm is better off using internal structures rather than arm's length market intermediaries in the host country. A firm is thus better off owning the production function (internalizing) if a) there is a high possibility that market agents would take advantage of the entrant's incomplete knowledge (*information asymmetry*) and b) if the firm cannot anticipate all possible future market transactions.

Morck and Yeung (1991) make an important argument with regard to the transfer and acquisition of intangible assets. They posit that hierarchical entry modes should be chosen whenever a firm can increase its value by internalizing markets for certain intangible assets. These commonly include:

- Technological know-how
- Marketing ability
- Effective management

The above can be considered tacit knowledge, which is an intangible asset. Internalization theory assumes that intangible assets have some of the characteristics of public goods in that their value increases in direct proportion to the scale of the firm's market. Since these assets are based mostly on proprietary information, they cannot be exchanged at arm's length for reasons arising from the economics of information, also known as information asymmetry, bounded rationality, and economics of public goods (Morck and Yeung, 1992). They also find that there is no reason for a firm to expand internationally in the absence of acquirable intangible assets.

Caves (1989) attributed the lack of intangible assets by the foreign firm to the lack of a basis for utility maximization together with the presence of high transaction costs associated with new market entries. Likewise, Caves (1989) argued that utility from a market entry will be enhanced if intangible assets can be gained from the foreign partner; however, intangible assets are unlikely to be exchanged or processed effectively if either partner does not possess them. Therefore, the utility to be gained from any particular entry mode has to exceed the transaction costs associated with it.

In the early stages, internalization theory was concerned with discussing equity versus non-equity entry modes (Morck and Yeung, 1992; Tallman and Li, 1996). Non-equity entry modes included contractual arrangements such as exporting, licensing, franchising, distribution, technical contracts, and contractual joint ventures.

Non-equity entry modes were suitable where knowledge, skills, or technology were known exactly and future market transactions could be foreseen with relative certainty. As such, they were more suitable with regard to the transfer of explicit knowledge, i.e. knowledge that is codifiable in the form of manuals, rules, and patents.

Equity-based (hierarchical) entry modes, on the other hand, which include international joint ventures (IJVs) and wholly owned subsidiaries (WOS), were more useful with regard to knowledge transfer that could not be predicted with precision and which included high amounts of tacit knowledge that was subject to information uncertainty. These were difficult to fix contractually beforehand.[16]

Entry mode studies by internalization theorists concentrated on the choice between licensing and direct investment (Buckley and Casson, 1976, Rugman, 1982);

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[16] Tacit knowledge refers to that part of knowledge/technology transfer which is not codifiable, i.e. it cannot be put on paper and thus cannot be transferred through arm's length transactions. Tacit knowledge encompasses the "know-how" of doing things, and is thus an integral part of company culture (Hennart, 1988). Polanyi (1958) defines it as the intimate knowledge of local customs, market, politics, and people. Since tacit knowledge cannot be codified, its exchange/transfer thus relies on human contact and communication, instead of manuals and patents (e.g. Morck and Yeung, 1992; Kremic, 2003). It is therefore subject to information uncertainty which Hennart (1988) has described as:
"The buyer of knowledge cannot be told prior to the sale the exact characteristics of what he is buying. If the seller were to provide that information in order to educate the buyer on the value if know-how for sale, he would, by revealing the information, be transferring the know-how free of charge." (p. 365)

although other scholars began to concentrate on the question of level of ownership, specifically the choice between wholly-owned subsidiaries and joint ventures (Hennart, 1982). These and other studies in the internalization stream explained higher ownership levels as being a response to the need to protect firm-specific knowledge from unwanted dissemination, protecting which could result in higher transaction costs. Therefore, internalization theory stated that full ownership and control would be observed when a firm transferred unique, firm-specific knowledge to the host country when making foreign investments. Similarly, Hagedoorn and Narula (1996) argued that in industries with high R&D intensity, technology partnering agreements will be marked by the retention of high ownership levels by the technology transferor for reasons of organizational flexibility. Moreover, Japanese companies more frequently engage in equity arrangements as these arrangements offer a larger degree of control over technology sharing than non-equity partnerships (Hagedoorn and Narula, 1996). This is in line with findings by internalization theorists (e.g. Buckley and Casson, 1988; Dunning, 1995; Rugman, 1980).

Internalization theory is useful for providing an economic rationale for foreign companies to establish presence abroad. The theory is concerned with minimizing location-based disadvantages and imperfect markets, whereby it takes the general view that a foreign firm is better off using internal structures rather than arm's length market intermediaries in a host country. Generally, internalization theory takes the view that imperfect markets increase transaction costs and if the cost of arm's length market transactions is greater than the cost of internalization, the foreign company will internalize. Per internalization theory, a company is thus better off owning the production function as a result of imperfect markets arising from the difficulty of anticipating all future market transactions. The theory therefore addresses whether a foreign company should choose an equity-based mode or a non-equity-based entry mode. Internalization theorist's notable preference for wholly-owned entry modes to JVs, however, raises a problem with regard to knowledge-intensive industries and their resource commitment in the transfer of explicit and tacit knowledge. Resource commitment does not apply to the foreign firm unilaterally.

Although a fundamental tenet of internalization theory is the reduction of location-based disadvantages through the acquisition of local knowledge, the fundamental assumption of internalization theory is that the foreign firm will increase its resource commitment in the host country as location-based disadvantages diminish, or local knowledge is acquired through experience. The disadvantage, however, is precisely that the theory views knowledge acquisition as an inevitable process whereby experience is simply gained by being in the host country. It does not, for instance, view the sources of local knowledge as entities with their own motivations (i.e. bounded rationality), and thus does not address the interaction between the sources of local knowledge (e.g. local IJV partners) and the foreign entrant itself. The amount of local knowledge that the foreign firm is exposed to may depend on its ability to contribute its knowledge or other assets to the local subsidiary, including the JV partner. This is why internalization theory is not adequate in explaining entry mode choices within equity-based entry modes. Particularly where JVs are chosen as entry modes, it is not adequate to explain the level of control (e.g. level of foreign ownership). A significant disadvantage of internalization theory has thus been its limitation in explaining technology transfer in more knowledge-intensive industries with high levels of tacit knowledge, which has also been referred to in the literature as *asset specificity* (e.g. Delios and Beamish, 1997). It means that the asset has limited or no use if it leaves the firm which owns and understands it (e.g. Delios and Beamish, 1999; 1999; Dhanaraj and Beamish, 2003; Delios and Henisz, 2002). As such, the choice of control level within equity-based entry modes becomes important. It is difficult to explain a specific ownership structure from only an internalization theory perspective, however.[17]

2.2.4 Transaction cost (TC) theory

In transaction cost (TC) theory, the focus of entry modes shifted to equity participation, explaining the choice between JVs and WOS, and later ownership levels within JVs. The theory could address the transfer and internalization of tangible and intangible assets.[18]

Transaction cost theory is thus concerned with finding the most efficient structures under which to govern a specific set of transactions. Many studies have used ownership as a proxy for such governance. For example, Grossman and Hart (1986) have found that proprietary assets form the ownership advantage of the firm and that the level of ownership assumed in the foreign subsidiary "confers a proportional degree of control over the uses of firm-specific assets." (Grossman and Hart, 1986; Delios and Beamish, 1999). Delios and Beamish (1999) mention in their research on IJV ownership structures that the control and protection of proprietary assets is only one consideration in "structuring a foreign market entry," and that the need to acquire complementary assets is a key motivation behind the structure of

[17] For this dissertation, I want to establish at which ownership structure the most efficient transfer rate between sources of knowledge can thus occur. I distinguish between two types of knowledge: Explicit and tacit knowledge. Explicit knowledge is codifiable knowledge contained in patents, technical drawings, manuals, etc. Explicit knowledge can be transferred in both hierarchical and non-hierarchical entry modes. Tacit knowledge refers to company culture, values, management style, experience, and connections. Tacit knowledge is not codifiable in manuals or patents and can only be exchanged through human contact and communication. Therefore, the choice of a correct equity-based entry mode becomes critical, where the idea is that in lieu of an arm's length market transaction (i.e. a monetary transaction), a local partner's resource commitment (commitment to contribute intangible assets), including the local partner's, will depend on some other proxy - equity in the case of this dissertation. Assessing the value of knowledge becomes a critical issue.

[18] Tangible assets include land, machinery, factories, as well as explicit knowledge. Intangible assets include tacit knowledge, and those assets that are not tangible "objects", such as government connections, a large client base, or access to and knowledge of the market and suppliers.

ownership, moderated by endogenous and exogenous factors, such as the firm's international experience and the institutional environment in the host country.

Other transaction cost scholars such as Chan *et al.* (2006) view entry modes as organizational responses to imperfections in the goods, knowledge, and capital markets. Therefore, the ideas of transaction cost theory run parallel to those of internalization theory (e.g. Williamson, 1975; 1985). Accordingly, scholars writing on entry mode strategies (e.g. Anderson and Gatignon, 1986) and scholars writing on the theories of JVs based their ideas of transaction cost theory on previous work on internalization theory. Buckley and Casson (1976) and Hennart (1982) argue that firms make foreign investments to minimize market transaction costs by internalizing transactions other than cross-border "interdependent economic activities" (Chan *et al.*, 2006: 644).

2.2.5 Utility of transaction cost theory

Transaction cost theory can be applied to determining an efficient governance structure for a specific set of transactions. Chan *et al.* (2006) view foreign direct investment as an organizational response to imperfections in the goods, knowledge, and capital markets.

Studies on the theories of joint ventures (e.g. Beamish and Banks, 1987, Hennart, 1988, Kogut, 1988) and entry mode strategies (Anderson and Gatignon, 1986) combined the ideas of transaction cost theory with internalization theory. Previously, Buckley and Casson (1976) and Hennart (1982) had argued that firms make foreign investments to minimize market transaction costs by internalizing transactions and other cross-border "interdependent economic activities" (Chan *et al.*, 2006: 644). A problem that remains, however, is the choice of an optimum equity-based platform for such foreign investment.

Many theories exist as to the entry mode behavior of foreign companies, with consideration to nationality or culture (e.g. Delios and Beamish, 1999, 2001), experience in foreign market entries (e.g. Delios and Beamish, 1999, 2001; Buckley and Casson, 1976, 1996), industry (e.g. Chan *et al.*, 2006), and possession of ownership advantages, including those of the local partner. Likewise, scholars of trade theory, economic geography, and strategic management view foreign direct investment as a platform from which firms can gain access to location-specific assets including tangible assets such as raw material, labor, or knowledge, and other strategic assets owned by firms in the host country (Dunning, 1995). Such local assets can generate rents if combined with specific non-transferable intangible assets of the foreign firm such as technological and managerial know-how, international marketing expertise, and experience in foreign markets (Asiedu and Esfahani, 2001).

Other studies indicate that certain types of local assets are costly to obtain through market transactions – these are mainly intangible assets. For developing countries including China these will mostly include local market knowledge, access to the local market and suppliers, and government connections (e.g. Luo, 2001). Although experience in foreign market entries and experience accumulated over time in a foreign market (e.g. China) can mitigate the need for a local partner to provide these, the local partner's acquisition of knowledge and improvements in technologies in the same time period often leads to a renewed utility for the local partner with regard to technologies and new uses for intangible assets. These can include finding new suppliers, providing new market access and knowledge that was previously not required and potentially re-negotiating with government agencies as subsidiaries assume new and higher value-added projects such as research and development

(R&D) (Asiedu and Esfahani, 2001).

The cost of transacting intangible assets can be particularly high due to faulty ownership structures that do not, for example, address inadequacies in the institutional environment of the host country (Asiedu and Esfahani, 2001).[19]

In a later study, Buckley and Casson (1996) proposed that the rationale of joint ownership is that it allows both partner firms to acquire some of the benefits of internalizing knowledge flows without incurring the full set-up costs if they were to establish as WOS (p. 859).

In conceptual and empirical entry mode studies, however, transaction cost theory has been particularly useful in understanding the determination of ownership levels (e.g. Anderson and Gatignon, 1986; Gatignon and Anderson, 1988; Gomes-Casseres, 1989). Asiedu and Esfahani (2001) noted that in transaction cost theory of ownership structure the choice between sole and joint ownership depended on the benefits of avoiding costly arm's-length transactions relative to the costs of sharing ownership, which include impeded decision making, reduced incentives, and free riding by partners (p.648).

Gatignon and Anderson (1986) equated the amount of equity ownership to the amount of control a firm can exert over its subsidiary's operations. They consider control important as it provides the foreign parent with the ability to influence systems, methods, and decisions (Anderson and Gatignon, 1986), while Davidson (1982) remarks that control is a means to resolve disputes arising in the joint management of an enterprise.

Other research has implicated IJVs to be an important strategic tool to

[19] Grossman and Hart (1986) claim that ownership is purchasing control of "residual" rights – those rights that are difficult to define in advance in contracts and applicable to high-tech industries where product life cycles are short and development fast. This basic principle is applied in this dissertation.

overcome resource constraints at the time of foreign market entry, and a preferred tool to WOS when the cost of acquiring complementary assets on the market exceeds the cost of acquisition through joint venturing (e.g. Beamish and Delios, 1999).

With transaction cost theory, the focus shifted to equity participation that explained the choice between JVs and WOS first. A logical extension to the choice between sole ownership and shared ownership would be to determine optimum levels of shared ownership (within JVs). Transaction cost theorists viewed JVs as a better structure for the transfer of knowledge that was difficult to obtain through market transactions. Transfer of technology and knowledge can be used as a reference by which to determine optimal ownership structures.

Moreover, Beamish (1988) focused on the role of IJVs as a means of local knowledge acquisition by positing that some types of knowledge cannot be obtained through market transactions or experience accumulation. Such knowledge can be obtained through shared equity (e.g. IJVs). Therefore, ownership becomes a proxy for the exchange of knowledge, particularly tacit knowledge.

Beamish (1988) found that the need for a local firm is a significant factor that influences IJV performance. Makino and Delios (1996) remarked that this need became more pronounced when foreign firms operated in developing countries. Gomes-Casseres (1989) noted that access to information about the local environment was the main criterion for US companies to set up IJVs with local partners in environments where information was difficult to obtain and the infrastructure generally weak.

In a study of US-Japanese IJVs in the automotive industry, Inkpen (1992) found that US partners required the Japanese partner’s technological knowledge, while the Japanese partner required knowledge about how to operate locally. In addition, Nitsch *et al*. (1995) found in a study of Japanese companies with several alliances in Southeast Asia that access to local knowledge was the primary concern.

Firm experience and knowledge

The construct of firm experience and knowledge acquired from previous market entries abroad remains unclear despite previous studies on the topic (e.g. Makino and Delios, 1996). Local knowledge has been examined under the umbrella of local experience and generally quantified in the number of years that a foreign company has accumulated in a particular location (e.g. Makino and Delios, 1996). The acquisition of local knowledge through the accumulation of operational experience in the host country has also been considered to free a foreign firm from the need for a local partner (Makino and Delios, 1996). Within tacit knowledge, the amount of experience, however, has had an inconclusive effect on the choice of control with positive (e.g. Davidson, 1980; Gatignon and Anderson, 1988), negative (e.g. Stopford and Wells, 1972; Davidson and McFetridge, 1985), and neutral effects (e.g. Sharma and Johanson, 1987; Kogut and Singh, 1988). Erramilli (1991) provides a more conclusive explanation on the relationship between experience and control, in which he identified a U-shaped relationship. Unlike Erramilli's (1991) study, I seek to establish a relationship between ownership level (control) and the rate of technological progress that implies an efficient rate of knowledge exchange among the participants in the JV.

Hagedoorn and Narula (1996) argue that in industries with high R&D intensity, technology partnering agreements will be marked by the retention of high control (i.e. ownership levels) by the technology transferor to ensure organizational flexibility. Moreover, Hagedoorn and Narula (1996) point out that Japanese companies more frequently engage in equity arrangements as these offer a larger degree of control over technology sharing than non-equity partnerships.

2.2.6 Network theory

Another stream of research has focused on the MNC-centered network theory. Teece (1991), Bartlett and Ghoshal (1989), and Gupta and Govindarajan (1991) explain that an MNC is a network of capital, product, and knowledge transactions among units located in different countries. Root (1987) classifies entry mode strategies into three broad categories: export entry modes, contractual entry modes, and investment entry modes. Under network theory and Root's (1987) progressive framework of entry modes, export entry modes involve product flows from the home country to foreign markets. Contractual entry modes involve knowledge flows from corporate headquarters to foreign contractors/contractual partner. Investment entry modes are characterized by capital and knowledge flows from the parent company to foreign subsidiaries. The latter would resemble my approach to ownership levels within equity-based entry modes, even though I will not specifically use network theory.

2.2.7 Other factors relevant to theories on entry modes

Many studies exist as to the entry mode behavior of foreign companies that take into account moderating factors such as nationality (culture) (e.g. Delios and Beamish, 1999; 2001), experience in foreign market entries (Delios and Beamish, 1999, 2001; Buckley and Casson, 1976; 1996), a firm's industry (e.g. Chan *et al.*, 2006), and possession and interaction of tangible and intangible assets across borders (e.g. Inkpen and Beamish, 1997; Doukas *et al.*, 1999; Makino and Inkpen, 2003).

Other scholars view FDI as a means by which firms can gain access to location-specific assets including factor endowments such as raw material, labor, or knowledge, and strategic assets owned by other firms in the host country (Dunning, 1995). According to Dunning (1995), such local assets can generate rents if combined with specific non-transferable intangible assets of the foreign firm such as technological and managerial know-how, international marketing expertise, and experience with foreign markets (Asiedu and Esfahani, 2001).

Asiedu and Esfahani (2001) also argue that the cost of transacting intangible or knowledge-based assets is often high due to opportunistic behavior which stems from a lack of sufficient control mechanisms within the subsidiary as a result of unsuitable ownership structures. In addition, Asiedu and Esfahani (2001) point out that the cost of transacting intangible assets is high if ownership structures are not set correctly for a given subsidiary.

Ownership structures depend on the amount and type of tangible and intangible assets held by both equity partners. Several factors are important such as tacit knowledge (experience in foreign markets, innovativeness, connections) as well as tangible assets such as capital, technologies, and processes and other factors such as industry, firm size, and R&D intensity.

Buckley and Casson (1996) propose that the rationale for joint ownership is that both partner firms can acquire some of the benefits of internalizing knowledge flows without incurring the full setup costs had they established as WOS.

Gatignon and Anderson (1986) and Grossman and Hart (1986) relate the amount of equity ownership to the amount of control a firm can exert over its subsidiary's operations. Ownership is directly linked to the level of control, providing the foreign parent with the ability to influence systems, methods, and decisions (Gatignon and Anderson, 1986). Moreover, Davidson (1982) remarked that control/ownership is a means to resolve disputes arising from the joint management of a subsidiary.

Other research has implicated IJVs to be an important strategic tool to overcome resource constraints at the time of market entry, and a preferred tool to WOS when the cost of acquiring complementary assets through arm's length market transactions exceeds the cost of acquiring them through joint venturing (e.g. Delios and Beamish, 1999). I use transaction cost and internalization theories as the basic concepts from which I develop further quantitative models.

2.2.8 Existing entry mode models and transaction cost theory

While earlier entry mode models argue from a product differentiation perspective (Agarwal and Ramaswami, 1992), most subsequent entry mode models take a hierarchical view in which entry mode choice is a decision between low-control and high-control entry modes (Anderson and Gatignon, 1986).

In this thesis, I link control and ownership by setting ownership as proxy for control. Ownership is thus a purchase of residual control rights that cannot clearly be defined at the outset, and would therefore be expensive to obtain through arm's length transactions subsequently (Grossman and Hart, 1988).

Other models that extend entry mode choice to transaction cost factors (e.g. Buckley and Casson, 1981, 1996) are limited to choices within low-control entry modes (e.g. Buckley and Casson, 1981), although they extend their later model (1996) to include joint ventures as the next higher-control entry mode choice. Kim and Hwang (1992) find prior experience in market entry and interaction between subsidiaries in different countries to be the main factor behind subsequent entry mode decisions. Pan and Tse (2000) further specify the previous model with respect to entry mode choices within the low-control entry mode option (licensing and exporting) and high-control entry mode options (JV, WOS) based on transaction cost factors. Later entry mode models argue for control factors as motivators behind entry mode decisions (e.g. Pan and Tse, 2000; Chang and Rosenzweig, 2001).

Agarwal and Ramaswami's (1992) entry mode model determines a company's mode choice based on their asset specificity, size, and prior experience in foreign market entries. Companies with high asset specificity have a higher ability to develop differentiated products and are not likely to show preference for any *specific entry mode* (hierarchical context) in the absence of other variables. However, in the presence of institutional risk, these companies will choose sole ventures as they place a premium on control over valuable assets and skills (Agarwal and Ramaswami, 1992). Prior foreign market entry experience also increases a firm's propensity to choose a wholly owned mode of entry versus joint venture. In general, large firms will have more foreign market entry experience than small firms, and thus large companies are more likely to form sole enterprises. In the Japanese context this is moderated by supplier firms or firms that are part of a vertical keiretsu structure in that they will often follow the supplier to a similar location and cluster. Furthermore, as a result of clustering and knowledge pooling, smaller companies will tend to follow a similar entry path as the larger MNCs (Maitland *et al.*, 2005).

Additionally, Kim and Hwang's (1992) study identifies country risk, location unfamiliarity, demand uncertainty marked by industry growth rate and frequency of major technological changes, competition intensity (e.g. number of existing and potential competitors, instability of market share, fixed costs relative to value added), value of firm-specific know-how (e.g. international recognition of brand name, technological innovativeness), and the tacit nature of know-how as key variables in a firm's entry mode choice. Their model shows that wholly-owned subsidiaries place greatest importance on global synergies and the tacit nature of their know-how while location unfamiliarity will moderate the previous effects and result in a preference for lower-control entry modes through joint ventures.

Chang and Rosenzweig (2001) further advance the research on entry mode modeling by developing a sequential model of a firm's entry mode. Their model is a first construct in modeling sequential entry. They find that although transaction costs and cultural factors are important influences in the initial choice of entry mode, these factors tend to become less important as a firm accumulates experience in the host country and experience with specific entry modes. Thus, their study provides an important contribution of the effect of experience across entries over time (i.e. that firms learn from earlier entry modes). Their model analyzes sequential entries of high-tech companies into the US from 1975 to 1992 from Japan, the UK, and Scandinavian countries. Since their study is based on empirical data, their model does not include details about the strategic motivations behind entry mode choice, and thus does not mention whether firms set up joint ventures with the intention to acquire them later and continue as sole enterprises. Chang and Rosenzweig (2001) also do not include data on performance either at the firm or industry level, and thus do not explain whether companies chose entry modes successfully. In this dissertation I seek to close this gap by applying a productivity-based model.

2.3 Joint ventures vs. wholly-owned subsidiaries: transaction cost and internalization perspectives

Hymer (1976), Makino and Delios (1996), and Buckley and Casson (1996) stress that a local joint venture partner is an immediate source of locally-relevant knowledge and "provides other valuable resources such as capital, technology, customers, and employees." On the other hand, the fit between contributed assets and complementary assets has been identified by Yan (1999) and Delios and Beamish (1999, 2001) as a significant constraint on the productivity and survival of joint ventures. Accordingly, Delios and Beamish (1999) have conducted an empirical investigation into the relative importance of three factors – transactional, experiential, and institutional – on the ownership strategies of Japanese companies on nine countries in East and Southeast Asia, in which they stipulated the percentage of equity holding within Japanese subsidiaries at the time of market entry. Delios and Beamish (1999) argue that the topic of ownership levels has received "scant attention in the empirical literature" despite the leading position of Japanese firms as foreign investor in Asian countries (UNCTAD, 1996). In all, studies by Gatignon and Anderson (1988), Gomes-Casseres (1989) and Hennart (1991) have empirically examined ownership strategies of non-Japanese firms outside their home countries from a transaction cost-based approach to ownership levels in foreign subsidiaries. Delios and Beamish (1999) extended those studies to Japanese companies' ownership levels in Asian countries using a transaction cost approach.

Further research (e.g. Lu and Beamish, 2006) advances previous transaction cost approaches in several ways. Experience and tacit knowledge brought to a new subsidiary depend on how they were gained – whether the foreign firm had obtained these intangible assets through IJVs, WOS, or a combination of both in previous foreign market entries. Different experiences let the firm develop country-specific and collaborative know-how such as identifying and selecting potential IJV partners and the ability to negotiate the terms and structure of a collaborative agreement, knowledge in monitoring the JV partner and knowledge of when and how to exit collaborations (Simonin, 1999). Greater IJV-specific host country experience should result in improved subsidiary performance and lower transaction costs in future IJV set ups (e.g. Simonin, 1999; Lu and Beamish, 2006).

Their research, however, raises two questions: First, what are transaction costs and how can they be measured? Second, how can subsequent effects of acquiring intangible assets on the subsidiary be measured?

Hymer (1976) notes that the cost of acquiring complementary assets can be considerable, but "once acquired it is a as a fixed cost and need not be incurred again." His view is static and does not take the effects of learning and subsequent changes in knowledge and capabilities into account. The transaction of tacit knowledge that is non-static (and the transaction of intangible assets), however, is important in assessing/estimating further transaction costs. Therefore, a suitable proxy for transaction costs under circumstances where intangible assets are transacted in non-arm's length transactions is needed.

2.3.1 Further considerations regarding non-arm's length transactions

Non-arm's length transactions are transactions that do not take place on the open market and where no exchange of money is involved in order to transact assets. Therefore, the value of transactions is difficult to quantify. For WOS, transactions are simpler. Without a local IJV partner, WOS need to obtain the assets they do not already possess through arm's length transactions; therefore, transaction costs are easier to quantify. For example, if a WOS does not possess an intangible asset, such as experience necessary to operate in the host country, knowledge of its market or economy, or connections to key people or institutions, a WOS will need to 'purchase' that knowledge by hiring the relevant people. In an IJV, however, this knowledge can often be acquired without the need for arm's length transactions (e.g. hiring), since the local partner's knowledge can be tapped. It does not mean, however, that such knowledge comes free of charge (i.e. free of transaction cost). Bounded rationality, opportunism, or simply irrelevant knowledge can lead to indirect costs. It is therefore difficult to assign a monetary value to such costs. What *can* be done, however, is to minimize transaction costs through an indirect measure. An indirect quantitative measure would be embodied in a performance-related variable, such as residual growth in productivity (due to technology and knowledge flows) for the subsidiary which would depend on ownership as the transaction value. Different approaches to performance are discussed subsequently.

Since ownership is control (Grossman and Hart, 1987), it can also be assumed that partner behavior can be controlled through the right choice of ownership. The partner wants to obtain certain complementary assets, and ownership can be a tool to control the motivation of the local partner. If ownership for the local partner is too little, the local partner will be less motivated to contribute its knowledge, *guanxi*, etc. to the IJV. The Japanese partner may lose some trust in the local partner and become more cautious in its contributions to the IJV. Consequently, implementation of new knowledge would decline, which would affect the value of the technology/knowledge-based productivity growth variable.

In this dissertation, knowledge is viewed as non-static. Effects of learning can result in changing perceptions as to the need for complementary knowledge and therefore affect the value of complementary knowledge or assets. In other words, a higher level of knowledge by the local partner will make it more valuable to the Japanese partner. The local partner could become a potential higher value-added partner such as supplier of components or an R&D participant. This would require an adjustment to the value of the medium of exchange (i.e. ownership) for new knowledge and complementary assets. An efficient transaction of those assets would result in higher technology/knowledge-based productivity growth. Accordingly, in addition to knowledge, ownership should also be viewed as non-static, and subject to change according to the perceived value of tacit knowledge and other intangible assets to each partner over time as a result of learning effects.

To summarize, ownership is used as a proxy for the price or cost of transacting complementary assets in non-arm's length transactions. The second measure - technology/knowledge-based productivity growth - is used to quantify the performance of a transaction and therefore validates the cost of the transaction (i.e. ownership). In other words, technology/knowledge-based productivity growth can establish whether the cost of the transaction is high, medium, or low relative to what is being transacted; and thus whether a transaction is worth proceeding with.

2.3.2 Hierarchical (equity-based) alliance formation

Alliances have been suggested as one important means of overcoming resource and capability constraints and enhancing the likelihood of success for internationalizing firms (Jarillo, 1989; Zacharakis, 1997; Beamish, 1994). Prior research on alliances points to several benefits including minimization of transaction costs, increased market power, shared risks and better access to key resources – both tangible and intangible – such as capital and information (Kogut, 1988; Lu and Beamish, 2001). Therefore, entering into alliances and having access to alliance partners' resources offers a potentially efficient way to overcome resource and capability constraints.

While the correct entry mode and ownership structure need to be chosen at the time of entry, the ownership structure also needs to reflect future contributions and knowledge gain by each partner if knowledge is considered to be non-static (Gupta and Govindarajam, 1991; Kremic, 2003).

Each partner's share should thus reflect the amount of its resource contribution. However, goal misalignment may occur if the partner's ownership share does not reflect its real value or contribution to the joint venture or the other partner's goals. Ownership share therefore needs to be calibrated in order to align interests among joint venture partners.

The further literature review will discuss existing literature on specific entry modes and ownership strategies with respect to joint ventures and introduce the concept of knowledge flow and capability building in the context of developing countries such as China.

2.3.3 Ownership and measures of performance in the literature

Existing business literature has referred to different measures in order to establish the performance of joint ventures and frequently expressed them in terms of financial performance (e.g. Makino and Beamish, 1998), instability or survival rates (e.g. Barkema and Vermeulen, 1997; Makino and Beamish, 1998). Productivity measures were used as an extension of the former (e.g. Chen, 2002). Kogut and Zander (1996) measured the growth rate of IJVs in terms of employee numbers. Other studies have used profitability and productivity as proxies (e.g. Delios and Beamish, 2001; Buckley and Casson, 1996).

Scholars that have analyzed both performance and ownership include Hamel and Prahalad (1989), Calof (1993), Makino and Delios (1996), and Delios and

Beamish (1996), and Lu and Beamish (2006). However, their studies have not accounted for the effects of knowledge transfer on performance – in other words, they have not considered that part of productivity of an equity-based subsidiary that is due to the transfer of tangible and intangible assets. I will start by reviewing the literature on performance-related measures and their influence on ownership.

2.3.3.1 Performance and financial measures

The transfer of complementary assets has been examined in the context of ownership/entry mode choice and a subsidiary's performance - measured by financial measures (e.g. profitability, sales), survival rates (instability), knowledge and technology spillovers (learning), and productivity. Earlier entry mode studies used a variety of financial indicators typically employed in business research. These included profitability, growth rates of sales, and cost structures (or lower costs) (e.g. Lecraw, 1984; Hamel and Prahalad, 1989; Calof, 1993; Makino and Delios, 1996). Later studies measured performance in terms of subsidiary survival rates and duration of joint ventures (e.g. Killing, 1983; Kogut, 1988; Yan, 1999), while Delios and Beamish (2001) examine performance from perspectives of IJV survival and profitability relative to a subsidiary's (IJV's) host country and entry mode experience. More recent studies have shown that the likelihood of a firm's entry into a market is influenced by external and internal factors and previous decisions of related firms, such as those within the same business group (keiretsu) or supplier companies (Martin *et al.*, 1998; Chan *et al.*, 2006), extending research done previously (e.g. Delios and Beamish, 2001) with respect to different types of experience on subsidiary performance.

Lecraw (1984) discusses the profitability of subsidiaries under a structure-performance framework in which structure refers to the structure of tangible assets of the firm such as capital, physical and human assets in relation to financial performance. Lecraw's (1984) study is an extension of Caves' (1980) study, which was one of the earliest studies to combine transaction cost and internalization theories in explaining a subsidiary's financial performance.

Delios and Beamish (1997) discuss internal and external factors as transactional, institutional, and experience influences on the foreign partner's equity share within an IJV. Further discussion points they mention include dependence on the local partner's complementary assets and asset specificity. The former will require the foreign partner to give a greater equity share to the local IJV partner. The latter, however, will positively influence the foreign partner's ownership choice. Asset specificity with regard to the IJV as an integrated unit and resulting ownership division has rarely been discussed in the literature. Asset specificity as a component of the tacit knowledge of a company will therefore be discussed in the section on sequential entry modes, which also covers arguments for why an IJV should continue to revise ownership structures after entry.

In a further study, Delios and Beamish (2001) extend subsidiary profitability as a performance measure to include subsidiary termination rates, or survival, as a measure of a subsidiary's performance relative to its intangible assets and entry mode choice. An important intangible asset, experience is partitioned into host country and entry mode experience. As for the former, Delios and Beamish (2001) find that in IJVs, the level of a firm's host country experience has no influence on profitability although it has strong influence on IJV survival. As for the latter, they find that experience with a particular entry mode has a positive effect on both profitability and IJV survival. Host country experience therefore appears to remove the liability of foreignness and lower transaction costs for new intangible assets (Hymer, 1976; Delios and Beamish, 2001).

Lu and Beamish (2001) discuss the effects of hierarchical and non-hierarchical entry mode choice on the financial performance (profitability) of Japanese SMEs that either decided to either export or to invest in another country. They argue that higher FDI and alliance formation with local partners helps overcome deficiencies in resources and capabilities (tangible and intangible assets) in the initial entry mode choice. Likewise, higher FDI results in higher subsidiary profitability while low FDI levels result in declining financial performance. However, the relationship between FDI and performance is nonlinear. Performance increased when the number of FDI countries exceeded five, before which the relationship was negative.

Lu and Beamish's (2001) results are also limited by the time frame of the study which was conducted during a period when the yen experienced sharp appreciation (1986-1996), which has resulted in Japanese exports becoming less competitive from a price perspective. From the viewpoint of profitability, they suggest Japanese companies may have been inclined to choose IJVs. Moreover, they find alliances raise financial performance (profitability) by helping the foreign firm overcome resource constraints with regard to local knowledge. With regard to new foreign markets, they further argue that companies face two liabilities (i.e. shortages or mismatch of tacit knowledge) – one of being foreign and one of being establishing a new business. In the former liability, significant differences between foreign markets means that the knowledge a company has developed by operating in its home country and other countries may not be suited to the new market. Therefore, new knowledge and capabilities need to be acquired. In the latter, a new subsidiary faces the additional burdens that any new company would face, i.e. establishing new business relationships, legitimacy, and recruiting staff (Barringer and Greening, 1998), while negotiating political and other risks (Delios and Henisz, 2000).

Hamel and Prahalad (1989) discuss the importance of the concept of interest alignment. They claim that financial performance depends on the incentives that stakeholders have within the organization to provide background information, including tacit knowledge, which is key to an organization's performance. They address that a "sense of reciprocal responsibility is crucial because competitiveness ultimately depends on the pace at which a company embeds new advantages deep within its organization, not on its stock of advantages…" (p. 69) They further argue that direct costs are not an indicator of how well costs are perceived to be distributed so that stakeholders feel motivated to give their maximum contribution. In a sense, their argument addresses the problem of bounded rationality. If extended to a subsidiary level, one can argue that performance depends on the extent to which knowledge is given the chance to be dispersed and subsequently internalized. Accordingly, I use ownership as a tool to adjust the extent to which knowledge is given the chance to be dispersed.

Calof (1993) provides a performance-based entry mode model based on sales performance for 38 Canadian companies in developed countries. He discusses sequential entry modes and mode adjustments from lower hierarchy to the next higher hierarchy (control) entry mode as a type of entry mode adjustment. His example includes switches from low-control modes such as exporting to establishing sales subsidiaries and joint ventures to wholly-owned subsidiaries. Although his study addresses ownership structures based on a performance measure, it has shortcomings with regard to the performance measure (sales do not equal profits) and sample size.

As an earlier work, however, it does take into account the importance of learning effects of the parent company, which is the justification for the subsequent next higher-control entry mode. However, his work is constrained by its small sample size and limitation to entry modes in developed countries, where the required sets of know-how and tacit knowledge and other complementary assets are likely to differ from those in developing countries (Makino and Delios, 1996).

Makino and Delios (1996) measure the financial performance in 558 Japanese IJVs in East and Southeast Asia. They find that the relevance of the local partner declines as the Japanese partner gains experience in the host country, to the point where the local partner becomes a liability to the Japanese company. Although their study addresses the learning effects of the parent company, and is therefore non-static with regard to knowledge, it still fails to consider the learning effects of the local partner. Although IJVs' financial performance declined in their study, it could also mean that ownership structures did not reflect the change in knowledge accumulation by both partners meaning that declining performance could be due to inappropriate ownership structures.

2.3.3.2 Performance and productivity-based measures

A study by Buckley and Casson (1981) is one of the first to use productivity-based (efficiency-seeking) measures as proxies for subsidiary performance. They use the financial measures of net present value of an investment to determine whether to choose low-control entry modes (exporting or licensing) or higher-control entry modes (IJVs) and whether to switch entry modes subsequently. Due to the objective of maximizing an investment's net present value (NPV), their model implies (optimal) timing strategies for entry modes and subsequent adjustments.

In extending Buckley and Casson's (1981) study, Kogut (1988) later defined NPV as the quotient of the sum of cash flows, learning, and joint production and the interest rate plus one. It is in a sense a measure of productivity-based performance. Their study suggests that foreign investments with high technological intensity will take longer to reach their full net present value; however, their net present value will also take longer to decline, which could affect entry mode choice.

Buckley and Casson (1996) provide a model for joint venture selection versus lower-control types of entry modes. Their model addresses the conditions under which the most efficient transfer of knowledge and its internalization can be achieved. They divide knowledge sought by both partners as either technology or marketing knowledge. Each partner is valuable to the other for these sets of assets, either separate or in combination. Interaction among explanatory factors is then explained. These factors include market size, technological change, cultural distance, economies of scale, and technological uncertainty, all of which affect entry mode choice. Moreover, these factors can have different effects on the sets of knowledge combinations being exchanged. We will review these in a later section. Nonetheless, in terms of performance-based measures, their model is one of the first (and only) models to use the concept of productivity, which they view as the efficient transfer of tacit knowledge and its related sets of tangible and intangible assets (technology, technological knowledge, marketing knowledge). However, they link knowledge absorption with profitability only conceptually without using quantitative data.

There is a significant amount of literature on domestic spillovers of tacit knowledge that has resulted in new R&D (Kremic, 1993; 2003). This has been extended to examining international spillovers between manufacturing in pairs of countries (e.g. Bernstein, 1996). Kokko (1992) and Dunning (1993) conducted related studies with regard to the effects of multinational enterprises on host country firms. They examined whether sectoral productivity was positively related with the share of foreign ownership, given other variables. (Caves, 1974; Blomstrom, 1989; Kokko, 1992). These studies are generally cross-sectional and relate to labor productivity in manufacturing. Beyond labor productivity, a study by Haddad and Harrison (1993) did not produce conclusive results for the effects of non-arm's length transactions (FDI) on total factor productivity, a version of which will be used in this dissertation.

Jefferson *et al.* (2000) conducted a study on state-owned enterprises (SOEs) in the manufacturing industry in China. Their study established that productivity offers a more reliable gauge of long-term industrial performance than profitability, particularly in transition economies. It further established that a rise in SOE productivity raises SOE profitability, which in itself is an important result because it means that productivity growth measures entail higher profitability, which makes my productivity growth measure directly relevant to companies. Their finding supports my model indirectly when the assumption that firms try to minimize costs and maximize profitability is made. Jefferson *et al.* (2000) also found that SOEs may enhance the profitability of established producers by assuming complementary roles as suppliers or subcontractors if their productivity increases. In the context of China, however, Jefferson *et al.*'s (2000) findings indicate weak labor and capital productivity growth in SOEs. As for ownership, their findings remain inconclusive due to frequent entry mode conversions (ownership conversions) and high exit rates of SOEs in the early 1990s, to which their data is limited. Importantly, they suggest that "until it becomes possible to track the performance of fixed samples of firms in different ownership categories, we cannot eliminate the possibility that enterprise conversions may have influenced our comparison of productivity differences over time and across ownership groups." (Jefferson *et al*., 2000) This is a gap that I partially try to fill with time-series data on Japanese manufacturing subsidiaries in China, a majority among which are Sino-Japanese equity IJVs.

Important to my model of efficiency transaction processes is also the fact that the authors' model directly links labor and capital productivity to subsidiary performance and productivity increases by the local partner. The basic assumption of their model is similar to my model.

Perkins (1996) conducted a study on SOEs as potential IJV partners in China. They found foreign ownership – either as JV or WFOE - to be highly significant in explaining the growth of labor productivity versus domestic enterprises. In terms of methods, Perkins' (1996) study is closest to the methods chosen in this dissertation; they measure a (residual) type of productivity growth that is due to technological progress. My dissertation further seeks to refine the results of the ownership levels at which highest knowledge spillovers and technological progress will occur.

Wei *et al.* (2002) examine the influence of ownership and control on the profitability of state-owned enterprises (SOEs) in China. They found moderating effects of SOEs as IJV partners on profitability, which is closely linked to the partial measure of capital productivity in our model. Moreover, they found that profitability took on average six to seven years to occur. They argue that state allocation and involvement negatively affects resource allocation and human resource management.

Hejazi and Safarian (1999) measured performance in terms of knowledge and R&D spillovers in arm's length and non-arm's length transactions. In terms of total factor productivity, they find that technological/knowledge spillovers will be larger through subsidiary-based production and equity-based entry modes rather than through trade. While they discuss total factor productivity, their study only distinguishes between hierarchical and non-hierarchical entry modes and does not address ownership choices within hierarchical entry modes.

Similar to Makino and Delios (1996), Petersen *et al.* (2000) build on profitability as an indication of subsidiary performance and discuss subsequent strategies to dissolve or integrate with the foreign partner. Their discussion includes both low-control and high-control entry modes. Profitability is used as a measure to decide on and revise entry modes, including adjustments to lower and higher-control modes. Their study is one of the first to consider entry mode flexibility by accounting for changing circumstances through learning and relationship building between alliance partners.

2.3.3.3 Effects of structural market failure (government interference) on ownership and productivity growth

Evidence of a general labor and capital productivity slowdown may to some extent imply constraints on foreign ownership due to legal, financial, and regulatory systems. In other words, a subsidiary may not be free to choose ownership structures based on which ownership structure will yield highest performance. The foreign company could thus end up with ownership that is too low or too high. This is in line with Delios and Henisz' (2000) findings which claim that a foreign company will limit its ownership if the potential for structural failure is perceived to be high (i.e. high government interference, public expropriation hazards).

Blomstrom and Sjoholm (1999) argue that a significant factor influencing productivity due to technology diffusion between foreign and local companies is ownership structure. Their study also mentions public expropriation hazards, whereby governments recognize the causality of technology spillovers and ownership and therefore restrict foreign ownership with the expectation that there will be more technology learning/diffusion if the local partner has more control. Delios and Henisz (2000), however, find opposite influences of public expropriation hazards on ownership compared to private expropriation hazards. Therefore, if foreign companies perceive a risk of losing proprietary knowledge to a local partner, they may refuse to set up a subsidiary or, with regard to our study, transfer less advanced or older technologies.

The rate of technology-based productivity growth can also give an indication of the appropriateness of the technologies introduced, which may also include older technologies initially. Where technology or knowledge gaps are large, transferring older technologies may even produce higher learning rates in the beginning, and therefore initially contribute to high technology/knowledge-based productivity growth (Rai, 2004) because the local partner can process knowledge at the lower level faster. However, continued non-upgrading of older technologies would eventually lead to a decline in technology/knowledge-based productivity growth due to diminishing marginal returns. Technology/knowledge-based productivity growth can therefore also implicate subsidiaries that lack renewal of technology or production processes (innovation). However, since other factors can also lead to low technology/knowledge-based productivity growth, reasons can only be confirmed qualitatively.

The authors also note a positive link between ownership and control over profits, which provides a greater incentive to transfer technology and management skills to subsidiaries. However, their view of control is slanted towards the owner of technology, while they do not address how ownership affects all participants in the IJV, including the minority owner, and that motivation for the local partner to contribute complementary assets may therefore depend on its ownership share as well (Blomstrom and Sjoholm, 1999), lending further weight to my argument that an appropriate ownership structure for optimum levels of knowledge exchange may be below full ownership. Therefore, without an optimum ownership structure the foreign firm may not be able to obtain the partner's local knowledge, as a result of which transaction costs could rise since technology would be transferred without getting intangible assets in return. Moreover, limited cooperation by the partner may compromise the ability of the foreign firm to make judgments regarding the suitability of technologies, processes, and knowledge transferred (Perkins, 1996). Their study finds that diminishing returns to scale cause labor productivity to decline over time, further implying that only where new skills were introduced could labor productivity remain constant or increase.

2.3.3.4 Performance and subsidiary survival

Instability/survival (performance): The lifespan of IJVs has also been considered a performance measure by several scholars. Woodcock *et al.* (1994), Hymer (1976) and Lu and Beamish (2001) attribute initial low performance during the early stages of an IJV to the liability of foreignness. Therefore, this finding, when combined with the findings by Delios and Beamish (2001), who argued for a decline in performance after seven years, and likely IJV termination after 10 years, effectively leaves an IJV with a financially productive lifespan of four years in the worst case and seven years in the best case out of ten years.

Additionally, Buckley and Casson (1996) find that in the interest of JV performance (productivity), the effective lifespan of JVs is not expected to be very long. In fact, their study shows that a long JV lifetime indicates strategic errors on the part of management, and that ownership adjustment to that of a wholly owned enterprise would have been preferable instead. Their study also notes that firms that engage in a series of short-lived JVs may experience productivity gains due to flexibility under conditions of rapid technological change (Buckley and Casson, 1996). Therefore, these findings are similar to those by Makino and Delios (1996) and Delios and Beamish (2001) in that they confirm the findings regarding the limited productive lifespan of IJVs.

2.3.3.5 Other factors affecting entry mode and performance

Subsidiary performance and thus entry mode choice can be affected by endogenous and exogenous (internal/external) factors. Exogenous factors can include market imperfections such as structural market failure (e.g. Dunning, 1997), which affects entry mode choice but is moderated by internal factors such as a firm's experience in foreign market entries, for instance. I will first discuss internal and external factors separately and follow with a discussion on their interaction.

2.3.3.5.1 Company-internal factors in relation to technology/knowledge-based productivity growth

Tacit knowledge and technology/knowledge-based productivity growth

Tacit knowledge forms the largest part of a technology intensive firm's intangible assets and thus internal factors (Gupta and Govindarajam, 1991; Kremic, 2003). A joint venture partner with less sophisticated technologies can still contribute tacit knowledge even in the early stages after setup in the form of knowledge about the local culture, work ethic/suitable company culture, and valuable connections that can help an IJV operate smoothly, raise productivity, and reduce transaction costs. Equity-based entry modes allow for contact with tacit knowledge and thus allow it to be exchanged effectively which arm's length transactions would not accomplish (e.g. Daellenbach and Davenport, 2004).

Oliver (1992) and Chan *et al.* (2006) note that firms "make normatively rational choices" in entry mode decisions based on intangible factors and social justification. Therefore, tacit knowledge plays a critical part in a firm's entry mode and ownership choice abroad.

Tacit knowledge also affects productivity in the subsidiary (Buckley and Casson, 1996). Joint ventures are formed on the understanding that both partners contribute what is needed to achieve a common objective. While neither partner is likely to supply all its knowledge, neither partner will actively attempt to restrict the contribution of knowledge necessary to achieve an immediate objective, such as solving a technical or other problems (Kremic, 2003). Buckley and Casson (1996) argue that shared-equity arrangements provide mutual insurance to the partners where they are not only unsure about their partner's competence, but about their own competence as well, particularly in new markets. The need for such mutual insurance - a local partner - would be moderated proportionately to the foreign partner's experience in the host country or other foreign markets. Interestingly, Buckley and Casson (1996) also note that if each partner knew exactly what it was capable of and had a full understanding of the requirements of the project, it would be able to "specify exactly what it required from its partner" and thus would be fully clear what it should supply itself (Buckley and Casson, 1996). A possible inference one can draw from this finding is that arm's length and non-arm's length transactions would both result in the acquisition of the needed skills in a scenario of full knowledge. Therefore, the more uncertain the two partners are about the relevance of their expertise relative to the contributed process, product, or technology, the greater the uncertainty of specifying exactly what is required of the partner to complement one's own skills, which complicates the process of assessing the value of the complementary knowledge for both partner. In the former, the foreign partner does not know exactly what knowledge is being bought from the local partner, since the information sought may already be known, obsolete, or inappropriate. In the latter (as the seller of knowledge), the foreign partner may find it difficult to assess the cost of the transfer due to technical or human problems that may arise.

In this regard, hierarchical entry modes are particularly useful in controlling buyer's and seller's uncertainty, which particularly the foreign partner faces and risks as the owner of proprietary knowledge and technologies. Therefore, the risk of agreeing to supply a specific skill through arm's-length transactions will be greater (Buckley and Casson, 1996). The mutual insurance to each partner through the entry mode of JVs, however, will only work if the other partner can be trusted to make an appropriate response (Casson, 1991), and the appropriate response can be influenced through the appropriate equity share (e.g. Buckley and Casson, 1996). Therefore, knowledge transfer within equity-calibrated limits of information uncertainty is key to reducing transaction costs and enhancing productivity. Daellenbach and Davenport's (2004) study reinforces the link between equity, trust, and performance within subsidiaries. Without mutual trust, the productivity of a JV is likely to be limited as transaction costs rise due to inefficiencies caused by distrust and the higher cost of protection of proprietary knowledge and technology.

Experience and technology/knowledge-based productivity growth

Delios and Henisz (2000) suggest that the degree of ownership is positively influenced by factors such as firm experience and the presence of other firms in the location and moderated by partner capabilities and local institutional constraints, such as structural market failure (e.g. political hazards). In terms of performance, Delios and Beamish (2001) further show that the foreign firm's likelihood of survival and degree of profitability will depend on its possession of experience and knowledge of the host country. Experience is usually acquired over time and frequency of foreign market entries (e.g. Johanson and Vahlne, 1977; Delios and Beamish, 2001). The level of experience can also be indirectly and immediately raised by acquiring it through a local partner firm at the time of market entry through equity involvement (e.g. Inkpen and Beamish, 1997; Delios and Beamish, 2001). In addition, Chang (1995) notes that a higher degree of experience (an intangible asset) upon market entry compensates for a foreign company's lack of the cultural, political, and economic understanding of the host country, and should therefore lead to higher productivity in a shorter time as well as a higher ownership share for the foreign partner.

Another consideration in IJV performance has been the effect of a firm's accumulated experience in equity-based entry modes, including WOS, on its new shared-equity subsidiaries. For example, Hannan and Freeman (1984) and Baum and Ingram (1998) found that firms with extensive networks of hierarchical subsidiaries will be likely to replicate organizational procedures, routines, and structures in newly-formed JVs. Again, firms that frequently chose WOS in the past will sometimes choose JVs due to lower transaction costs or to compensate for factors such as political or economic uncertainties (UNCTAD, 1996). Greve (1999) and Lu and Beamish (2006) also note that strategies that have been successfully implemented in WOS are transferable and will similarly enhance IJV performance. Thus, prior WOS experience will positively affect IJV performance.

Tallman and Li (1996) also found support that financial performance is positively related to and linearly related to the degree of experience in foreign hierarchical market entries. Studies by Grant (1988) and Geringer and Hebert (1989) support these findings by establishing strong links between firm performance and its experience in foreign markets, although Ramaswami (1993) finds only limited links. The idea behind the prior discussion of experience accumulation is to show the likely existence of a link between the accumulation of the stock of tacit knowledge (i.e. intangible assets) gained in prior equity-based entry modes and their positive influence on the utility gained from future equity-based entry modes.

2.3.3.5.2 Company-external factors in relation to technology/knowledge-based productivity growth

More recent research (e.g. Guillen, 2002; Chan *et al.*, 2006) has emphasized the perspective of (tacit knowledge and intangible assets) as sociological factors and their facilitating (legitimizing) effects on entry mode decisions. However, firms tend to replicate their previous investment decisions subject to external factors such as government restrictions (i.e. structural market failure). Firms with less experience are also likely to imitate the entry mode choices of those firms that operate in the same market as DiMaggio and Powell (1983), Scott (2001), and Delios and Henisz (2000) have shown. Furthermore, Delios and Henisz (2001) find that such entry mode replication occurs more frequently when Japanese companies establish foreign subsidiaries. The likelihood of a Japanese company’s entry mode into a foreign market is strongly influenced by the entry modes of other Japanese companies in the vicinity, particularly where a main company is being followed as an entry mode example.

2.3.3.5.3 Interaction between internal and external factors

Fagre and Wells (1982) talk about the interaction between a firm's internal factors and outside forces. The choice of entry mode that would be made in the absence of external factors such as government pressure would depend entirely on firm-internal factors. Firm-internal factors are made up of both tangible factors (e.g. technology, capital) and intangible factors (e.g. product diversity/differentiation, market access, know-how). Fagre and Wells (1982) used government interference (institutional environment) and the degree of competition in an industry as external factors that would limit a foreign firm's bargaining power in choosing a desired ownership level. Government influence was used as a moderating factor on ownership choice in later studies (e.g. Luo, 2000, 2002). A foreign firm's ability to secure a desired ownership level would thus depend on its bargaining power which is influenced by the presence of the internal and external factors mentioned.

Buckley and Casson (1998) further argue that joint ventures are useful when costs of learning by experience, building trust, acquiring an intermediate output market and technologies through arm's length transactions are higher than internalizing them.

2.4 Sequential entry modes and their relevance to the discussion of ownership adjustment

Prior research has evaluated sequential entry modes in terms of resource commitment and the level of entry mode hierarchy in JVs and WOS (i.e. low hierarchy entry modes to the next higher hierarchy level of entry mode). The earliest sequential entry mode studies, most notably the Uppsala School (i.e. Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1977), focused on resource commitment, which grows incrementally as knowledge is gained. As early studies on sequential entry modes, the Uppsala school segments increased resource commitment into activities that a foreign firm undertakes. Accordingly, a foreign firm will first engage in export activities which are then upgraded to sales subsidiaries followed by manufacturing subsidiaries as new knowledge is gained. In a wider sense, this could be extended to higher value-added activities in the present context. Several studies have followed the Uppsala School; for instance, studies that have discussed sequences in which a firm exports and then upgrades its activities by setting up a sales subsidiary or adding a production subsidiary in the host country include those by Kogut (1983) and Kogut and Chang (1991). Chang (1995) extended prior research by focusing on firms that add lines of business to their local subsidiaries that have built strong local organizations/subsidiaries, adding that Japanese firms sequentially enter markets where they have a stronger competitive advantage to reduce the risk of failure.

Further research on sequential entry modes has largely followed the concept that higher-control entry modes are chosen as subsequent entry modes where an IJV remains successful (i.e. it is not terminated for reasons of business failure). Whereas the Uppsala School argued from the point of view of resource commitment, later studies have argued from the point of view of entry mode hierarchies.

Buckley and Casson (1996) follow where early studies focused on switching from low-control to higher-control entry modes (e.g. JV to WOS). For hierarchical entry modes, Benito and Welch (1994) argue that a firm’s commitment to a foreign market tends to increase over time and that a firm will choose higher-level hierarchy entry modes with time. Later research by Vanhonacker and Pan (1997) and Pan and Tse (2000) specifies the prior findings by arguing that subsequent types of entry modes, such as JV followed by WOS, depend more on firm-internal factors such as higher R&D intensity - as a result of the successful transfer of tacit knowledge. The above review necessitates a further discussion of entry mode adjustment.

2.5 Entry mode adjustments and performance

Anderson and Gatignon (1986) explain that entry mode is a tradeoff between control and cost of resource commitment with effects on a subsidiary's long-term productivity. Their research thus concerns the question of the circumstances under which a particular entry mode is the most efficient choice in the long term with regard to the tradeoff between risk and return. High-control, equity-based entry modes offer higher returns along with higher risk, whereas low-control entry modes minimize risk (Anderson and Gatignon, 1986). With regard to a partner's complementary assets, their study makes an early attempt in explaining the degree of ownership by arguing that products involving a high degree of tacit knowledge require a higher degree of control, However, where products mature, less control, hence ownership, should be sought. As for the learning process by the local partner, which requires time, transferring a greater degree of control to the local partner could thus be productivity-enhancing.

Studies extending the impact of the tradeoff between control/ownership and resources on performance were further developed by Hoang and Rothaermel (2005) and Knudsen and Stieglitz (2007). Pan and Tse (2000) create a hierarchical model of entry modes, explaining that the first decision firms face is the choice between hierarchical and non-hierarchical entry modes. Within hierarchical entry modes, they then face the choice between JVs and WOS. Their study then segments joint ventures into three categories, namely those that are minority-owned, 50%-owned by both sides, and majority-owned. They find that the choice within equity-based entry modes depends largely on firm-internal factors, while only the choice between non-equity and equity-based entry modes is more dependent on outside factors such as government influence or cultural factors. As for the choice within equity-based entry modes, however, Pan and Tse (2000) found less support for industry and host country factors as influences. Prior studies such as Benito and Gripsrud (1992) found a correlation between firm-external factors, subsequent ownership choice, and performance. Firm-internal factors, and their influence on subsequent entry mode choice and ownership adjustment resulting from firm-internal performance, however, have remained largely under-discussed.

Within hierarchical (equity-based view) sequential entry modes, Lu and Beamish (2006) found that prior collaboration through equity-based partnerships would increase experience levels and thus future IJV performance through absorption of tacit knowledge. However, Hoang and Rothaermel (2005) argue that the experience and knowledge gained from partners will eventually become subject to diminishing returns, following which IJV performance will decline. To compensate for diminishing returns on existing quantities of knowledge, higher value-added knowledge must be sought (Rothaermel and Deeds, 2004; Hoang and Rothaermel, 2005). Knudsen and Stieglitz (2007) suggest transacting new and higher value-added knowledge through incremental adjustment of equity control in their framework of knowledge exploitation. They use equity ownership as a proxy for refining resource choice configurations between joint venture partners and that more control over input factors given to the joint venture partner could facilitate obtaining them. For the majority owner, relinquishing some equity ownership enables it to simplify the search for new knowledge, both of which will lead to higher organizational performance as long as some randomness in performance outcomes is accepted (Knudsen and Stieglitz, 2007).

With regard to the productive lifespan of JVs, Buckley and Casson (1996) note that JVs may experience productivity gains due to higher flexibility under conditions of technological change that require new knowledge and skills at faster rates. With respect to my argument about ownership as a medium for the exchange of complementary assets, more ownership should thus be offered to the joint venture partner if higher value-added knowledge or contributions are sought.

From the perspective of firm-internal factors, Chang and Rosenzweig (2001) further advance the research on entry mode modeling by developing a sequential model of a firm's entry mode. Their model is a first construct in modeling sequential entry modes and finds that despite higher transaction costs due to factors such as cultural differences, their impact on transaction costs tends to decline as a firm accumulates experience in foreign market entries – which is possible through either frequent market entries across different countries or the length of time spent in one country. Based on their findings that firms learn and accumulate experience from earlier entry modes or an extended presence in one country, their choice of entry mode will also vary. For the case that a subsidiary spends a long time in one country, this means ownership adjustment would take place (Chang and Rosenzweig, 2001). The shortcoming of their model/theory is that they do not include data on performance or data that could be linked to lower transaction costs due to the increased experience in the host country.

The common finding among sequential entry mode studies, however, has been that successive entry modes will follow a pattern of greater commitment to the host country owing to higher levels of knowledge and experience gained over time. Although prior studies have been able to explain sequential entry modes within a resource commitment framework and thus the increasing sophistication of activities in the host country market, and other studies between non-equity and equity-based entry modes, little research exists on sequential entry modes within equity-based entry modes themselves.

This dissertation addresses the gap by arguing that ownership adjustment is needed over time in order to ensure the most efficient transfer of assets. I chose high-tech industries because they have a high component of tacit knowledge (Kremic, 1993).

In the first instance, my dissertation argues from a similar perspective in that learning in its larger sense (i.e. experience gain, building connections) is a non-static process that both partners are subject to and that can change the nature of assets required from either joint venture partner. In the second instance, I argue that the learning process calls for a continuous re-assessment of ownership structures, which may require adjusting ownership structures in either direction.

2.6 Knowledge as a dynamic concept

This section will introduce the concept of knowledge transfer and resulting changes in levels of knowledge. In other words, the section explains the importance of viewing knowledge as a dynamic concept (knowledge dynamism) rather than a static concept. Knowledge dynamism is then discussed with respect to ownership levels, which, as a result, necessitate a dynamic view as well.

2.6.1 Dynamic view of knowledge and ownership

Spender (1996) mentioned that "knowledge is not an immutable reality… it is a diagnostic and explanatory probe, a method for unpacking the complexity of the evolved quasi-objects… Its purpose is to help us see how individual creativity interacts with the background collective knowledge that gives each system its meaning and identity." (Spender, 1996: 58) Therefore, my argument closely follows Spender's (1996) and previous research by Polanyi (1959) in that new capabilities require new sets of knowledge, which are applied from individual learning to absorption within the organization. The simple diagram below shows the relationship between knowledge in the individual and organizational contexts:

Table 2.1: Different types of organizational knowledge

	Individual level	**Organization level**
Explicit knowledge	*Conscious*	*Objectified*
Implicit knowledge (tacit)	*Automatic*	*Collective*

Source: Spender (1996)

The above table highlights that organizational knowledge is an amalgamation of various individual sources of knowledge, which, after adjustment of ownership, can be internalized by the subsidiary more productively. Importantly, the beneficiary of knowledge transfer is the entire subsidiary - not only the technology-seeking (local) partner.

According to Bresman *et al.* (1999), technology and knowledge transfer in the beginning stages tends to be from the technology owner to the local IJV partner, while in later stages reciprocal (two-way) knowledge transfer occurs, during which more tacit knowledge is transferred.

2.6.2 Shared ownership and knowledge transfer

The dynamic view of knowledge acquisition posits that the mutual acquisition of tacit and explicit knowledge is important. For example, the local partner may, through capabilities acquired from the Japanese partner, become a potential supplier to the IJV, or the local IJV partner may have the knowledge to source other local suppliers, an option that Japanese companies in China are increasingly utilizing. A concept for acquiring such tacit knowledge most efficiently (at minimal transaction cost) is developed and applied through data in the quantitative chapter.

Knowledge has come to be regarded as a key asset of employees, their ability to readily acquire and use it a core competence (e.g. Kremic, 2003). From the organizational point of view, creating and sharing new knowledge is crucial for innovation processes (Nonaka and Takeuchi, 1995; Ayas, 1996; Poell *et al.*, 2000).

The prior literature review has discussed the importance of ownership structures in transferring knowledge effectively.

There are several issues that warrant a discussion of knowledge transfer with regard to its absorption by the partner and its internalization within the subsidiary. Tacit knowledge in particular, eventually needs to be absorbed by the subsidiary in order to result in higher productivity; otherwise only its transaction costs are incurred without benefit.

2.6.3 Absorptive capacities

On the recipient's side, the transfer of knowledge depends on the recipient's ability to absorb such. In many cases the learning capacities of the Chinese partner will be lower than what can be absorbed from the transferring/foreign partner (Kremic, 2003). This ultimately lowers productivity that is dependent upon the foreign partner's new technologies and knowledge. In the short term, the asymmetry in learning capacities does not affect the foreign partner or IJV negatively. A gap in learning capacities between foreign and local partner benefits the foreign partner initially with respect to knowledge acquisition from the local partner. Kremic (2003) suggests that the Chinese partner will still offer its complementary assets in return for the knowledge, technologies, and capital received from the foreign (Japanese) partner even without fully understanding the foreign (Japanese) partner's new technologies and knowledge. Kremic (2003) also posits that the partner with the more advanced technology will internalize new knowledge from its local IJV partner at a faster rate than the local partner to whom technology is being transferred. In the initial stages of an IJV, the utility from the knowledge of the local (Chinese) partner will be greater to the foreign (Japanese) partner than vice versa, until the local (Chinese) partner catches up with the foreign (Japanese) partner's new technology. Regardless of the aforementioned relationship, however, the marginal benefit to the foreign partner of the knowledge contributed by the local partner will eventually decrease, while the marginal benefit to the local partner from the foreign partner will increase as the local partner absorbs the foreign partner's knowledge at a greater rate with improvement in the local partner's learning capacities. However, the local partner's learning capacities will reach a peak after which the marginal benefit of having a foreign partner will also decline. To reverse this process, innovation from the newly internalized knowledge must take place within the subsidiary (Kremic, 1993; 2003).

For the transfer of tacit knowledge, Kremic (2003) suggests a three-phase model, beginning with specificity and technical precision (know-how), to a higher level of skill (know-why), to the third phase of knowledge creation (innovation), a result of which would/could be R&D. The third stage is signifies high productivity levels as a result of the transfer of and internalization of explicit and tacit knowledge. A table is provided below.

Table 2.2: Phases of technology transfer and learning process

	Phase I: Specificity and technical precision (know-how)	Phase II: Higher level of skill: generality and depth (know-why)	Phase III: Depth (Creating) (R&D)
Type of information transferred	Transfer of explicit knowledge	Transfer of tacit (implicit) knowledge	Integration of explicit and tacit knowledge
Organizational skills to be acquired by recipient	*1. Specific production skills based on manuals and training; some learning-by-doing and/or learning-by-using*	*1. Higher level of technological skills through internalization/absorption of explicit knowledge* *2. Integration of technology and organization through initial absorption of tacit knowledge*	*1. Flexibility in problem solving* *2. Knowledge Creation*
Main technological skills to be acquired by recipient	*1. Production Capabilities*	*1. Production Efficiency* *2. Higher rates of knowledge processing*	*1. Conducting R&D for new product and/or production processes* *2. Innovation resulting in new products and/or production processes*

Source: Kremic (2003) and own compilation of various sources

With regard to the amount of knowledge transfer, Gupta and Govindarajam (1991) previously noted that the desire for knowledge has served as a behavioral tool for locally hired managers to share their expertise with the subsidiary. Gupta and Govindarajam's (1991) argument implies that the type of knowledge is a motivator for obtaining and sharing knowledge. This dissertation additionally argues that ownership structure is a tool to control the transfer of knowledge. However, they also recognize that hierarchical entry modes serve to internalize knowledge transfer - in line with prior research by Caves (1982), Hymer (1976), and Teece (1976).

Gupta and Govindarajam's (1991) research thus focuses on the volume and relevance of knowledge flows and transactions within organizations and find that knowledge flows will be greater between partners where knowledge and technology gaps are large; in other words, where the subsidiary is located in a developing country.

Gupta and Govindarajam (1991) further define subsidiary-internal knowledge flows as either expertise (e.g. skills and capabilities) or external market data of strategic value (e.g. information or knowledge about customers, competitors, and suppliers). They further segment expertise into input processes (e.g. purchasing skills), throughput processes (e.g. product designs and/or process designs) or output processes (e.g. marketing know-how, distribution expertise). For this dissertation, the terms 'knowledge' or 'intangible assets' broadly refer to what Gupta and Govindarajam (1991) defined as *throughput* or *output* processes.

Extending the above framework of the phases of *technology transfer and learning process* (see Table 2.2), Gupta and Govindarajam (1991) further propose a framework of subsidiaries with regard to their roles as processors and creators of knowledge relative to the knowledge supplied by the parent company. As such, subsidiaries have the capability to create high and low outflows of knowledge, but are constrained in their autonomy by the parent company. The table below summarizes the role of subsidiaries relative to inflows and outflows of knowledge.

Table 2.3: Knowledge flows-based framework

Outflow of knowledge from the subsidiary (to the parent company)	**High**	*Global Innovator*	*Integrated Player*
	Low	*Local Innovator*	*Implementor*
		Low	High
	Inflow of knowledge to the subsidiary from the parent company		

Source: Gupta and Govindarajam (1991)

Ultimately, subsidiaries can take on the role of innovator by becoming creators of new knowledge, products, or processes, having processed transferred knowledge from the parent company, subject to the autonomy of the subsidiary from the parent company. Gupta and Govindarajam (1991) argue that the need for autonomy will be higher the higher the subsidiary's knowledge creation (innovation) is. With regard to Japanese subsidiaries in China, however, knowledge creation is constrained due to high involvement and control by the parent company and Japanese subsidiaries' arguably lower degree of autonomy and higher involvement by the Japanese headquarters in decision-making. According to Gupta & and Govindarajam's model, such subsidiaries would thus be unlikely to go beyond the role of 'integrated player' or 'local innovator'. With regard to Kremic's (1993; 2003) framework, Phase II is unlikely to be exceeded since a high degree of tacit knowledge is required for innovation to take place. Low subsidiary technology/knowledge-based productivity growth may ultimately signal that tacit knowledge has not been fully internalized.

Poell *et al.* (2000) state that learning has become more important to the survival of organizations in recent years and resulted in changes in the structural shape of subsidiaries. Their learning-network theory explains what happens between people as they interact socially, but not what takes place inside a person's mind (i.e. bounded rationality, opportunism) (Poell *et al.*, 2000). Negative effects of opportunism and bounded rationality can be controlled through the adjustment of ownership structures.

Poell *et al.* (2000) divide learning networks into several types, which link back to the prior discussion on the knowledge processing and creation. Similarly, the amount and content of knowledge acquired depends on the degree of involvement by the parent company resulting roughly in liberal, vertical, horizontal, and external learning networks that result in liberal, regulative, integrative, and inspiring learning styles, respectively (Van Der Krogt, 1995, 1998; Poell *et al.*, 2000). Poell *et al.* (2000) further argue that the transfer of tacit knowledge is best achieved under conditions where the content structure of learning is organization or problem oriented and learning climate integrative, which are usually found within horizontal organizational structures. The table below summarizes the most important points.

Table 2.4: Learning networks

Learning networks				
	Liberal	**Vertical**	**Horizontal**	**External**
Learning structures (content structure)	*Unstructured (individually oriented)*	*Structured (task/function oriented)*	*Open or thematic (organization or problem oriented)*	*Methodical (profession oriented)*
Organizational structure (relations)	*Loosely coupled (contractual)*	*Centralized (formalized)*	*Horizontal (egalitarian)*	*Externally directed (professional)*
Learning climate	*Liberal*	*Regulative*	*Integrative*	*Inspiring*

Source: Adapted from Van Der Krogt (1995, 1998) and Poell et al. (2000)

The categories that apply to equity-based entry modes, however, will fall mostly within the centralized, horizontal, or externally directed organizational type of structure. Among Sino-Japanese IJVs, organizational structure will mostly be centralized and to a smaller extent horizontal (Poell *et al.*, 2000, own fieldwork). With respect to the transfer of tacit knowledge, formalized organizational structures – or those under significantly constrained autonomy – may thus not the most conducive structures for the transfer of tacit knowledge.

To connect Gupta and Govindarajam's (1991) and Poell *et al.*'s (2000) frameworks, the former's assessment that for knowledge transfer to have been productive, knowledge creation should result in high outflows of knowledge from the subsidiary. Poell *et al.* (2000) attribute formalized and egalitarian (vertical and horizontal) learning networks, respectively, to result in the largest amounts of knowledge processing, albeit with explicit and tacit knowledge largely separated. Thus, while in their framework vertical networks are best suited to the transfer of explicit knowledge, horizontal structures are better suited for the transfer of tacit knowledge. As an extension to Poell *et al.*'s (2000) argument, organizations/subsidiaries should adopt horizontal structures in order to become what Gupta and Govindarajam (1991) have termed 'global innovators' or where more knowledge is created relative to knowledge inflows. Unlike Gupta and Govindarajam's (1991) framework, Poell *et al.*'s (2000) framework discusses adjustments in the learning structures of organizations and subsidiaries.

When linked to my argument of knowledge transfer as dependent on control or ownership, horizontal (egalitarian) structures would be better reflected through ownership structures that reflect or attest to the contribution of knowledge outflow by each partner. A partner with little equity will have little incentive to share or produce visible knowledge, while a partner with unjustifiably high ownership relative to its contribution could be seen as an obstacle by the other partner, inhibiting the absorption and processing of new knowledge and/or technology. A dynamic view of knowledge and learning should thus also coincide with a dynamic view of subsidiary ownership.

This dissertation extends findings on technology and knowledge transfer and shared ownership by arguing that within the context of China, it is precisely the IJV form of entry mode that enables the foreign company to obtain necessary intangible assets, namely tacit knowledge from the local partner most efficiently, enabling the IJV to engage in higher-value added activities in its later life stages with the help of ownership adjustment. The main question the quantitative chapter further addresses is the ownership structure at the time of entry and subsequently during later stages of Japanese-Chinese IJVs in China as new knowledge and technologies are acquired and internalized. In the setup of the quantitative chapter, both ownership and knowledge have been viewed as dynamic.

An important issue I will address in the next chapter concerns specific ownership structures that should be chosen at the time of entry and subsequently during the lifetime of Japanese high-tech subsidiaries in China with respect to optimizing productivity growth achieving through mutual knowledge and technology transfer. Due to the difficulty of predicting the knowledge that will be required, I follow Grossman and Hart's (1986) argument that ownership is a purchase of the control of these "residual rights". Ownership therefore controls their exchange.

2.7 Status of existing research

The literature review has shown a significant divide between business research methods and econometric methodologies when it comes to performance measurement. While the former concentrates on measures such as financial indicators, longevity of subsidiaries, and productivity growth to the extent that tangible measures are reflected (i.e. financial performance), the latter offers methods to measure the tacit element of productivity growth. An important consideration in the transfer of high technologies is their high degree of tacit knowledge and asset specificity. In other words, asset specificity - a term frequently used in business research - refers to the degree to which an asset cannot be separated from its owner, otherwise it is of little use; therefore, the term asset specificity refers to the presence of high degrees of tacit knowledge, but quantitative tools to measure such tacit knowledge and the latter's role in productivity growth have not found adequate application in business research. The quantitative part therefore utilizes econometric tools. The issue with the literature in economics has been its lack in going beyond the highly theoretical and conceptual and has therefore been lacking in specific applications using data in its models. The quantitative chapter seeks to remedy these issues as its fundamental contribution.

Specifically, the quantitative chapter will focus on these key points:

a) Performance and productivity-based measures, namely their residual values. Therefore, measures will be provided regarding productivity growth due to new technology and knowledge implemented. These incorporate the effects of structural market failure as discussed in section 2.3.3.3. The resulting effect on ownership structures is considered. In other words, regression analyses will discuss the relationship between technology/knowledge-based productivity growth and ownership structures using panel data of approximately 1,800 hierarchical Japanese subsidiaries in China. Where relationships are found, further ownership structures are calculated with respect to technology/knowledge-based productivity growth and time.

b) Further data analysis is conducted on relevant factors such as employee structures, ratio of Japanese staff to Chinese staff, etc.

c) Subsidiary survival rates are put into direct perspective with technology/knowledge-based productivity growth. As a result, the data analysis will establish a methodological connection between technology/knowledge-based productivity growth and potential adjustments in ownership structures and/or relevant factors such as employee structures.

d) The use of panel data in the next chapter is also useful in accounting for the dynamic nature of knowledge as discussed in this literature review.

3. Important concepts for consideration in quantitative analysis

This chapter is the first of two main parts in this dissertation to show quantitatively that variations within shared ownership with Chinese partner firms should be the entry mode of choice in subsidiary formation for Japanese high-tech companies in China. The qualitative part is the fourth chapter and will relate the applicability of the quantitative findings of this chapter to actual examples of Japanese subsidiaries in China through case studies.

I will discuss the concept of productivity growth due to technology and knowledge transfer in greater detail before developing the quantitative model. Productivity growth and ownership structures are also linked before variables are developed and applied in the quantitative model. One of the results of this chapter is specific amounts of ownership with regard to optimizing productivity growth within Japanese subsidiaries in the high-tech industry in China.

3.1 Review of concepts

The following sections will review the role of ownership with respect to productivity within other studies by introducing the variable of ownership in more specifically in different roles. The usage of ownership as dependent and independent variable is reviewed. Moreover, ownership is discussed from uni-dimensional and multidimensional perspectives, i.e. from the perspectives of the owner of technology, and all stakeholders, respectively. Other controlling factors are also reviewed in greater detail before they are used in the quantitative analysis. These are technological aspects that include technological knowledge, learning ability, and skill levels.

3.1.1 Productivity and ownership

Several studies have been conducted on ownership and productivity. Studies on a micro-economic level have tended to remain conceptual due to the difficulty of access to large-scale company or subsidiary-level data, particularly panel (time-series) data. Other studies have tended to remain industry-based or sector-based, such as private and state ownership. Therefore, most studies which have employed a productivity growth concept (e.g. Total Factor Productivity - TFP) have tended to analyze industry-level or country-level data.

A highly relevant study with regard to firm-level data, however, is by Fukao *et al*. (2005). They have included micro-level firm panel data of both foreign and domestically-owned companies in Japan's manufacturing sector over a seven-year period and conducted a TFP analysis. Their sample size was 236, and their findings have indicated that foreign-owned companies' technology-based productivity was about 8% higher, while the growth rate of technology-based productivity also exceeded that of domestic enterprises. Their data showed that foreign-owned companies showed higher R&D intensity as indicated by the expenditure on R&D per worker and had a higher capital per worker ratio. Interestingly, Fukao *et al*. (2005) found that foreign-owned companies had significantly lower growth rates of tangible assets, which shows that foreign-owned companies rely much more on the exchange of knowledge-based assets.

Their study also showed that local companies that were later acquired by foreign companies had higher technology-based productivity growth rates. While Fukao *et al*.'s (2005) study is thematically and methodologically closely linked to my thesis, their study leaves several significant issues unaddressed, and ignores the issue of knowledge as being non-static. Shortcomings comprise the non-addressing of the origin of foreign firms; ownership levels at both the time of entry, acquisition, and later lifespan; presence of foreign employees in the subsidiaries as well as experience in the present market or foreign market entries. My dataset includes these variables or their proxy variables.

Several studies have already considered ownership and its effects on technology-based productivity in more detail. For instance, Blomstrom and Sjoholm (1999) have found that majority ownership allows the subsidiary to receive more sophisticated technologies from the parent firm. Jefferson *et al.* (2000) on the other hand have suggested that minority ownership allows the local partner greater contact with technologies and therefore helps technology diffusion, barring large technological or knowledge gaps. Similarly, Dougherty and Guckin (2001) point out that value-added activities in Chinese SOEs tend to rise when partnering with a foreign firm due to technology and knowledge spillovers, which therefore raises the overall technology-induced productivity for the IJV. Their study, however, is conceptual and not nationality-specific. I will first review those studies that treated the issue of ownership and technology-based productivity.

Blomstrom and Sjoholm (1999) approach the problem of productivity growth from the perspective of technological spillover effects by MNCs entering a foreign market where their market entrance distorts the existing local market equilibrium. Local companies are then forced to react in order to protect their market share. Nonetheless, the authors argue that these effects have had a positive influence on local firms with respect to absorption of new technologies. Where technological gaps were too large, however, the authors found a moderating effect on productivity because of the "limited scope for learning" by the local partner.

Their study, however, leaves several issues unanswered. First, they merely present a statistical proof that productivity is compromised due to the local partner's limited absorption capacities. Second, they do not discuss or provide a framework for such absorption capacities.

On the other hand, the importance of their contribution is that productivity growth is linked to technological capabilities. Importantly, they discuss attempts to separate these technological capabilities from labor and capital-induced productivity. Implicitly, the result of the discussion had they taken their research further could be considered a type of technological progress. This is exactly where my research continues and in that their paper lays a conceptual foundation for my quantitative analysis. I further unlink technological progress from progress due to manual labor and capital accumulation. In this sense, my thesis utilizes the technology-linked productivity method, which is where their paper left off.

Importantly, Blomstrom and Sjoholm (1999) make a case for equity-based (hierarchical) IJVs by arguing that hierarchical IJVs facilitate knowledge spillovers by pooling their proprietary assets. However, other research has strongly criticized this fact as a liability of joint ventures (e.g. Mowery *et al.*, 1996, Inkpen and Dinur, 1998).

Perkins (1996) found that ownership was highly significant in explaining growth in total factor productivity (TFP). His study uses firm-level data of 3,000 foreign and domestic companies in China including Sino-foreign IJVs, WOSs, SOEs, collectives and township enterprises over a period from 1980 to 1994. He found that productivity growth was much higher in firms with a non-state partner, and that the ability to retain control, or keep majority ownership had a positive effect on labor productivity. Among the subsidiaries surveyed, IJVs and WOSs in China recorded the highest productivity growth. However, there was no clear distinction between IJVs and WOSs in terms of technology-based productivity growth, which challenges their previous hypothesis that higher ownership levels equal more control and therefore higher technology and knowledge transfer rates.

Wei *et al*. (2002) tested the relationship between ownership and productivity growth in state-owned enterprises, domestic non-state-owned enterprises, and foreign-owned enterprises. Wei *et al*.'s (2002) findings indicate, expectedly, that SOEs experience lower productivity growth than domestic non-SOEs and foreign-owned enterprises.

For foreign-owned enterprises, however, the findings were more unexpected. Wei *et al*. (2002) found their productivity growth to be lower than some domestic non-SOEs, but attributed it to the initial lack of knowledge of foreign-owned companies, which impacts productivity growth negatively. IJVs tended to outperform WOSs on productivity growth, which the authors attributed to the local partners' sharing of intangible assets, including tacit knowledge, connections, and access to the local market, thereby enhancing IJV productivity. Wei *et al*.'s (2002) study was groundbreaking in that it linked the long-term contribution of the local partner's intangible assets to the productivity growth of the subsidiary, therefore solidifying the argument that a local partner is indeed necessary. As such, Wei *et al*.'s (2002) research extends Perkins' (1996) and Blomstrom and Sjoholm's (1999) studies: with regard to the former, that productivity indeed depends on ownership and with regard to the latter – that state ownership and foreign ownership should be split so as to achieve higher productivity rates.

Moreover, Wei *et al*.'s (2002) study supports Perkins' (1996) findings by emphasizing that in the short-term productivity levels in foreign-owned subsidiaries tend to be low but in the long-term, they tend to be higher than in any other form of domestically-owned enterprise. In Wei *et al*.'s (2002) study, subsidiaries in high value-added industries such as electronics, precision machinery, and chemical industries tended to achieve the highest productivity growth levels.

However, the previous studies do not address conditions under which productivity rates can be raised or address any specific ownership structures between foreign and Chinese IJV partners.

3.1.2 Other factors in relation to productivity

Griffith (1999) addresses the problem of parent nationality, ownership, and productivity in high-tech manufacturing IJVs on the example of the UK as the host country. His findings indicate that foreign-owned subsidiaries are more productive and have greater unit output per worker than domestic firms. In fact, one can find support for simple productivity-related performance measures since the works of Gerschenkron (1962) and Nelson and Phelps (1966), who argued that differences in technological knowledge and ability across countries have been seen as possible sources of differences in productivity levels. Thus, Dunning's (1988) eclectic theory, and its concept of ownership advantages, could also apply to productivity-related measures (e.g. Dunning, 1988; Brouthers *et al*., 1996; Madhok, 1996). Griffith (1999) specified his findings into output per worker and value-added per worker and found differences in nationalities regarding value-added per worker. Certain nationalities, such as US and German-owned IJVs in the UK had higher value-added per worker than did French-owned IJVs. His study, however, did not include any Japanese IJV partners.

With respect to emerging economies, scholars have found that non-transparency, high discretionary powers of officials, opaque legislation, and weak enforcement of intellectual property rights (IPR) can alter the relationship between productivity rates and ownership. Several studies have argued that foreign ownership has a positive effect on productivity in high value-added manufacturing industries (e.g. Delios and Beamish, 1999; Li *et al.*, 2002; Asiedu and Esfahani, 2001).

Studies have thus far not identified to which extent foreign ownership in high value-added industries has resulted in higher levels of technology-based productivity growth and therefore lower transaction costs.

Prior work on productivity has identified the relationship between ownership and productivity growth to the extent that foreign ownership raises productivity in the long term within both the subsidiary and the foreign partner company. Productivity rates may be low in the short term due to the liability of being foreign (e.g. Delios and Beamish, 1996). Further work (e.g. Oulton, 1998; Moon and Lado, 2000) has shown that productivity is higher in industries that have a high value-added component. These subsidiaries are often found in the electronics, precision-mechanical, and chemical industries. Studies have also shown that in these industries IJVs occasionally exhibit higher technology-induced productivity than WOSs, although causes and reasons have not been discussed. Several studies have addressed the utility of a local partner and inferred a link between tacit knowledge spillovers from the local to the foreign partner which may impact productivity in the long term (Perkins, 1996; Griffith, 1999; Wei *et al*., 2002).

In support of the previous studies, Okamoto and Sjoholm's (2000) study of the automotive industry in Indonesia indicates that majority foreign-owned subsidiaries tend to display higher technology-induced productivity than locally-owned firms. Therefore, I expect majority foreign ownership to be essential for technology transfer. Further quantitative analysis will seek to find ownership combinations within Japanese majority ownership for the specific case of Sino-Japanese high-tech joint ventures by linking their technology/knowledge-induced productivity growth to ownership levels.

In so doing, I take Okamoto and Sjoholm's (2000) study and methodology further by using panel data for a much longer period (17 years) and conducting regression analyses. Importantly, the above studies have only shown links between minority and majority ownership. They have not addressed variations within majority ownership.

3.1.3 Technological aspects: knowledge and skills

It has been noted in IJV literature that complementary needs create interpartner fit which is expected to generate a synergistic effect on IJV performance (Buckley and Casson, 1988). However, complementariness is not likely to materialize unless a certain level of skills is already in place (Luo, 2000). Chinese partners in IJVs generally seek technological, innovational, and managerial skills from foreign partners (e.g. Luo, 2000). The success of an IJV's local operations and expansion in this market will largely depend upon its local partner's learning capability, or its ability to acquire, assimilate, integrate, and exploit knowledge and skills. The firm's ability to process, integrate, and deploy an inflow of new knowledge and skills closely depends on how these relate to the skills already established. This skill base is expected to influence strategic and organizational fit between IJV partners, which in turn influence the IJV's accomplishment in financial goals in both short and long term, as well as higher knowledge transfer and internalization of new skills and technology in the long term (Luo, 2000). In this way, Luo (2000) argues will the Chinese partner's learning ability contribute to the

IJV's profitability, sales growth, and productivity. For example, one of Fujitsu's IJV partners in northern China, the Zhonghuan Group, has high R&D intensity and employs one of the largest numbers of engineers in China's semiconductor industry. These skills have fundamentally contributed to its superior learning capabilities (Luo, 2000).

In further research, Yan and Luo (2001) argue that the initial use of a large local workforce and the reliance on Chinese managers in the IJV's management functions can be critical in the beginning phases of an IJV. If the local partner is an active participant in management and not a silent partner, the local partner will likely be responsible for recruiting the workforce and will largely be involved in managing it since the local partner is likely to have more knowledge on how to manage local workers. Several general managers have reported key contributions such as recruiting, appraisal, and reprimanding of Chinese workers to be key contributions of their local partners because differences between Japan and China were perceived to be too significant.

Where Japanese managers managed Chinese workers directly, higher staff turnover was reported, which weighed on the respective subsidiary's technology and knowledge-induced productivity growth values. Japanese managers also acknowledged that they did not fully understand how to recruit effectively or design effective job advertisements to recruit local workers, and admitted that the local partner was useful for this task. Moreover, the use of a local partner in recruitment, human resource management (HRM), and direct supervision activities gave credibility to a subsidiary's management among Chinese workers as some job seekers preferred not to work for a Japanese company (e.g. Kwan, 2003; Yu and Meyer-Ohle, 2008).

An additional aspect that makes a local partner invaluable is that foreign subsidiaries in China are also subject to labor unions. "A foreign company needs a local partner that can deal with unions under these circumstances." (General Manager A, 2007)

At the set-up stage, local partners' contributions allowed IJVs to channel resources into training, while general managers credited local partner presence with keeping employee turnover rates low, which prevented any significant knowledge outflow. In terms of productivity growth rates, this contribution must therefore have a positive effect on technology-induced productivity growth rates. Although the data in my study does not allow for an itemization of productivity growth rates by specific partner contributions, it does allow for an analysis of the impact of the presence of a local partner on technology/knowledge-based productivity growth rates.

As for the skills of the local workforce, research has shown that a high skills gap can lead to lower knowledge absorption rates (e.g. Kremic, 2003) and therefore less or even negative productivity growth.

Noronha (2002) further emphasizes the absence of quality orientation in Chinese workers (p. 64). Similarly, an IMF (2003) study found productivity of Chinese engineers to be lower than in developed countries due to larger gaps in education, training, and work experience, including limited exposure to advanced technologies.

One difficulty electronics firms of all nationalities in China face is the availability of skilled labor, which can vary greatly by region. Qualified labor is easier to recruit in the coastal areas along the eastern seaboard than in other areas where education levels seldom exceed primary school (IMF, 2003). According to one Japanese manager, the perceived skills gap between a well-trained Chinese engineer and an engineer of similar rank in Japan was about "20 years" (General

Manager B, 2007).

For my method of calculation, a high technology-induced productivity growth index would therefore indicate particularly effective methods of technology implementation and high learning rates (Felipe, 1997). As a residual value, however, a technology/knowledge-induced index is only useful in connection with a qualitative analysis.

Many Chinese companies are state-owned conglomerates which are normally not competitive in the international marketplace (Yeung, 1997). Japanese companies, however, generally make fewer commitments to product modifications or development to the local market because they are more export-oriented (Yan and Luo, 2001). This is gradually changing, and Japanese companies with high technology-induced productivity growth are increasingly diversifying their orientation away from export-orientation to include local market access, for which more product modifications are being considered and performed locally. Therefore, there has been a gradual shift from mere labor-intensive assembly of products to more technology and capital-intensive production (Yan and Luo, 2001). As a result, subsidiaries in China have seen higher product and process innovation (Luo, 2000; Yan and Luo, 2001).

3.1.4 Political factors

Political factors in China have significantly shaped the landscape for potential IJV partners (Luo, 2000). The Chinese economy is characterized by strong governmental interference, poorly specified guidelines for ownership (entry mode) approval as well as poorly specified property rights. State-owned enterprises, however, have the location-based advantages of access to scarce resources, materials, capital, networks (*guanxi*) and information. SOEs also have an advantage over local privately owned firms in terms of their government connections, access to capital, market presence, industry experience, production and innovation (R&D) facilities, and economies of scale. For these reasons, an SOE or SOE-affiliated enterprise may contribute more to an IJV than a non-state owned enterprise.

3.1.5 Organizational rank of local partner

SOEs are generally ranked into the following levels in descending order of importance: national, provincial, city, and county. Different levels imply different degrees of autonomy. The higher the organizational level, the greater the power delegated to the SOE and the greater the support it receives from the government. Besides regional levels, all firms, including SOEs, are also ranked into classes of development. Higher-class firms generally have superior product quality, internal management, customer responsiveness, and organizational performance. Depending on the goals of the foreign company, these rankings should be taken into account when selecting a local IJV partner (Yan and Luo, 2001).

To Chinese SOEs, organizational skills have been important and the government has pursued the acquisition of these skills from foreign companies through assigning SOEs as IJV partners. Compared to Japanese companies, the managerial expertise of western companies has generally been more attractive to the Chinese side (Yan and Luo, 2001). As a trade-off, however, companies from the US and Europe have also been allowed to hold greater shares in IJVs or establish WOSs. They have been more likely to transfer their critical organizational skills to local subsidiaries because they have focused more on long-term market growth in China, while Japanese companies have mainly viewed China as a production base from which to export back to Japan and abroad. The orientation of Japanese companies, however, has also changed, and cases for this and the changing requirements for the local JV partner are discussed in the following chapter. In Sino-Japanese IJVs, receiving a new set of complementary assets has partially worked, and as my on-site research has shown, it has worked particularly well where divergent interests between the partners could be aligned effectively through changes in the ownership structure.

3.1.6 Applicability to Japanese companies in China

Having fewer cultural barriers with China than with western companies means that Japanese MNCs face lower costs and time as they learn about the local environment, which would result in more communication, fewer misunderstandings and therefore fewer barriers to communicating technological and managerial knowledge within IJVs. They will also share similar values, such as high regard for *guanxi* and network building and will therefore likewise recognize the value of this intangible asset as a contribution from the Chinese partner (e.g. Makino and Beamish, 1998; Yan and Luo, 2001). The result should be a positive impact on residual-value (technology/knowledge)-induced productivity growth.

Another moderating factor in China could be the government. The government has a large influence on the choice of IJV partner (Yan and Luo, 2001). It is difficult to predict the effect of government involvement on productivity values in IJVs because government involvement can speed up the process for finding a local IJV partner for inexperienced Japanese companies on one hand, but could also take advantage of the Japanese partner’s inexperience on the other, which would be another principal-agent problem. However, for experienced foreign companies in China, government influence can have the opposite effect, depending on the quality of *guanxi*.

3.2 Methodological development

This part is concerned with developing the concept for measuring the performance of Japanese subsidiaries in China, and based on technology/knowledge-induced productivity growth as a performance measure, the entry mode or ownership strategy that should be chosen.

According to Prasad and Wei (2007), a natural measure of performance is a productivity ratio – the ratio of outputs to inputs, in which a larger value of the ratio is associated with better performance. However, performance is a relative concept and several methods/studies regarding performance measurement and its dependent entry mode or ownership strategies exist. All studies are based on the underlying concept of an efficient and least costly method to define ownership structures.

3.2.1 Review of previous methods

Studies can be defined into two broad categories: a) studies in which ownership structures/entry mode were the outcome of a composition of a subsidiary's combined assets (ownership advantages) and/or environmental factors and b) studies in which the performance of a subsidiary was the (outcome) of ownership decisions. Generally, in category a) ownership was the dependent variable while in category b) ownership was the independent variable. My study attempts to combine both approaches. In the first part, my method would fall into category b) in which a statistical relationship is established linking ownership and ownership change to a performance variable which I refer to as technology/knowledge-based productivity. In other words, out of a sample of 1,800 subsidiaries (IJVs), a relationship is initially shown in which subsidiary performance depends on ownership-related variables. In a further sub-part of the quantitative chapter, ownership is then adjusted to show its influence IJV performance.

In prior literature, studies can still be further divided into two more groups - namely those studies that have addressed performance and ownership uni-dimensionally - thus from the point of view of the benefit for the technology owner or parent company; while the other broad group of studies has been concerned with assessing performance multi-dimensionally, i.e. from the point of view of all stakeholders. For the case of IJVs – multi-dimensional studies take into account the foreign and local IJV partners' tangible and intangible assets. Multi-dimensional studies have been better at linking the ownership with (performance measures) firm-linked or endogenous attributes such as financial measures, capital productivity, labor productivity, asset specificity, or bargaining power, and exogenous factors such as a host country's environment, including infrastructure, presence of other MNEs. In addition, those studies that used ownership as an independent variable, tended to link ownership to financial indicators most frequently.

Most research has tended to treat ownership as a dependent variable and to focus on parent firm capabilities in determining an ownership structure. Uni-dimensional studies, which look only at the parent company, tend to be concerned with the choice between (non-equity, contractual) and hierarchical (equity) entry modes, while multidimensional studies tend to focus more specifically on the levels of ownership and consider both equity partner's capabilities. Multi-dimensional studies are also less concerned with financial performance indicators and tend to focus on factor inputs in subsidiaries and therefore are more inclined to use productivity factors and the choice of ownership (e.g. Burgel and Murray, 2000; Moon and Lado, 2000).

Moreover, uni-dimensional studies tend to focus on financial performance such as sales, profits, return on assets (ROA) and return on investment (ROI) while multi-dimensional studies shifted their focus to factor inputs and often resulted in productivity measures for capital or labor (eg. Oulton, 1998).

The table below summarizes the most important literature that has linked ownership to firm-level performance indicators. Studies have been categorized as either uni-dimensional or multi-dimensional. I further categorized existing research into whether ownership was treated as a dependent or independent variable. Table 3.1 (next page) summarizes these findings.

Table 3.1: Overview of ownership as dependent and independent variable in previous studies

Dimension of studies / ***Role of ownership variable***	***Uni- dimensional***	**Main findings**	***Multi-dimensional***	**Main findings**
Dependent	*(a)* Burgel and Murray (2000); *(b)* Moon and Lado (2000)	*(a)* Organizational capabilities considered, entry mode depends on subsidiary age and experience; high degree of tacit knowledge leads parent company to choose local partner *(b)* suggest longitudinal research designs in the study of ownership change caused by technological progress, changes in knowledge	*(e)* Asiedu and Esfahani (2001); *(f)* Hagedoorn and Narula (1996); *(g)* Delios and Beamish (1999)	*(f)* if learning rates are similar for both partners, alliances can be sustained *(g)* high asset specificity causes high owner to assume high ownership share, requirements for complementary assets moderate ownership share *(e)* found negative link between foreign ownership share and importance of local partner's contributed assets; importance of local partner's assets increases due to non-static view of knowledge
Independent	*(c)* Li *et al.* (2002); *(d)* Oulton (1998)	*(c)* measure effect of foreign ownership on capital efficiency (ROA) and technology intensity *(d)* foreign ownership raises capital and labor productivity	*(h)* Grossman and Hart (1986); *(i)* Rasiah (2004)	*(h)* mention ownership as means to purchase 'residual rights' at lower transaction costs, ownership depends on extent of residual rights *(i)* subsidiaries with high local ownership exhibit greater reliance on local partner's network

Source: Own compilation of various sources

Studies that are uni-dimensional and where ownership is the dependent variable emphasize financial performance and use the transaction cost approach (e.g. Burgel and Murray, 2000; Moon and Lado, 2000). In cases where ownership is an independent variable, however, uni-dimensional studies tend to extend beyond transaction cost theory, by extending financial performance indicators into productivity and efficiency measures. Studies that use measures such as capital and labor productivity and technical efficiency as a result of a parent company's ownership choice include those by Oulton (1998) and Li *et al.* (2002).

Multi-dimensional studies, on the other hand, expand the focus to include the resource-based view where partner capabilities and complementary assets become a central issue. The exchange of these assets at the lowest transaction cost becomes a central focus of multi-dimensional studies. These studies make the claim that shared ownership is preferred to sole ownership or non-hierarchical (non-equity) entry modes where it is necessary to overcome the disadvantage of being foreign, mainly in the institutional and experiential sense. Scholars that have published multi-dimensional studies including Delios and Beamish (1997), Asiedu and Esfahani (2002), and Gomes-Casseres (1989, 1992) argue from the point of view that shared equity ownership lowers the transaction costs for acquiring these intangible assets.

The transaction cost approach is the direction taken by most scholars including those in uni-dimensional studies. The difference between ownership as a dependent and independent variable is that with the former the impact of non-firm specific factors in addition to firm-specific factors can be measured, such as the host country environment, host country risk, or other externalities such as improvements in infrastructure. The importance for ownership is that any change in these variables can cause a change in ownership – the dependent variable. The most important concept to the effects of changes in ownership that has emerged from studies that use ownership as a dependent variable is the concept that intangible assets are not static and that they have an impact on ownership over time, which therefore calls for the case that ownership be revised periodically. However, when ownership is revised and adjusted, the role of the ownership variable changes. Ownership then becomes an independent variable that will influence an IJV's performance in the future. Thus, if knowledge is non-static and dependent on ownership adjustment, then how can the effects of a change in ownership on knowledge/capabilities be measured quantitatively? This is where many studies have shown limitations.

As a non-static concept, it is not sufficient to capture changes in knowledge by measures such as R&D intensity, or percentage of engineers employed in a subsidiary. These measures do not capture the internalization and absorption effects of new technologies and knowledge by the subsidiary – (therefore they are insufficient to address the view of knowledge transfer and absorption, which by definition is a non-static process).

Subsidiary-level data availability, however, has often been a significant problem. I begin with the papers in which ownership was used as an independent variable. Studies in this stream tend to precede those in which ownership was used as a dependent variable.

3.2.1.1 Ownership as independent variable: uni-dimensional studies

Oulton (1998) found that foreign ownership raised productivity by about one-third in a study of foreign-owned companies in the UK. His notion of productivity was based on labor and capital productivity, measures which do not lead to an implicit understanding to how well or how efficiently knowledge is absorbed.

Thus, when foreign ownership raised productivity, it did so through deployment of more capital and greater employee numbers or outlays in employee expenses. He found that higher foreign ownership – even in the UK, an industrialized country – led to higher productivity among these factor inputs. His study was based on approximately 140,000 majority foreign-owned subsidiaries in the UK in one year – 1996 - and included both JVs and WOS. Foreign ownership in this study was limited to US and Canadian companies, although as companies from industrialized countries, we see the results as relevant to our study which analyzes Japanese subsidiaries. Although the study confirms the benefits of foreign ownership, it does not specify which ownership levels cause which technology-based productivity levels. The insufficiency with productivity values in this study, as in the previous study, is that he does not base it on the concept of technology and knowledge absorption, and as such do not explain productivity or efficiency in technology transfer. The study found that in manufacturing industries foreign ownership raised input intensity. In manufacturing foreign ownership raised capital intensity, while in the non-manufacturing sector, labor intensity was found to be significantly higher. The results confirm, however, that foreign ownership in the manufacturing sector has a direct impact on the technology transfer in its basic form – as shifts in capital and technology occur - even between industrialized economies.

Li *et al.* (2002) used ownership to test its influence on firm performance including what they refer to as subsidiary effectiveness, efficiency, and technology intensity of Sino-foreign JVs in China. They used subsidiaries in the electronics industry which they defined as electronics companies those companies that manufacture electronics components and/or assemble or manufacture products containing electronic components. They used hierarchical blocked regressions to test the effects of strategic choices (independent variables) on firm performance. These strategic choices were location, ownership, and capital and technology intensity. The dependent variables were efficiency, and technology intensity. As for the dependent variable of firm performance, the authors did not further elaborate on effectiveness, except that the companies they tested were in the "top 10 of sales revenues in their respective sectors" (Li *et al*., 2002). Unlike their vaguely used concept of effectiveness, the authors define efficiency as return on assets (ROA). Technology intensity, the third dependent variable, was defined as average assets per employee. Clearly, technology intensity in their study is not based on the view that that technology is something that is absorbed based on improvements in and absorption of knowledge. Nonetheless, their study yielded significant findings with respect to the effects between technology intensity and ownership, in that wholly-owned subsidiaries were more likely to have higher capital and technology intensity than IJVs. Their findings, however, are not surprising, as they reinforce other studies in the first stream that treated ownership as an independent variable. Again, what their study does not show are the effects of technology-intensity on ownership.

3.2.1.2 Ownership as independent variable: multidimensional studies

Grossman and Hart (1986) make a case between contractual and equity IJVs, using transaction cost theory and linking it to the profitability of both the investing company and the potential partner company. They conclude that equity ownership is a lower cost alternative to contractual ownership in industries where it is difficult to anticipate or predict exactly what is required of the partner. Ownership is thus viewed as a purchase allocating residual rights to these unspecified assets between the two parties.

In their framework, however, the residual rights allocated to one party are lost by the other party, from which another cost arises as incentives for opportunistic behavior also shift. Importantly, Grossman and Hart's (1986) study has established that the degree of control – or ownership - in a foreign subsidiary confers a proportional degree of control over the uses to which these firm-specific assets can be put (Grossman and Hart, 1986; Delios and Beamish, 1997). Therefore, their research has been groundbreaking and opened other avenues for enquiry into the study of equity joint ventures, including bounded rationality and opportunistic behavior.

As another representative of the multi-dimensional stream with ownership as the independent variable, Rasiah (2004) extends previous research by focusing on human resource capability, process technology capability, R&D capability, and network strength in the electronics industry in several developing Asian countries, excluding China. Rasiah's (2004) results indicate that subsidiaries with high local ownership exhibit higher reliance on network strength with regard to technology intensity and R&D, compared to subsidiaries with high foreign ownership. Similar to Li *et al.* (2002), Rasiah (2004) defines technology intensity as assets per employee. This is an important finding in support of my argument because lower foreign ownership thus leads to greater access to the local partner's country-internal networks. Together with the non-static view of knowledge, the local partner's importance to the foreign partner is expected to rise in terms of potential component-localization, which may lead to more component and supplier sourcing within the country as the local partner's technological capabilities improve.

Based on the uncertainty of what is being transacted and the view of knowledge as non-static, the above literature has essentially argued for equity ownership as a tool to reduce such uncertainty and acquire a set of assets from the local partner, both tangible and intangible. Ownership controls the interaction between the foreign company and local partner, which then allows the foreign partner to tap the local partner's capabilities and networks.

3.2.1.3 Ownership as dependent variable: uni-dimensional studies

Burgel and Murray (2000) take the approach of organizational capabilities of high-tech companies rather than transaction cost factors in the determination of entry mode choice. Their study comprised both non-hierarchical/non-equity and hierarchical/equity-based entry mode choices. The former included direct selling and using distributors in the host country while the latter included JVs and WOS. Although their study was biased in favor of the former, it nonetheless offers valuable insights for equity-based entry modes. As a uni-dimensional study, however, they focus on capabilities of the parent firm, while capabilities present in host-country firms are not considered. Though their approach works in the context of a survey-based study comprising 246 high-tech companies in the UK that ascertains the goals of parent companies in the choice of market entry modes, the magnitude of such a survey and resource constraints likely prevent the same authors from extending it to subsidiaries. Their findings indicate that subsidiaries' ownership structures changed over time, as subsidiary managers gained experience. Importantly, Burgel and Murray's (2000) findings show that entry modes by companies with innovative technologies that embody a higher degree of tacit knowledge are more likely to involve a collaborative arrangement involving a local partner. These findings mirror similar findings by Robertson and Gatignon (1998), who found that firms experiencing higher technology uncertainty (ie. Firms with new technologies rather than mature technologies) are also more likely to engage in alliances. Though both studies lack the consideration of local partner capabilities, their findings support my argument in the sense that rising partner capabilities lead to higher innovation potential – a point I stress in the case studies - and therefore less likelihood for technologies to mature due to higher innovation potential, thereby increasing the importance of the local partner.

Moon and Lado (2000) take a resource-based view of the (parent) firm by arguing that firm-specific resources including managerial and technological resources provide a sustained basis for bargaining power vis-à-vis the host government. According to other scholars such as Fagre and Wells (1982) and LeCraw (1984), ownership is the outcome of negotiations between a foreign firm and a host country government. The disadvantage of their view, however, is that higher bargaining power equates to higher ownership, and that highest possible ownership should be the default strategy of the foreign entrant. Other scholars, however, have addressed this problem and defined the preference of ownership around factors such as the nature of transactions (Gatignon and Anderson, 1988; Gomes-Casseres, 1989; Hennart, 1991), strategic benefits expected such as acquisition of marketing capabilities, access to local markets, or localization of supply (Gomes-Casseres, 1989; Moon and Lado, 2000). Others have raised cultural distance as a factor (e.g. Kogut and Singh, 1988). Moon and Lado (2000) also depart from the view of knowledge as static, and address the measure of subsequent ownership adjustment caused by technological progress, emphasizing that initial ownership levels do not reflect potential and actual changes in future bargaining positions and that this issue needs to be addressed by “longitudinal research designs” (Moon and Lado, 2000; p. 89). My research addresses this issue. However, I depart from their research by the fact that I use ownership as an independent variable with which to adjust technology and knowledge-based productivity taking into account changes in both partners' (technological) capabilities.

3.2.1.4 Ownership as dependent variable: multidimensional studies

Hagedoorn and Narula (1996) found a higher incidence of IJVs in mature industries compared to high-tech industries, though their study is limited to developed countries. They argue from a transaction cost perspective. Their study finds that due to a higher rate of changing technologies in the high-tech sector, organizational flexibility becomes more important and therefore contractual alliances will be preferred to equity arrangements. Unlike Asiedu and Esfahani (2001), their study discounts the role of external factors, such as host country environment and the local partner's contribution in managing local market imperfections. Moreover, their study discounts any consideration of the local partner's knowledge as a process in development. They argue that knowledge and technological advancement between partners will be similar, which means that the rate of learning will also be similar (Kremic, 2003), following which no JV partner would have a significant knowledge advantage. From this point of view, alliances can be sustained, but less so where the technological and knowledge gap is significantly greater, such as in alliances with partners from technologically advanced and less advanced countries, e.g. Japan and China. However, Hagedoorn and Narula's (1996) study carries significance for my research in that additional layers of administration created in joint ventures can compromise responsiveness and adaptability of the subsidiary - an important consideration where product cycles are short. It also creates another issue for our research – that of the composition of management-level employees within joint ventures. Hagedoorn and Narula (1996) offer no solution in this regard; however, my data yields enough evidence to conclude which levels of management and/or expatriate employees increase efficiency/productivity, therefore lowering transaction costs and making a case for IJVs in the high-tech sector.

In their multidimensional study on 1043 Japanese equity-based subsidiaries in East and Southeast Asia, including China, Delios and Beamish (1999) show that high asset specificity causes the foreign investor to assume a higher ownership position while requirements for complementary assets moderate higher ownership shares. Similar to studies previously discussed, Delios and Beamish (1999) also found that experience in foreign market entries had a positive effect on the ownership share assumed by the foreign company and that market imperfections and country risk generally caused the foreign company/partner to assume a lower ownership share, excluding the case of intellectual property protection, where the foreign partner would tend to assume a higher ownership share.

Delios and Beamish (1999) provide a list of complementary asset requirements required by foreign firms in these markets, consisting mainly of intangible assets, which included market knowledge, tacit technology, distribution systems and other intermediate inputs. In the context of Japanese high-tech companies, my research has shown that tacit knowledge applies mostly to quality improvements, adherence to *kanban* systems as well as higher innovation capabilities. These enable the local partner firms to increasingly replace or source components that were originally procured from Japan.

Asiedu and Esfahani (2001) argue from a transaction cost perspective in their explanation of ownership choice and levels in equity-based foreign entry modes. They found that there is a negative link between the foreign ownership share and the importance of the local partner's contributed assets and is moderated by a host-country government's policy towards foreign direct investment including government motivation for the outcome of the ownership structure. They include locally-owned intangible assets in their model as a determinant factor in ownership outcomes, including intangible assets not directly related to the product such as knowledge on how to overcome structural market failures in the local market (ie: how to navigate the black market), which emphasizes the importance of the local partner's intangible assets such as *guanxi*. Although their findings complement research by Moon and Lado (2000), the importance of the local partner in this paper does not decline with the foreign manager accumulating experience and his own connections over time. Due to their non-static view of knowledge, the local partner's capabilities and intangible assets become an increasingly relevant factor in the local partner's future setting of ownership share in addition to navigating structural market failures in China. Past research has offered only inconsistent findings on the issue of ownership choice. It remains unclear how decisions related to entry mode and ownership strategies after market entry have influenced firm performance.

3.2.2 Data source

The following section will form the quantitative concept which is used in order to analyze technology-based productivity growth based on data from the *Toyo Keizai Kaigai Shinshutsu Kigyo Soran* which had been compiled in electronic form ranging from 1986 to 2003. There were over 16000 subsidiaries in the entire dataset, of which 1881 subsidiaries yielded relevant data. I have chosen companies from electronics-related industries that manufacture end products and assemble components. More details of the dataset including SIC codes are mentioned in the section on descriptive data later.

4. Methodology applied

4.1 Intended contribution

Applying an economics-related concept, I seek to make an important cross-discipline contribution to current business research. Quantitative business research has relied heavily on statistical methods, but application of micro-economic frameworks has been rare. Furthermore, I also seek to make a contribution to the field of economics since most economics-related papers eschew application of the theoretical concepts they develop, due in part to a lack of firm-level data. In doing so, I combine approaches from both the fields of business research and economics. The advantage of my study is that I have complete micro-level time-series subsidiary data for 1881 Japanese subsidiaries (WOSs and IJVs) in China covering a 17-year period from 1986 to 2003, obtained from each annual issue of the *Toyo Keizai Kaigai Shinshutsu Kigyo Soran from 1986 to 2003*.

I use residual values in order to estimate productivity growth within subsidiaries. In other words, a low residual value would indicate low productivity growth. From this one could infer that some factors within the subsidiary are obstructing the transfer and absorption of knowledge and/or technology. This could be due to an inappropriate ownership structure or other factors that have an impact on ownership choice, such as experience in foreign market entries or subsidiary age. Employee ratio between Japanese and local employees can also be a factor and a direct result of the control structure (Felipe, 1997). The method used or its variations have until now mostly been applied in macroeconomic studies (e.g. Felipe, 1997; Li *et al*., 2002) and several microeconomic studies on industry scale (e.g. Perkins, 1996; Blomstrom and Sjoholm, 1999). Economists (e.g. Solow, 1956; Felipe, 1997; Barro and Sala-i-Martin, 1997; Barro, 1998) mathematically proved the measurement approach's feasibility to private sector companies, including factories, units within a firm, service industries, and non-profit organizations - as long as micro-level data was available.

In this section, a background and overview of the quantitative methods further employed is provided. I begin with a general economic explanation and specify it in subsequent sections.

4.2 Overview of methods

There are essentially four major methods available for productivity measurements (Coelli *et al.*, 2005):

1. least-squares econometric production models;
2. total factor productivity (TFP);
3. data envelopment analysis (DEA); and
4. stochastic frontiers

The first two methods are most often applied to aggregate time-series data and provide measures of technical change expressed by a total factor productivity (TFP) index. The TFP method is also referred to as growth accounting (e.g. Solow, 1956; Barro, 1998). Methods 3 and 4, however, are most often applied to data on a sample of firms with linear data and provide measures of relative efficiency among those firms (Coelli *et al.*, 2005). The two methodologies used in most papers on productivity growth have been growth accounting (TFP, method 2) and econometric estimation of production functions (stochastic frontiers, method 4). I use a modification of method 2 due to availability of time-series (panel) data that covers an extensive time period (17 years; 1986 to 2003) with a large sample of Japanese subsidiaries in China that had complete data availability for a time-series analysis on micro-level (subsidiary-level) data (n=1881 subsidiaries). However, the original sample exceeded 16,000 subsidiaries.

Several scholars, including founding scholar Solow (1956) as well as later scholars such as Barro and Sala-i-Martin (1997), Barro (1998) and Felipe (1997) have developed and applied the TFP method to account for knowledge-based and value-added progress, which is commonly referred to as technological progress. In the case of firms producing multiple outputs using multiple inputs, productivity growth or decrease is represented by growth in the TFP index (i.e. productivity growth) (Coelli *et al.*, 2005).

This method breaks down economic growth into components associated with factor inputs and the Solow residual, which reflect technological progress and processes that facilitate residual productivity growth; in other words, capable management that enables knowledge and intangible assets to be transacted efficiently. As a residual value, the Solow residual is the TFP growth rate between two discrete time points where the influence of changes in capital and labor have been removed. TFP therefore signifies that part of productivity growth which cannot be attributed to the firm’s current tangible assets such as labor and capital, hence the term ‘residual’. It implies some kind of progress within technological systems or processes within a company which requires implementation of new skills (e.g. Solow, 1956; Barro, 1998). Economists therefore attribute this residual value to technological improvements and/or improved management of firm-internal resources. It is therefore a measure for technological change, and in this sense it is an implied measure for technology and knowledge transfer (Barro, 1998: 3). The TFP method provides a breakdown of observed output growth into components associated with changes in factor inputs and a residual that reflects technological progress.

4.3 Technology/knowledge-based productivity growth

In its simplest form, productivity can be defined as the ratio of outputs that a firm produces to the inputs that it uses. Therefore,

$$Productivity = \frac{Outputs}{Inputs} \qquad (1)$$

This calculation is the most basic example of productivity, where the production process involves a single input and a single output. However, in practical terms, this is seldom the case. Thus, when there is more than one input, a method for aggregating these inputs into a single index or inputs must be used to obtain a ratio measure of productivity. Therefore, when one refers to productivity, the reference is to total factor productivity (TFP), which is a productivity measure that involves all factors of production. Other measures of productivity, such as labor productivity, capital productivity, and land productivity are often referred to as partial measures of productivity. These partial productivity measures, however, are not an indication of overall productivity when considered in isolation. Therefore, I do not follow partial productivity measures in this dissertation.

When one considers productivity comparisons through time, however, an additional source of productivity change is possible. It is commonly referred to as technical change (e.g. Coelli *et al.*, 1998, 2005). This measure involves advances in technology and/or improved management. An introduction of new technology, for instance, can extend the productivity potential of the firm/subsidiary beyond previous limits, thus resulting in productivity growth/positive productivity change.

Up to this point, I have not discussed issues such as costs or profits, as all discussion has involved physical quantities and technical relationships (Felipe, 1997). In addition, I have made behavioral assumptions including cost minimization and profit maximization. Performance measures can be devised that incorporate this information. The additional measures would be referred to as allocative efficiency. Allocative efficiency involves selecting a mix of inputs (e.g. labor and capital) that produces a given quantity of output at minimum cost. Thus, when minimum cost is subtracted, then the result obtained would be maximum profit. Allocative efficiency and technical efficiency combine to provide an overall economic efficiency measure. In this study I work with the overall economic efficiency measure without decomposing the measure further.

4.3.1 Weights

One of the important assumptions scholars make about productivity is that it is a technical concept which refers to a ratio of outputs to inputs (Barro, 1998; Felipe, 1997; Coelli *et al*., 2005). When more than one factor is taken into account, however, the problem of how to weight each factor becomes critical to the equation. Therefore, weights of labor and capital become important. They are often indicated by the coefficients α (*alpha*) and β (*beta*), respectively. In an ideal scenario, these weights could be measured. Due to difficulties, however, some scholars have addressed these as aggregate values, derived from a large pool of economic data. Another problem is that data has been biased in favor of companies based in developed industrial countries. Nonetheless, values were assigned to the factors of labor and capital. Under the Hicks-neutral technique and the hicks- technique, fixed values of α =0.4 and β =0.6 or α =0.35 and β =0.65 have commonly been assigned, respectively.

The disadvantage of fixed weights is that they are generic by assuming constant returns to scale. I circumvent this problem, however. With enough micro-level subsidiary data, individual weights can be assigned to each subsidiary within a given time period. The dataset enables me to do so. Therefore, I can avoid assuming constant returns to scale and using generic values, thereby making calculations more accurate.

In the simplest form, the problem of weighing can be solved by relating the productivity ratio to the basic aggregate production function, where output is a function of capital, labor, and technology. I have already discussed the difficulty of quantifying the last part – technology - and therefore treat it as a residual value. In its simplest form, the aggregate production function can be written as:

$Q_t = F(K_t, L_t, t)$ (Felipe, 1997) (2)

The next section will discuss in closer detail the concept of growth accounting as a method for computing the TFP. Behind the TFP is the (neoclassical) production function:

$Y = F(A, K, L)$ (Barro, 1998) (3)

A is the level of technology, K is the capital stock, and L is the quantity of labor. In Barro's (1998) version, the growth rate of output can be partitioned into components associated with factor accumulation and technological progress.

If technological progress appears in a Hicks-Neutral way, output becomes a function of technology-induced productivity and a function of capital and labor.

$F(A, K, L)$ will become:

$Q_t = A_t F(K_t, L_t)$ (4)

A division by $F(K_t, L_t)$ will then yield:

$$A_t = \frac{Q_t}{F(K_t, L_t)} \tag{5}$$

In equation (2), output was shown to be the dependent variable of a function of capital, labor, and time, where time as a shift factor is a proxy for the effects of productivity and technical progress/change. Barro (1998) and Felipe (1997) both assume that "*t*" is separable from *K* and *L*, a finding from which they create a new variable: *A*, or technical progress at a discrete point in time.

In its simplest form, productivity is a function of output, capital, and labor, which is derived from the aggregate production function of

$$A = \frac{Q}{\alpha_L \beta_K} \quad , \tag{6}$$

whereby A denotes a technology-based productivity measure at a discrete point in time.

Per this equation, A_t is referred to as exogenous and Hicks-Neutral technical progress, and is a measure of how output changes at different time intervals. Therefore, the measure of productivity can be interpreted as an index of factors other than labor and capital, which contribute to the generation of output but which cannot be accounted for in discrete terms. So what are these factors? Solow (1959), Barro (1998), and Felipe (1997) point out that these factors are managerial capabilities, organizational competence, diffusion of technology, intersectoral transfer of resources, and research and development. Therefore, it is a combined and implied measure of technology and knowledge transfer.

Equation (2) by itself is impractical since it requires knowledge of the marginal products $F(K_t)$ and $F(L_t)$. According to Barro (1998: 5), however, $F(K_t)$ and $F(L_t)$ can be measured by observed factor prices. Thus, if *K* and *L* have “paid their social marginal products”, so that $F_K = R$ (R is the rental price of capital, thus the interest rate or depreciation rate) and $F_L = w$ (wage rate), then Barro (1998) suggests that the standard of the rate of technological progress can therefore be calculated from equation (2) as a residual, according to the following notation:

$$g = \frac{\dot{Y}}{Y} - s_k\left(\frac{\dot{K}}{K}\right) - s_l\left(\frac{\dot{L}}{L}\right) \tag{7}$$

Variables s_k and s_l are factor payments of capital and labor, respectively.

If adapted to the variables used in this thesis, g can be used in the following notation:

$$g = \frac{\dot{A}}{A} \quad g = \frac{\dot{b}_t}{b_t} \quad , \tag{8}$$

since I use the variable b_t to denote technical change. This formula illustrates the residual of technology growth, which one can also call the growth rate, or change in TFP, where technological progress is the result of subtracting changes in the shares of capital and the shares of labor. I closely follow this method.

4.3.2 Estimation

A significant advantage of the aforementioned method (growth accounting - TFP) method is that it enables us to calculate the growth rates for technology-induced productivity between specific time intervals, which therefore makes it suitable for panel data. By using panel data, one can get more accurate results for both the weights of labor with respect to time and technology-induced growth (TFP growth) as a result. For empirical purposes, however, equation (2) also raises a conceptual problem. Although the equation represents output per unit of joint inputs, it is much more difficult to assign a meaningful interpretation to it as well as to the meaning of the level of technology, which in itself can be subject to speculation (Felipe, 1997). Studies have tended to use such measures as technology intensity (assets per employee) (e.g. Li *et al*., 2002) or R&D intensity (R&D expenditure relative to sales) (e.g. Makino and Delios, 1996), but these are static figures and are not based on absorption rates of new technology or knowledge and therefore say little about a firm's technology/knowledge-based productivity growth, thus the efficacy of technology or knowledge transfer. The partial productivity in the growth accounting method index, however, addresses the problem more suitably by accounting for the weighted productivities of labor and capital, leaving a residual value for growth in productivity (Felipe, 1997).

Coelli *et al*. (1998; 2005) have developed a framework for measuring productivity and productivity change as part of a performance measurement. "Productivity is essentially a level concept and measures of productivity can be used in comparing performance of firms at a given time. In contrast, productivity change refers to movements in productivity performance of a firm or an industry over time." (Coelli *et al*., 2005)

The *Thornqvist* index has become a commonly used measure of technology-induced productivity change (Coelli *et al.*, 2005). In the *Thornqvist* index, observed productivity improvements could be the result of improvements in technical efficiency and/or in the underlying production technology (Coelli *et al.*, 2005). I have specifically chosen the Thornqvist index and subsequently refer to it as such or as technology/knowledge-based productivity growth interchangeably.

4.3.3 Applicability

For the *Thornqvist* index to be utilized, the following assumptions and limitations apply:

- The firm engages in either cost minimization or revenue maximization.
- The residual value is a combined value of technical change and technical efficiency change, without separating the two due to the difficulty of quantifying the value of technical change.
- Price information is incorporated/part of the *PQ* index (output), which is suitable for a large number of companies in an industry because it assumes an aggregate function similar to that of the GDP value for any given economy.
- An important advantage of the *Thornqvist* index, however, is that it can be calculated with a minimum of two time-related data points and information on output, labor, and capital data, while other frontier approaches require several time periods, and specific data on any given technology. In this sense, the *Thornqvist* index significantly enhances the number of usable observations from my dataset and thus provides a higher likelihood of yielding significant results.

Scholars have suggested several measures of productivity change in firms with regard to technological influence.

In most empirical applications, where TFP indices are calculated, the *Thornqvist* index formula is used for purposes of output and in input calculations. Then the *Thornqvist* TFP index is defined in its logarithmic form as:

$$\ln TFP = \ln\left(\frac{OutputIndex}{InputIndex}\right) = \ln OutputIndex - \ln InputIndex \qquad (9)$$

The first part of the right-hand side of equation is the logarithmic form of the *Thornqvist* index applied to output data, and the second part is the input index, which is calculated using input quantities and the corresponding cost shares.

To measure technology-related productivity changes, the *Thornqvist* index can measure changes in the levels of outputs generated and inputs contributed to the production process over two time periods for a given firm. Where more time periods were available for a given subsidiary, I calculated the value of the *Thornqvist* index between each consecutive time period. The *Thornqvist* index provides a reasonable approximation to the true output and input quantity index numbers (Coelli *et al*., 2005: 88), and in most practical applications involving panel data, the formula yields realistic numerical values for the TFP index (Diewert, 1992; Coelli *et al*., 2005).

In calculating the specific data, I followed Chambers' (1988), and Felipe's (1997) notation of the *Thornqvist* index:

$$\varphi_{t,t-1} = \ln\left(\frac{Q_t}{Q_{t-1}}\right) - \Theta_L \ln\left(\frac{L_t}{L_{t-1}}\right) - \Theta_K \ln\left(\frac{K_t}{K_{t-1}}\right) \tag{10}$$

$$\Theta_L = \frac{\theta_{L,t} + \theta_{L,t-1}}{2} \qquad \Theta_K = \frac{\theta_{K,t} + \theta_{K,t-1}}{2} \tag{11}$$

Θ_L and Θ_K denote shares of each aggregate factor in total factor payments.

4.3.4 Estimation of shares of aggregate factors in factor payments (θ_l, θ_k)

Both Θ_L and Θ_K are estimated as the share of either labor or capital out of the total non-residual factor payment share of capital and labor in time periods *t* and *t-1*. The change in labor-based factor payment shares and capital-based factor payment shares is then a middle-point in that time-period, as Felipe (1997) suggests. Therefore, I neither used the highest nor the lowest values. Factor payment of labor was determined according to the wage rate times the number of local employees. Capital was depreciated at an average rate of 0.95 per annum (Jefferson *et al.*, 2000).

Another issue is the estimation of labor. Since the value of technology-based productivity growth is an index value, thus without any assigned unit, all units in the original equations (10) and (11) needed to have a common denominator and therefore needed to be capital-based, i.e. have a monetary unit. Therefore, following other studies (e.g. Perkins, 1996; Jefferson *et al.*, 2000), I introduced a wage rate to the labor variable. The wage rate is already incorporated into the variable *L*. Therefore, *L* is the number of local employees in the subsidiary times their wage rate. I used the common wage rate of 12,000 yuan per worker per year. Ultimately, all denominators became common and thus cancellable, leading to an index of the growth rate of technology-based productivity.

4.4 Variables

In order to proceed with calculations of ownership structures that yielded the highest technology/knowledge-based productivity growth results, a regression to test the relationship of several independent and control variables with the dependent variable – technology/knowledge-based productivity growth – was set up first. Of particular interest are the relationships between ownership and its related variables such as ownership changes in relation to technology/knowledge-based productivity growth. I was further interested in aspects of labor-related and capital-related factor inputs on technology/knowledge-based productivity growth. In addition, since extensive time-series (panel) data was being used, I was also interested in determining the effects of subsidiary age on technology-induced productivity growth and instability among the subsidiaries in the sample.

To accomplish the aforementioned, I chose *STATA* as the statistical program to handle panel data in which random-effects regressions were set up in order to determine relationships among the aforementioned variables.

In the first instance, a regression established the relationship between ownership-related variables and technology/knowledge-based productivity growth. In further regressions, ownership-related variables were modified in order to specify linear and non-linear relationships between ownership-related variables and technology/knowledge-based productivity growth. In addition, limits with respect to subsidiary age were applied in order to further test the relationships between dependent and independent variables at different stages of subsidiary existence.

Other *STATA* commands were also used in order to filter data and apply some of the relationships established in the regressions to specific numeric data values. The relevant correlation analysis, regression tables, and related quantitative analyses are discussed in detail in subsequent sections of this chapter.

With regard to regressions, the advantage of using random effects is the ability to account for the individual characteristics of each subsidiary and the uncertainty that cannot be explained by individual factors (e.g. Sohn and Kim, 2007). In the following section, variables used in the regression are discussed in more detail.

4.4.1 Independent variables

Japanese ownership (*jatotal*, *logjatotal*) and ownership change (*changeown*) were defined as independent variables. Ownership change here is meant to be the percentage difference in ownership between two consecutive time intervals, i.e. at time *t* and *t-1*. Before proceeding with calculations on specific numeric values regarding ownership-related variables, the relationship between dependent and independent variables was tested first, with control variables applied.

Japanese ownership and logarithm of Japanese ownership (*jatotal* and *logjatotal*)

In addition to absolute Japanese ownership (*jatotal*) at each discrete time point, I further generated the variable of the natural logarithm of Japanese ownership (*logjatotal*) as an independent variable in the expectation that technology/knowledge-based productivity growth would diminish with rising Japanese ownership.

Change in ownership (*changeown*)

The change in ownership between two discrete time intervals is the third independent variable.

4.4.2 Dependent variable

Technology/knowledge-based productivity growth (*Thornqvist* index)

As previously discussed, technology/knowledge-based productivity growth (*Thornqvist* index) was set as the dependent variable. It will depend on the discrete ownership values (*jatotal* and/or *logjatotal*) at each time interval as well as the change in ownership between time intervals. According to the literature review, I do not expect technology/knowledge-based productivity growth to peak at the highest ownership levels. In order to obtain more conclusive results, I tested this assumption by creating a change in ownership value (*changeown*).

4.4.3 Control variables

In addition, variables related to labor, capital, technical change and subsidiary age were set as control variables since they have been discussed as factors in productivity growth and company performance in the literature review (e.g. Felipe, 1997; Hitt *et al.*, 1997; Tallman and Li, 1997; Barkema and Vermeulen, 1998; Geringer *et al.*, 2000). The following points summarize the specific control variables:

- Labor-related variables: number of local (Chinese) employees (*lemp*), number of Japanese employees (*jemp*), ratio of Japanese to Chinese employees (*empratio*), factor payments Θ_L and an inflation-adjusted time-related labor variable (l_t)

- Capital-related variables: Capital in USD (*uscpt*), an output variable (*pqt*), and factor payments Θ_K and k_t

- Age-related variables: Subsidiary age (s*ubsidiary_age*)

A correlation table will confirm that these variables did not show high collinearity and could therefore be used as control variables.

4.4.4 Explanation of control variables

Labor-related variables (l_t)

The combined number of Chinese employees and Japanese employees was used as a proxy for labor input. An inflation-adjusted and year-specific wage rate to the labor control variable l_t was assigned. Average wage rates were obtained from the *China Statistical Yearbook* for the relevant years and SIC codes.

In contrast, it is more difficult to assign a wage rate to Japanese expat employees. In addressing this difficulty, I decided to apply the same wage rate to the Japanese employees for two reasons: Any labor input measured is subsidiary-specific. First, Japanese expat employees' wages are usually not a (substantial) part of a subsidiary's expenses, since Japanese employees tend to receive their salary from the *headquarters* rather than the subsidiary directly (e.g. Agrawal, 2006). Second, the number of Japanese employees in the subsidiaries is very small. It did not exceed 6 employees in more than 90% of the observations, some of which include large *keiretsu* with more than one thousand Chinese employees. Therefore, expatriate wage rates were not included in the productivity calculations. Furthermore, the mean ratio of Japanese employees to Chinese staff in 1881 observations was only around 4.9%. The impact of a Japanese employee variable would therefore not be large, regardless of the wage-coefficient used (Bauer, 1990).

Θ_L denotes the share of the aggregate factor of labor in the total factor payments of the subsidiary. The other control variable used is l_t, which denotes the growth rate of local labor between two consecutive time intervals. Following Delios and Henisz (2002) l_t can be interpreted as a measure of inexperience, due to its measurement of the difference in local employees. It was also assumed that each additionally locally hired employee needed to be trained and immersed into the company culture first before becoming fully productive. This measure applies to manual labor, rather than new engineers, whose level of knowledge would be higher. Due to the large ratio of manual labor in subsidiaries, l_t therefore mainly refers to manual labor.

Japanese employees (*jemp*) and local employees (*lemp*)

In accordance with other studies that have involved the transfer of tangible and intangible assets (e.g. Kremic, 1993; Delios and Henisz, 2002; Dhanaraj and Beamish, 2003). Employee numbers of Japanese and local employees were also utilized as control variables since employees are the active sources and recipients of knowledge and therefore the key factors involved in technology and knowledge transfer.

Capital-related control variables (*uscpt*)

Furthermore, I controlled for the effects of capital using the amount of invested capital in US Dollars ($uscpt$) for each observation. The effects of output were also controlled for.

Output

It is necessary to define and discuss the usage of the *output* variable (PQ_t). In the sense of micro-level data, the variable PQ_t (STATA notation: *pqt*) is similar to what a GDP would represent for a macro-economy (Barro, 1998) – on a micro-level, it is an output variable for a subsidiary. It is not revenue or sales in the strictest sense because an essential implied component in aggregate output values is the price of goods, which is not a component of the dataset. Thus, rather than using revenue or sales as an output variable, I decided to base output on a function of profit, capital, a capital depreciation rate, and wage rates. Except for the price of goods, all other variables were available from the dataset. As in GDP figures, the price of goods is an implied component of the output, and therefore it is not necessary to designate a specific value to it (Hsieh, 1999). Designating a specific price would be impractical because companies make different products. Likewise, a macro-economic GDP figure also does not tell whether its value came from good A or good B. The PQ_t (output) value therefore is an aggregate output value for which it is not necessary to incorporate specific prices. In determining PQ_t, I followed the notation that output is a function of capital and labor over time:

$$PQ_t = F_t[K_t, L_t, t] \tag{12}$$

A profit function as suggested by Barro (1998), in which profit equals a price-output less cost of capital less labor costs was also used according to the following formula:

$$PQ_t = \Pi + rK_t + wL_t \tag{13}$$

($\Pi =$ Profit, $r =$ depreciation rate of capital, $w =$ wage rate)

According to Hsieh (1998), who suggested that the Solow residual (technology/knowledge-based productivity growth index) is a result of the growth rates of factor prices, rather than factor quantities. A similar assumption can be made for the purpose of this dissertation. I followed both Barro's (1998) and Hsieh's (1998) findings that productivity growth is based on the growth rate of output ($\frac{P\dot{Q}_t}{PQ_t}$) and the share-weighted growth in factor inputs, according to the following notation:

$$\frac{P\dot{Q}_t}{PQ_t} = s_k\left(\frac{\dot{r}}{r} + \frac{\dot{K}_t}{K_t}\right) + s_l\left(\frac{\dot{w}}{w} + \frac{\dot{L}_t}{L_t}\right), \tag{14}$$

where s_k and s_l are factor payments of capital and labor, respectively.

Another notation for productivity growth was developed by Felipe (1997), and is obtained from the sum of the share-weighted growth of factor prices, in which the following notation applies:

$$\varphi_{t,t-1} = \ln\left(\frac{PQ_t}{PQ_{t-1}}\right) - \Theta_L \ln\left(\frac{L_t}{L_{t-1}}\right) - \Theta_K \ln\left(\frac{K_t}{K_{t-1}}\right), \quad \text{whereby} \tag{15}$$

$$\Theta_L = \frac{\theta_{L,t} + \theta_{L,t-1}}{2} \quad \text{and} \quad \Theta_K = \frac{\theta_{K,t} + \theta_{K,t-1}}{2}, \quad \text{as in equation} \quad (11)$$

The last expression thus represents the share of factor inputs of labor and capital between two discrete and consecutive time points. This method was applied to my dataset in order to generate the new variable $\varphi_{t,t-1}$. It is also referred to as

Thornqvist index in this dissertation.

This section has shown how Felipe's (1997) model in equation (10) was adjusted to fit the situation of my dataset as shown in equation (15). Namely my usage addresses price-output (PQ_t) rather than output in general as in equation (10).

With only the condition that factor output equals factor incomes the result is that both productivity growth indexes will be the same. Therefore, no further information was needed on input prices, as they are implied in the expression PQ_t, which is price-including. Θ_K and Θ_L in Felipe's (1997) expression refer to what Barro (1998) termed s_k and s_l in his formula, respectively. A closer discussion was provided in the beginning of this chapter.

The advantage of Felipe's (1997) notation is that it introduces $\varphi_{t,t-1}$ as a variable for residual productivity growth and does away with the expression of $P\dot{Q}_t$. The expression $\frac{P\dot{Q}_t}{PQ_t}$ thus essentially becomes productivity growth, in which the difference in the share of factor inputs of labor and capital between two time points has been accounted for and weighted by Θ_L and Θ_K.

Capital-related factor payments (Θ_K and θ_k)

Θ_K and θ_k were then used as capital-related control variables. Θ_K denotes the share of the aggregate factor payment of capital in the total factor payments of a subsidiary. It interacts with the next control variable: θ_k. θ_k denotes the growth rate of capital between two consecutive time intervals. The relationship between the two variables (Θ_K and θ_k) is a result of the change of the share of capital within the factor payments of labor and capital between two time intervals and is calculated according to:

$$\Theta_K = \frac{\theta_{k,t} + \theta_{k,t-1}}{2} \qquad \text{(Felipe, 1997), whereby} \tag{16}$$

$\theta_{k(t,t-1)}$ represent the weights of capital in the total factor payments of labor (*L*) and capital (*K*) in periods *t* and *t-1*, according to the following notations:

$$\theta_{k,t} = \frac{K_t}{L_t + K_t} \;\; ; \;\; \theta_{k,t-1} = \frac{K_{t-1}}{L_{t-1} + K_{t-1}} \tag{17}$$

Labor-related factor payments (Θ_L and θ_l)

Similar to Θ_K, the share of the aggregate factor payment of labor was included in the regression as a control variable. In order to determine the factor payment of Θ_L, the change in the factor share of labor between two time intervals had to be determined, which is similar to that of capital (K) above. The equation for Θ_L as well as $\theta_{l,t}$ and $\theta_{l,t-1}$ (factor shares of labor at time points *t* and *t-1)* are expressed by the following notations, respectively:

Factor payment (labor)

$$\Theta_L = \frac{\theta_{l,t} + \theta_{l,t-1}}{2} \qquad \text{(Felipe, 1997),} \tag{18}$$

Factor shares:

$$\theta_{l,t} = \frac{L_t}{L_t + K_t} \;\; ; \;\; \theta_{l,t-1} = \frac{L_{t-1}}{L_{t-1} + K_{t-1}} \tag{19}$$

Subsidiary age

Subsidiary age was used as another control variable, mainly as a proxy to account for subsidiary experience. In accordance with my argument about the non-static view of knowledge, I controlled for the effects of subsidiary age and the related accumulated knowledge within the subsidiary on the outcome of the *Thornqvist* index. Subsidiary age is included in the analysis because previous studies suggest that it influences the innovations and international operations of a firm (Ietto-Gillies, 1998; Qian, 2008). Subsidiary age is measured as the actual duration of existence of a firm since its year of formation in years.

4.5 Quantitative analysis

As outlined above, I followed equation (10) in calculating the *Thornqvist* index. The *Thornqvist* index is a residual measure and implies a change in technology, technical, or managerial efficiency, which is not accounted for by changes in labor and capital productivities. The model is applied and productivity growth discussed following a discussion of the dataset.

4.5.1 Descriptive data

The dataset was compiled from the *Toyo Keizai Kaigai Shinshutsu Kigyo Soran* and contains time-series data on 1881 Japanese subsidiaries in China covering the years from 1986 to 2003, in 3-year time intervals.[20] The data had been compiled manually from the printed versions of *Toyo Keizai Kaigai Shinshutsu Kigyo Soran* (1986-2003) into electronic form. Some limited data was available with regard to descriptive information about subsidiary setups as far back as 1981 and was included in Table 4.2 only.

From a methodological point of view, there was little need to use data from every year due to the time needed in technology and knowledge transfer. Therefore, three-year time intervals are more practical. The 1881 companies are those

[20] The initial sample included equity-based high-tech manufacturing subsidiaries of Japanese companies in China; therefore, the initial sample contained both WOS and IJVs with one Chinese partner.

observations that contain complete data over at least two discrete time points so that at least one technology/knowledge-related productivity growth measure could be obtained. Complete data implied that all data necessary for the calculation of the indexes, dependent variables, and independent variables was available, including relevant two-digit SIC codes, which eventually narrowed the sample from approximately 3,000 observations to 1,881 observations that contained full data.

The sample includes data from the high-tech sector, which I have limited to the electronics, telecommunications, and high-precision industries, in the broad single-digit SIC 3 group. More specifically, data was from the two-digit SIC-code groups of 35 to 39, which includes all electronic component makers, be they computers, integrated circuits, transmitters, mobile phones, and other electronic devices.

Out of 1881 subsidiaries, there were 717 WOS, with Japanese ownership ratios greater than or equal to 90 percent and 1,164 IJVs, of which 593 were Japanese majority-owned (i.e. ownership exceeded 50%). Many scholars, including Delios and Beamish, 1997; 1999 and Makino and Delios, 1996 consider a subsidiary to be a WOS if one IJV partner owns at least 90% of equity. Out of 1164 IJVs, the mean Japanese ownership ratio was 56%, and the median ownership ratio was 52%. Even if the foundation year of the subsidiaries is taken into account, which would be subject to different IJV laws, the Japanese ownership ratios can be considered low, given that most of the subsidiaries in the sample were established between 1994 and 1996. The figures therefore point to the possibility that the rate of technology transferred in Japanese subsidiaries may not be high. The following two tables show the year of set up of the high-tech subsidiaries (1881 subsidiaries) and the mean subsidiary age of the subsidiaries in the sample, respectively:

Table 4.1: Subsidiaries by year of formation

Year of formation	Number of subsidiaries	Percent
1981	1	0.05
1983	1	0.05
1984	9	0.48
1985	28	1.49
1986	25	1.33
1987	23	1.22
1988	37	1.97
1989	40	2.13
1990	40	2.13
1991	64	3.40
1992	101	5.37
1993	145	7.71
1994	268	14.25
1995	340	18.08
1996	302	16.06
1997	204	10.85
1998	87	4.63
1999	64	3.40
2000	46	2.45
2001	44	2.34
2002	12	0.64
Total	1,881	100.00

Table 4.2: Mean subsidiary age

Variable	Obs	Mean	Std. Dev.	Min	Max
Subsidiary age	1881	7.69013	3.183967	.25	18.75

The data shows the mean subsidiary age to be 7.7 years, with 18.75 years as the maximum and 0.25 years as the minimum subsidiary ages. The data further shows that most subsidiaries were founded between 1992 and 1997, with set-up activity reaching a peak between 1994 and 1996.

Only 538 of 910 subsidiaries formed in those years were joint ventures at a level of Japanese ownership below 90%. The surge in new subsidiaries and increase in wholly-owned subsidiaries (WOS) coincided with the previously enacted *Provisions for Export-Oriented and Technologically-Advanced Foreign Investment*

Law of 1992 and the devaluation of the yuan in 1993. The former allowed greater freedom for export-oriented subsidiaries to set up WOS, bypassing previously mandatory IJVs with local SOEs. Therefore, it would be reasonable to assume that WOS established in these years were more assembly oriented, which could impact their technology/knowledge-based productivity growth values adversely.

4.5.1.1 Ownership adjustment

The data of 1881 subsidiaries indicated that 814 subsidiaries had never changed ownership, while 205 subsidiaries had increased ownership at a mean rate of 12% and 125 had decreased ownership at a mean rate of 9% (Table 4.4). For WOS, the rate of ownership decrease could result in WOS becoming IJVs if the ownership decrease resulted in Japanese ownership falling below 90%. The results analysis which follows the descriptive data section will further show the impact ownership and ownership change had on technology-induced productivity growth. Interestingly, of those subsidiaries that increased ownership, the dataset indicated that the majority of subsidiaries started to increase ownership when their subsidiary age was approximately 7 years, while for those subsidiaries that decreased ownership, the subsidiary age was approximately 8.5 years (Table 4.4). It is also at this age that Delios and Beamish (1999) have argued that IJVs end their productive lifespan. The change in ownership can therefore be interpreted as an adjustment or response to the productive lifespan. More specific analysis with regard to subsidiary age, ownership, and technology/knowledge-based productivity growth is conducted from Section 6.5.2 onwards.

Furthermore, an analysis will show that a change in ownership could affect the technological/knowledge-based productive lifespan and generate numerical values at which ownership should be adjusted to augment the productive lifespan.

Table 4.3: Occurrence of ownership changes in subsidiaries

Type of ownership adjustment (Japanese perspective)	Observations	Mean ownership change (in %) (Japanese perspective)	Std. Dev.	Min.	Max.
None	814	0	0	0	0
Increase	205	12.13897	12.68582	.0499992	62.4
Decrease	125	-9.133427	15.60896	-100	-.0149994

Table 4.4: Mean subsidiary age for subsidiaries that changed ownership

Type of ownership adjustment (Japanese perspective)	Observations	Mean subsidiary age	Std. Dev.	Min.	Max.
Increase	942	7.111673	3.344776	.25	18.583
Decrease	125	8.575664	3.216506	2.417	17.666

4.5.1.2 Subsidiary age and instability

In terms of subsidiary age and instability, the data showed that the majority of subsidiaries has remained in business. A further data breakdown by WOS and IJVs shows that of the 1486 subsidiaries that did not dissolve, 544 were wholly owned and 937 were IJVs. Of a total of 619 WOS in the sample, the non-termination rate for WOS at 88% was thus slightly higher than for IJVs, which recorded a slightly lower non-termination rate of 76%.

The data is in line with other findings that WOS are less likely to disintegrate than IJVs due to higher control and fewer partner disagreements (e.g. Delios and Beamish, 1998). However, the difference in this sample is not very large. Unlike WOS, IJVs have two potential sources of instability – one type of instability can be local-partner induced (caused by the local partner), implying loss of control by the majority shareholder/owner of technology (i.e. the Japanese partner). For the Japanese partner, this scenario would amount to uncontrolled instability. The other type is controlled instability in which the majority shareholder (i.e. Japanese partner) chooses the time at which to terminate the subsidiary. The latter scenario also applies to WOS. Both instability scenarios will be discussed as case studies in the qualitative chapter.

Table 4.5: Subsidiaries by year of exit

Exit year	Number of subsidiaries exited	Percent
Non-exit	1,486	79.00
1992	2	0.11
1993	2	0.11
1994	0	0.00
1995	4	0.21
1996	0	0.00
1997	10	0.53
1998	33	1.75
1999	75	3.99
2000	50	2.66
2001	19	1.01
2002	200	10.63
Total	1,881	100.00

Table 4.5 shows that 1486 subsidiaries did not terminate, yielding an overall stability rate for the sample of 79%. The largest number of exits was recorded in 2002 for both WOS and IJVs. The large number of exits in the year 2002 could be the result of an amendment passed in 2001 to the *Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures*, which simplified the process for establishing WOS. Thus, the large number of exits could simply mean that many IJVs were terminated and converted to WOS. However, the dataset may not reflect later subsidiary formations because the last year of observation is 2003. In fact, a split of the dataset into WOS and IJVs in the next two tables shows that IJV exits

exceeded WOS exits significantly.

The mean subsidiary age of those IJVs that exited was 9 years. The age of all non-exited subsidiaries was 7.6 years on average, in which WOS recorded a mean age of 6.9 years and IJVs, 8.3 years. Most of these subsidiaries were therefore formed between 1994 and 1996, immediately following the new IJV laws of 1993. Therefore, those subsidiaries that exited in 2002 at a mean age of nine 9 years were subsidiaries that had been established earlier than 1993, before the new law took effect and had thus been subject to greater structural market failure (Dunning, 1995). As such, they were exposed to greater government involvement and pressure, a higher degree of information asymmetry and thus non-alignment of goals between IJV partners. Ownership structures were likely to be more a result of government involvement rather than mutual bargaining and therefore did not adequately reflect the tangible or intangible assets to be transacted.

The following two tables summarize the years of exit by WOS and IJVs (Tables 3.7 and 3.8).

Table 4.6: WOS by year of exit

Exit year	Number of WOS exited	Percent
Non-exit	544	87.46
1992	0	0.00
1993	0	0.00
1994	0	0.00
1995	0	0.00
1996	0	0.00
1997	4	0.64
1998	9	1.45
1999	16	2.57
2000	6	0.96
2002	43	6.91
Total	622	100.00

Table 4.7: IJVs by year of exit

Exit year	Number of IJVs exited	Percent
Non-exit	937	74.42
1992	2	0.16
1993	2	0.16
1994	5	0.40
1995	4	0.32
1996	0	0.00
1997	6	0.48
1998	24	1.91
1999	59	4.69
2000	44	3.49
2001	19	1.51
2002	157	12.47
Total	1,259	100.00

4.5.1.3 Size of subsidiaries

Invested capital

The size of the companies measured by invested capital is also noteworthy. The average amount of invested capital for all subsidiaries in the year of their formation was 125 million USD, while for later time periods the amount of invested capital had fallen to an average of 107 million USD for all 1881 subsidiaries (Table 4.8).

Table 4.8: Invested capital

Variable	Obs	Mean	Std. Dev.	Min	Max
Capital in USD *(uscpt)*	1881	1.25e+07	1.30e+08	8	4.36e+09

Employee numbers

Unlike invested capital, however, subsidiaries have grown in terms of employee size. While the average number of all employees (Chinese and Japanese) at the time of subsidiary setup was 256, this number grew to 284 employees in following years, which corresponds to an 11% increase in overall total employee numbers (Tables 3.10; 3.11; 3.12). Such an increase was to be expected given the economic growth and expansion of production in China.

Further analysis showed that the average number of locally hired (Chinese) employees grew by 35 employees (Table 4.10) from a starting value of 246 employees (Table 4.9). This amounts to a locally hired workforce of 281, which corresponds to a 14% increase, according to the latest data. The average number of Japanese employees also increased from 2.75 to 3.33, which corresponds to a 21% increase (Table 4.10).

The decrease in invested capital and increase in employee numbers suggest that overall activities in subsidiaries had become more manual and less value-added with investments decreasing overall and employee numbers rising. This result is somewhat unexpected since it is an indication contrary to the behavior of capital-intensive high-tech companies. With lower value-added, the amount of tacit knowledge transferred necessary for sustained technology and knowledge transfer could thus also result in a decrease. The overall result of this analysis would suggest that most Japanese companies have increasingly used China as a base for production without emphasis on long-term value-added and knowledge-based capabilities.

Table 4.9: Mean total employee numbers by WOS/IJV (majority-owned)

Type of subsidiary	Observations	Mean number of employees	Std. Dev.	Min.	Max.
Entire Sample (WOS and IJVs)	1881	256.4588	694.4099	1	19244
WOS	717	261.8312	671.3356	1	9965
Majority Japanese-owned IJV	593	225.4755	489.8975	1	6741

Table 4.10: Mean number of local and Japanese employees at time of IJV formation (majority Japanese-owned IJVs)

Type of employee	Observations	Mean number of employees	Std. Dev.	Min.	Max.
Local	1654	246.2533	689.388	0	19240
Japanese	1654	2.751511	3.771039	0	43

Table 4.11: Mean change in number of employees since IJV formation

Type of employee	Observations	Mean change in number of employees	Std. Dev.	Min.	Max.
Local	1026	35.26358	307.452	-4947	5401
Japanese	1026	.5789799	15.02249	-12.66667	428

Table 4.12: Comparison of changes in numbers of local employees between WOS and majority Japanese-owned IJVs

Type of subsidiary	Observations	Mean change in number of local employees	Std. Dev.	Min.	Max.
WOS	365	56.83858	238.5404	-751	2393.5
Majority Japanese-owned IJV	368	20.30276	345.263	-4947	3510

Breakdown of results

When the aforementioned sample is broken down, however, the results become more differentiated. While both WOS and IJVs increased employee numbers, WOS did so at almost three times the rate of IJVs (Table 4.12). The average increase in employee numbers amounted to 57 for WOS and 20 for majority Japanese-owned IJVs (Table 4.12).

As for invested capital, however, the difference was even more pronounced (Table 4.13). While WOS showed capital declines, IJVs increased capital at similar but inverse amounts that WOS had decreased capital. Majority Japanese-owned IJVs, on average, increased capital at about USD 3.6 million, while WOS decreased capital by USD 4 million at the same time. In summary, IJVs increased both employee numbers and capital, while WOS increased employee numbers at greater rates than majority Japanese-owned JVs while decreasing capital. It can therefore be inferred that it has been WOS that have reduced value-added activities, not the majority Japanese-owned IJVs, as the initial analysis of the dataset might have suggested.

Contrary to the usual behavior of high-technology companies, these WOS did not show capital-intensiveness in both absolute terms (i.e. they decreased capital) and relative terms (i.e. compared to IJVs), even though these WOS are from high-tech industries. These findings thus support my case for IJVs as better vehicles for technology and knowledge transfer.

Table 4.13: Changes in invested capital by subsidiary type (WOS/majority Japanese-owned IJV)

Type of subsidiary	Observations	Mean change in invested capital(USD)	Std. Dev.	Min.	Max.
WOS	404	-3823528	1.10e+08	-2.18e+09	3.07e+08
Majority Japanese-owned IJV	414	3644268	6.93e+07	-3.10e+08	1.37e+09

5. Results of quantitative analysis

5.1 Panel data - reshaping

The data was received in linear form. In order to make a comparison among all subsidiaries over several intervals of time, the dataset had to be reshaped into panel data. The program utilized was *STATA*.

The data covers 17 years in intervals of three years. Time intervals of less than three years would not yield significant marginal benefit due to the time involved in transferring technologies and absorbing knowledge (e.g. Kennedy, 2003; Oud and Singer, 2007; Zheng, 2009).

5.2 Correlation analysis

Before the regression, a correlation analysis was conducted with the variables discussed in the previous section on variables. The correlation results show that most variables are not highly correlated, with most coefficients remaining well below 0.1. Other correlation values did not exceed the 0.5 mark at any point. I therefore proceeded to use the variables in the regression analysis. However, Θ_L and Θ_K, k_t, and PQ_t were dropped from the regression due to high collinearity with the dependent variable *Thornqvist.*[21] Correlation results are shown next.

[21] Technology/knowledge-based productivity growth is also referred to as *Thornqvist* index in this dissertation.

Table 5.1: Correlations (from *STATA*)

Variables	Technology/ knowledge – based productivity growth	Change in ownership	Japanese ownership	Sales (USD)	Local employees	Japanese employees	Employee ratio	Capital (USD)	Θ_L	Θ_K	PQt (Output)	kt	lt	bt	Subsidiary age
Technology/ knowledge-based productivity growth	1														
Change in ownership	-0.0491	1													
Japanese ownership	0.0591	-0.203	1												
Sales (USD)	-0.1436	-0.01	0.054	1											
Local employees	-0.061	-0.026	0.032	0.395	1										
Japanese employees	0.011	-0.057	0.093	0.112	0.1283	1									
Employee ratio	0.0627	-0.014	0.102	-0	-0.0879	0.0367	1								
Capital (USD)	0.1186	0.0005	0.022	0.031	0.0486	0.0794	-0.0107	1							
Θ_L (aggregate factor payment – labor)	0.0606	-0.004	-0.02	-0	0.0106	0.0098	-0.0184	-0	1						
Θ_K (aggregate factor payment - capital	-0.0606	0.0041	0.018	0.003	-0.0106	-0.0098	0.0184	0.003	-1	1					
PQt (Output)	0.2028	0.001	0.022	-0.01	-0.0011	0.0412	-0.0015	0.003	0.3	-0	1				
kt (factor payment – capital)	0.0092	0.0021	-0.03	-0.01	-0.0026	-0.0021	-0.0025	-0	1	-1	0.3	1			
lt (factor payment – labor)	0.0619	0.1696	0.004	-0.02	-0.0416	-0.0225	0.031	-0.01	-0	0	-0	0.007	1		
bt (technical change)	-0.0338	-0.065	0.011	-0.01	-0.0087	-0.0323	-0.0105	-0	-0	0	-0	-0	-0	1	
Subsidiary age	-0.1586	0.01	-0.2	0.072	0.0792	-0.0157	-0.1159	-0.02	0	-0	-0	0.002	0.021	-0.017	1

5.3 Regression analyses

For the regression analysis, four random-effects regressions were set up. The first two regressions included the entire dataset, while the last two regressions comprised those subsidiaries before and after their peak productivity age. All regressions used technology/knowledge-based productivity growth (*Thornqvist* index) as the dependent variable, ownership-related variables as independent variables, in addition to other control variables. The first regression used total Japanese ownership (*jatotal*) and ownership change (*changeown*) as independent variables, whereas the subsequent three regressions used the natural logarithm of total Japanese ownership (*logjatotal*) as the independent variable. The latter was converted from the former by applying function *ln*(*jatotal*) to the dataset. The variables used in the random-effects regressions are listed below.

Dependent variable:

- Technology/knowledge-based productivity growth (*Thornqvist*)

Independent variables:

- Total Japanese ownership (*jatotal*) (Regression 1),
- Natural logarithm of total Japanese ownership (*logjatotal*) (regressions 2, 3, and 4)

Control variables:

- Number of local employees (*lemp*),
- Number of Japanese employees (*jemp*),
- Invested capital in USD (*uscpt*),

- Factor payment of labor (l_t),
- Technical change (b_t),
- Subsidiary age (*subsidiary_age*)

5.3.1 Regression setup

In setting up the random-effects regressions, those control variables where high collinearity had occurred were removed. According to the correlation table, the excluded variables were factor payments Θ_L, Θ_K, k_t, and PQ_t. However, high collinearity was to be expected for variables Θ_L and Θ_K, since in the econometric setup of the model, the sum of these two variables would be equal to or close to one, due to rounding errors.

With regard to ownership and technology/knowledge-based productivity growth (*Thornqvist* index), the regression included the ownership-related variables ownership change (*changeown*) and total Japanese ownership (*jatotal*). The regression also included other control variables which had shown no significant correlation in the previous correlation table. These were namely variables related to labor (*lemp, jemp, empratio*), invested capital (*uscpt*), technical change (b_t), and subsidiary age (*subsidiary_age*).

Table 5.2: Regression 1 (random effects)

Number of observations:	692
Number of groups:	456

Random-effects GLS regression							
Dependent variable: **Technology/ knowledge-based productivity growth**	***Thornqvist***	Coefficient	Std. Err.	z	P>|z|	[95% Conf.]	Interval
Independent variables:							
Change in ownership	***changeown***	-0.012898	0.0047881	-2.69	0.007	-0.0222824	-0.0035135
Japanese ownership	***jatotal***	-0.0025229	0.0031196	-0.81	0.419	-0.0086373	0.0035915
Control variables:							
Number of local employees	***lemp***	-0.0001285	0.0001031	-1.25	0.213	-0.0003305	0.0000735
Number of Japanese employees	***jemp***	-0.0024285	0.0146163	-0.17	0.868	-0.0310758	0.0262189
Employee ratio	***empratio***	0.6453462	0.567851	1.14	0.256	-0.4676213	1.758314
Capital (USD)	***uscpt***	1.48E-09	3.26E-10	4.53	0	8.39E-10	2.12E-09
Factor payment - labor	***lt***	0.031349	0.0137526	2.28	0.023	0.0043943	0.0583036
Technical change	***bt***	-3.95E-06	2.01E-06	-1.97	0.049	-7.88E-06	-1.53E-08
Subsidiary age	***subsidiary_age***	-0.1125387	0.0224524	-5.01	0	-0.1565446	-0.0685328

R-squared:	within	0.0838
	between	0.0877
	overall	0.0936
sigma_u		0
sigma_e		1.4227871
rho		0
Wald chi2(12)		70.13
Prob > chi2		0

5.3.2 Discussion (regression 1)

In the first regression, a relationship between linear ownership-related variables and growth in technology/knowledge-based productivity growth (*Thornqvist* index) is established.

Under these conditions, a regression of the dataset yielded a significant result within the *1%* confidence interval with regard to change in ownership (*changeown*) and its relationship to technology/knowledge-based productivity growth, which was negative, with a coefficient of *-0.012*. As such, this regression establishes the existence of a negative relationship between ownership change (*changeown*) and productivity growth (*Thornqvist* index). Furthermore, it is important to note the negative coefficient for subsidiary age (*subsidiary_age*), which is also statistically significant.

Although *jatotal* shows a negative relationship with *Thornqvist*, the validity of this relationship cannot be confirmed due to the high P>|z| value. The regression did not yield significant results with regard to total Japanese ownership (*jatotal*) due to a P>|z| value of *0.42*.

Moreover, the regression shows only a marginal relationship between invested capital and growth in technology/knowledge-based productivity due to the low coefficient of *uscpt*, which continues unchanged throughout further regressions. The dataset for this regression yielded 692 observations that had complete data for the given variables.

R^2, sigma (σ), and rho (ρ) values also remained within acceptable limits.

With regard to the negative relationship between change in ownership and technology/knowledge-based productivity growth, the next regression (regression 2) will test the sample further by including the natural logarithm of total Japanese ownership to determine the behavior of the rate of growth for changes in technology/knowledge-based productivity growth (*Thornqvist* index). In other words, the next regression will determine whether productivity growth is non-linear and would slow after increases in Japanese ownership.

Table 5.3: Regression 2 (random effects)

Number of observations	692
Number of groups	456

Random-effects GLS regression							
Dependent variable:							
Technology/ knowledge-based productivity growth	***Thornqvist***	Coefficient	Std. Err.	z	P>|z|	[95% Conf.]	Interval
Independent variables:							
Change in ownership	***changeown***	-0.0096959	0.0051567	-1.88	0.06	-0.0198028	0.000411
Log Japanese ownership	***logjatotal***	2.815523	1.696987	1.66	0.097	-0.5105099	6.141555
Control variables:							
Number of local employees	***lemp***	-0.0001225	0.000103	-1.19	0.234	-0.0003244	0.0000793
Number of Japanese employees	***jemp***	-0.0021689	0.0145983	-0.15	0.882	-0.030781	0.0264432
Employee ratio	***empratio***	0.662311	0.5671791	1.17	0.243	-0.4493396	1.773962
Capital (USD)	***uscpt***	1.48E-09	3.25E-10	4.56	0	8.47E-10	2.12E-09
Factor payment - labor	***lt***	0.0329098	0.0137671	2.39	0.017	0.0059268	0.0598927
Technical change	***bt***	-3.77E-06	2.01E-06	-1.88	0.06	-7.70E-06	1.66E-07
Subsidiary age	***subsidiary_age***	-0.1110885	0.0224405	-4.95	0	-0.1550711	-0.067106

R-squared:	within	0.0941
	between	0.0854
	overall	0.0973
sigma_u		0
sigma_e		1.411068
rho		0
Wald chi2(13)		73.07
Prob > chi2		0

5.3.3 Discussion (regression 2)

In this regression, a new variable was included – *logjatotal*, which is the natural logarithm of total Japanese ownership (*jatotal*) and substituted *jatotal*. The purpose was to find whether the relationship between total Japanese ownership and productivity could be *non-linear*.

In this regression, significant results were obtained for both change in ownership (*changeown*) and the natural logarithm function of total Japanese ownership (*logjatotal*). The latter exhibited a positive and significant relationship with technology/knowledge-based productivity growth (*Thornqvist* index), with a coefficient of 2.81 within a 10% confidence interval (P>|z| is 0.097). The result means that the relationship between the share of Japanese ownership and technology/knowledge-based productivity growth in local subsidiaries and IJVs in China is not a linear one, but rather follows an *inverse upward-sloping* flattening curve, characteristic of *ln* functions. Since *logjatotal* shows a positive and significant relationship with productivity growth, the relationship between Japanese ownership and technology/knowledge-based productivity growth is thus not negative and linear if the regression 1 had been statistically significant.

In practical terms, higher ownership still yields higher technology/knowledge-based productivity growth, but it also means that full Japanese ownership will not yield highest technology/knowledge-based productivity growth and therefore lower transaction costs. Full ownership at some point would lead to a decline in technology/knowledge-based productivity growth and thus increases in transaction costs due to the pattern the curve of *logjatotal* follows. Maximum productivity and thus minimum transaction costs would therefore not be achievable with full (100%) Japanese ownership, but rather at some ownership level below.

Specific ownership levels are discussed in later sections of this chapter.

The relationship between change in ownership (*changeown*) and technology/knowledge-based productivity growth remained unchanged and retained its significance with this particular regression setup. The coefficient of the ownership change variable (*changeown*) remained negative at a value of *-0.009* and significant at better than a *6%* confidence interval. As such, lowering ownership would positively impact technology/knowledge-based productivity growth, while raising ownership would likely lead to productivity losses.

R^2, Sigma (σ), and Rho (ρ) values all remained within acceptable levels in this regression.

Beyond ownership change and ownership as an absolute value, a wider result of the regression can also be interpreted as one in which the timing of ownership change matters. When the control variable of subsidiary age (*subsidiary_age*) is considered, a highly significant and negative relationship with productivity at a 0% confidence level can be noticed, which means subsidiaries became less productive over time with regard to technology and knowledge transfer. Downward ownership adjustment could then reverse declining technology/knowledge-based productivity growth. Timing and other details of ownership adjustments are therefore also discussed in subsequent sections of this chapter.

5.3.4 About regressions 3 and 4

A further limitation of subsidiary age parameters yielded more specific results with respect to ownership change (*changeown*), subsidiary age (*subsidiary_age*), and technology/knowledge-based productivity growth (*Thornqvist* index). In the next two sections, regressions were made on subsidiaries before their peak productivity age and after their peak productivity age. I chose to split the dataset at a subsidiary age of 7.3 years as the critical productivity age for the next two regressions, which is based on the average number for the peak productivity age among all majority Japanese-owned subsidiaries in the sample. A more specific breakdown by ownership ranges, however, is presented in Sections 3.5.6.6 and 3.5.6.7 of this chapter. Peak productivity age for the dataset was determined by analyzing the age at which technology/knowledge-based productivity growth values were highest and limiting the dataset to those observations beyond the peak productivity age. The following regression table shows results for subsidiaries below their peak productivity age.

Table 5.4: Regression 3 (random effects): subsidiary age<7.3 years

Number of observations	187
Number of groups	150

Random-effects GLS regression							
Dependent variable: **Technology/ knowledge-based productivity growth**	***Thornqvist***	Coefficient	Std. Err.	z	P>|z|	[95% Conf.]	Interval
Independent variables:							
Change in ownership	***changeown***	0.0216987	0.0106257	2.04	0.041	0.0008726	0.0425247
Log Japanese ownership	***logjatotal***	3.607636	2.893735	1.25	0.213	-2.06398	9.279251
Control variables:							
Number of local employees	***lemp***	0.0002293	0.0002285	1	0.316	-0.0002186	0.0006772
Number of Japanese employees	***jemp***	-0.0799398	0.0270861	-2.95	0.003	-0.1330277	-0.0268519
Employee ratio	***empratio***	0.0553789	0.5068924	0.11	0.913	-0.9381119	1.04887
Capital (USD)	***uscpt***	1.27E-08	6.71E-09	1.89	0.058	-4.42E-10	2.59E-08
Factor payment - labor	***lt***	0.0855665	0.0684008	1.25	0.211	-0.0484966	0.2196295
Technical change	***bt***	0.0000117	3.21E-06	3.66	0	5.45E-06	0.000018
Subsidiary age	***subsidiary_age***	-0.3792696	0.1034523	-3.67	0	-0.5820323	-0.1765069

R-squared:	within	0.535
	between	0.5562
	overall	0.5397
sigma_u		0.66508218
sigma_e		0.8411153
rho		0.38470234
Wald chi2(14)		201.23
Prob > chi2		0

5.3.5 Discussion (regression 3)

The table shows significant results with regard to the relationship between ownership change (*changeown*) and growth in technology/knowledge-based productivity (*Thornqvist*). Before the peak productivity year, the relationship between the dependent variable (*Thornqvist*) and independent variable of ownership change (*changeown*) was positive and significant within a 5% confidence level. This means that upward ownership changes yielded higher technology/knowledge-based productivity growth in the early years, before subsidiaries reached their peak productivity age. This finding is important because it is more specific with respect to the previous two regressions in which ownership change (*changeown*) was negatively related with growth in technology/knowledge-based productivity. In a subsidiary's younger years, an upward adjustment in Japanese ownership could therefore yield even higher productivity growth. However, much cannot be concluded about the relationship between non-linear productivity growth and total Japanese ownership as seen in the statistical insignificance (P>|z| value) between *logjatotal* and *Thornqvist*.

In contrast, other variables showed statistical significance. Specifically, subsidiary age (*subsidiary_age*), and the number of Japanese employees (*jemp*) were all significantly and negatively related to growth in technology/knowledge-based productivity growth (*Thornqvist* index).

Although the result for ownership change was significant, the regression is also based on fewer observations (187 observations) due to the limitation of subsidiary age parameters. The limitation could affect the interpretability of the results, as the values of R^2, sigma (σ), and rho (ρ) suggest. Another limitation of the finding could be that different subsidiary setup years are not considered.

Table 5.5: Regression 4 (random effects): subsidiary age>=7.3 years

Number of observations	505
Number of groups	306

Random-effects GLS regression							
Dependent variable: **Technology/ knowledge-based productivity growth**	***Thornqvist***	Coefficient	Std. Err.	z	P>|z|	[95% Conf.]	Interval
Independent variables:							
Change in ownership	***changeown***	-0.0108011	0.0050001	-2.16	0.031	-0.0206011	-0.0010011
Log Japanese ownership	***logjatotal***	4.179471	1.723028	2.43	0.015	0.8023987	7.556544
Control variables:							
Number of local employees	***lemp***	-0.0001648	0.0000989	-1.67	0.096	-0.0003587	0.0000291
Number of Japanese employees	***jemp***	0.0066033	0.0147174	0.45	0.654	-0.0222422	0.0354488
Employee ratio	***empratio***	0.1382068	1.264663	0.11	0.913	-2.340487	2.616901
Capital (USD)	***uscpt***	1.50E-09	2.83E-10	5.29	0	9.45E-10	2.06E-09
Factor payment - labor	***lt***	0.032521	0.0122912	2.65	0.008	0.0084307	0.0566112
Technical change	***bt***	2.19E-06	2.50E-06	0.88	0.38	-2.70E-06	7.09E-06
Subsidiary age	***subsidiary_age***	-0.0752259	0.02552	-2.95	0.003	-0.1252442	-0.0252075

R-squared:	within	0.1539
	between	0.3101
	overall	0.2784
sigma_u		0
sigma_e		1.2779916
rho		0
Wald chi2(15)		160.91
Prob > chi2		0

5.3.6 Discussion (regression 4)

After the peak productivity year, the relationship between the dependent variable (*Thornqvist* index) and ownership-related independent variables (*changeown, jatotal*) was similar to that in regression 2, and significant for all variables within 1% to 3% confidence levels (P>|z|). In other words, changes in ownership remained significantly and negatively related with technology/knowledge-based productivity growth, while the influence of total ownership on productivity growth followed a pattern of the sum of negative total ownership and the natural logarithm of Japanese ownership (*logjatotal*). The specific relationship has been shown in regression 2. Therefore, it can be inferred that after the peak productivity age, decreasing ownership is preferable to increasing ownership if high rates of knowledge and technology implementation are to be maintained. The higher absolute coefficient values of the ownership-related variables (*changeown, logjatotal*) compared to regression 2 suggest that changes in ownership after the peak productivity subsidiary age affected technology/knowledge-based productivity growth relatively more strongly.

Moreover, the significance of the negative relationship between the number of local employees (*lemp*) and productivity growth is also noteworthy. It could suggest that higher technology/knowledge-based productivity growth could be achieved by employing fewer local workers. The value added per worker would therefore increase with time. The variable for subsidiary age (*subsidiary_age*) also shows a negative relationship with the *Thornqvist* index, meaning that the age of the subsidiary is still a liability to technology/knowledge-based productivity growth.

The reliability of this sample is high since it includes 505 observations with favorable R^2, sigma (σ), and rho (ρ) values.

5.3.7 Concluding remarks about regression results

The combined results of regressions 1, 2, 3, and 4 suggest that it could be prudent to choose higher Japanese ownership levels at the time an IJV is set up, or adjust ownership levels upwards if low Japanese ownership had been chosen when the IJV was formed. However, the difference between *jatotal* and *logjatotal*, in which the former has a negative coefficient, also possibly means that sole Japanese ownership would not be effective and therefore any growth in technology/knowledge-dependent productivity based on efficient knowledge and/or technology transfer would depend on shared ownership. Upward ownership adjustments would need to be completed before an IJV reached approximately 7.3 years of age in order to attain higher levels of productivity growth. After the peak productivity age, it would still make sense to cede some ownership to the Chinese IJV partner in order to maintain positive productivity growth.

5.4 Additional issues, limitations, and concluding remarks

The chapter has shown several important findings with respect to the dataset. In the first instance, the dataset was analyzed with respect to its descriptive qualities regarding information on the status of Japanese-Chinese IJVs in China. Several important findings with respect to descriptive data have also been established:

Furthermore, the chapter has sought to provide a link between economic concepts and business research, thus addressing a gap in both economics and business literature. Moreover, the findings made in this chapter could provide some utility in practical application and thus be useful for managers and policymakers. Practical implications are addressed in the next chapter more closely.

5.4.1 Findings of descriptive data

The descriptive data has given background information on Japanese subsidiaries (WOS and IJVs with local partners) in China. It has consisted of background information that is relevant to the set-up and management of subsidiaries in China. Most samples of descriptive data were categorized by WOS and IJVs. As such, descriptive data has given information about the years of formation by type of subsidiary (WOS or IJV), the size of subsidiaries by invested capital and employees. Accordingly, descriptive data gave evidence about instability rates, which included termination rates by subsidiary type and the time it took to reach instability. An important finding in this regard has been the productive lifespan of subsidiaries. Even though IJVs were more likely to experience instability than WOS, IJVs that eventually managed to survive experienced longer periods of productive lifespan and could achieve higher technology/knowledge-based productivity growth after ownership adjustment. WOS became an unproductive liability following their peak productivity growth year. Additionally, descriptive data provided further information about ownership changes by subsidiary age as well as information about factor-input changes.

5.4.2 Findings of regressions

The primary purpose of the chapter, however, was to find the relationship between ownership-related variables and technology/knowledge-based productivity growth under constraints of several other variables that were previously identified as relevant in the literature review and included as control variables in the regressions. Thus, the relationship between ownership-related variables (i.e. Japanese ownership and ownership change) and changes in technology/knowledge-based productivity was tested using random-effects regressions. A total of four regressions (random-effects) were developed. The first two regressions tested the entire sample of Japanese high-tech WOS and IJVs in China with respect to total Japanese ownership and change in ownership. Control variables included subsidiary age and factor input-related variables (capital, labor, employee ratio, technical change).

While the first regression established a negative relationship between ownership change and technology/knowledge-based productivity growth, the regression did not establish a conclusive relationship between the linear function of total Japanese ownership and technology/knowledge-based productivity growth.

In accordance with the review of theories in chapters two and three, the argument of the dissertation was that highest productivity growth would occur within some majority-Japanese ownership level below full ownership. In order to account for the argument in quantitative terms, a new ownership variable was generated as the natural logarithm of total Japanese ownership. Its function is upward sloping but flattens near the maximum. Consequently, the second random-effects regression established a positive relationship between the natural logarithm of total Japanese ownership and technology/knowledge-based productivity growth within an acceptable confidence interval of better than 10%. The result means that while high Japanese ownership is indeed important for technology/knowledge-based productivity growth, Japanese ownership should not be too high or productivity growth may be jeopardized.

5.4.3 Findings of related quantitative analyses (control variables)

With respect to subsidiary age, both regressions have shown a highly significant negative relationship between subsidiary age and technology/knowledge-based productivity growth. As a result of its significance, a specific value for subsidiary age at which technology/knowledge-based productivity growth peaked was generated from the sample. The value for the age for peak growth in technology/knowledge-based productivity was 7.3 years. The sample was then divided into subsidiaries before the age for peak productivity growth and subsidiaries at least the age for peak productivity growth (including subsidiaries of 7.3 years and older).

As a result, two new regressions were formed: one random-effects regression was completed on the sample of subsidiaries less than 7.3 years of subsidiary age and another regression was formed on subsidiaries of subsidiary ages of 7.3 years or higher.

After the split of the sample by subsidiary age, the regression results became more differentiated:

For subsidiaries before the subsidiary age of 7.3 years, no significant relationship between the logarithmic function of total Japanese ownership and technology/knowledge-based productivity growth could be found. However, a significant positive relationship between ownership change and technology/knowledge-based productivity growth could be found.

For subsidiaries with subsidiary age of 7.3 years and after, two significant relationships with respect to ownership-related variables were established for this sample. A significant and positive relationship could be determined for the logarithmic function of total Japanese ownership and technology/knowledge-based productivity growth at a high significance of 0.015. Furthermore, there was also a positive relationship between change in ownership and technology/knowledge-based productivity growth at a confidence interval better than 0.05.

5.4.4 Summary of interpretation of quantitative findings

The findings mean that the Japanese investor should seek higher ownership when negotiating for the joint venture set-up. However, a higher ownership should be given to the Chinese partner over the life of the joint venture, particularly when peak productivity age is reached. Therefore, ownership should be renegotiated after approximately 7 years of forming the IJV.

Variations by specific ownership range, related ownership adjustments, and changes in technology/knowledge productivity that resulted were further discussed in the chapter. Importantly, the results imply that learning, knowledge absorption, and higher skills result in higher potential value added that the Chinese partner can contribute to the IJV, and for this additional value added, the Chinese partner needs to be compensated accordingly – in the form of additional ownership. The concept of ownership as a medium for the transaction of complementary assets (tangible and intangible) had been discussed in the literature review. The according productivity growth values therefore give guidance on the value or worth received from changing ownership structures.

In addition, analysis on employee structures, possible adjustments to employee ratios and their impact on technology/knowledge-based productivity growth were also discussed. Employees are an essential component in the knowledge transfer and absorption process.

5.4.5 Limitations

In addition to determining relationships between technology/knowledge-based productivity growth, ownership, and factor-input related variables, the chapter has extended these findings from numerous angles by determining numeric values for specific ownership ranges in order to provide a context for possible practical implementation of the findings. As such, the chapter has provided additional information on new productive growth periods and subsidiary instability rates following ownership adjustment.

A note about limits in the sample size

Findings where specific parameters were applied may have been limited by their sample size. This occasionally applied to cases in which values were calculated for specific ownership ranges. Setting specific parameters could limit the sample of subsidiaries with useful data.

Further limitations could include some initial assumptions that were made in order to fit the model, such as constant returns to scale and the price-output ratio. Moreover, the data consists of three-year time intervals. Although the time frame is appropriate for absorption and processing of new technological and managerial knowledge, results may have differed if data had been used on a yearly basis. However, the limited expected additional marginal benefit of manually compiling data on a yearly basis for an almost two-decade time span worth of observations did not justify the additional time for a single-person project such as this dissertation.

The main purpose of this section was to show the potential that the methodology can be used for. While some very specific parameters caused the data to be limited, the sections have nonetheless shown the potential for research under the relevant methodologies. While sometimes inconclusive, the data may nevertheless have provided an insight into general trends and thus given rough estimates of the results that could be expected out of more collaborative and well-funded research on a greater scale with a team of researchers in the future by employing such methodology.

5.4.6 Qualitative interpretation

The next chapter will provide a qualitative interpretation of the findings made in this chapter by discussing several aspects of their relevance with regard to actual joint ventures between Japanese and Chinese companies in China. Four case studies were selected based on the extent of technology/knowledge-based productivity growth found in the dataset. Technology/knowledge-based productivity growth was ranked from the data and divided into very high, high, medium, and low productivity growth over a similar time span. Cases of subsidiaries of a similar age and employee size were selected as case studies.

6. Additional analysis

6.1 Objectives

Having established a significant relationship between ownership-related variables and technology/knowledge-based productivity growth, I then proceeded to find the optimal levels at which ownership resulted in highest technology-induced productivity growth levels based on the sample. In addition to the *Thornqvist* index, I wanted to find further interactions between variables such as changes in ownership, subsidiary age, productive lifespan and Japanese-Chinese employee ratios with respect to technology/knowledge-based productivity growth (*Thornqvist* index) and their specific numeric values. *STATA* was used throughout the analysis.

6.2 Method

In order to gain a general idea of the *Thornqvist* index and how it relates to specific ownership levels, values for the *Thornqvist* index with respect to ownership in steps of 10 percent were calculated. The number of subsidiaries that had exited within a particular ownership range was then counted using *STATA*. Although the data do not reveal reasons for termination, possible reasons are discussed in the qualitative chapter. The *Thornqvist* index was calculated for wholly-owned subsidiaries first.

Due to different numbers of observations for each subsidiary – and different years of formation and exit across subsidiaries – a comparable variable for ownership that would encompass all observations for a subsidiary and its observed time intervals needed to be generated. As a result, a mean ownership variable was generated. For example, if a subsidiary yielded three different ownership observations across three time intervals, *STATA* would calculate the mean ownership variable from these observations. Likewise, a mean *Thornqvist* index among the time intervals for each subsidiary was also generated. The results follow and are listed by ownership ranges.

6.3 Definition of ownership ranges

I have defined ownership ranges with respect to Japanese majority ownership in the following format:

Ownership range 1: *jatotal*>=90%, (Japanese ownership is greater than or equal to 90%) (WOS)

Ownership range 2: 90%>*jatotal* >=80% (Japanese ownership is between 80% and below 90%, greater than or equal to 80 and less than 90)

Ownership range 3: 80%>*jatotal*>=70% (Japanese ownership is between 70% and below 80%)

Ownership range 4: 70%>*jatotal*>=60% (Japanese ownership is between 60% and below 70%)

Ownership range 5: 60%>*jatotal*>50% (Japanese ownership is above 50% and below 60%)

6.4 Discussion by ownership ranges

Table 6.1: Technology/knowledge-based productivity growth and instability values by ownership range

Ownership range	Observations	Number of subsidiaries exited	Mean productivity growth**	Std. Dev.	Min.	Max.
1	359	30	.3868092	1.331707	-6.944955	10.11124
2	84	9	.4659516	.8474288	-2.078245	4.883531
3	96	8	.26229	1.261103	-5.49228	4.120498
4	105	16	.3067979	.8454231	-2.867648	2.991041
5	81	16	.2401744	.973858	-4.097531	2.492207
6 (minority Japanese-owned)	202	68	.1395638	1.164072	-6.274729	4.02515

** Values are fractions of 1. In other words, each value can be interpreted as a percentage by multiplying it by 100.

Ownership range 1:

For subsidiaries in which the majority holder owned 90% or more, the following results were obtained for the *mean Thornqvist* index[22]:

This ownership range yielded 45 observations with a *mean Thornqvist* index of 0.38 and a standard deviation of 1.02. The mean *Thornqvist* value being a positive number suggests that there has been a gain in technology-induced productivity. Since, however, I am more interested in how other ownership categories performed, the first absolute value obtained is not yet meaningful, other than the fact that in WOS, there was an overall increase in technology-based productivity growth of about 38%.

The preceding figure for technology/knowledge-based productivity growth was then paired with the instability rate. As for instability in the subsidiaries within this ownership range, the analysis showed that 30 out of 359 WOS, or less than one in ten subsidiaries eventually exited, although this analysis does not indicate whether they divested or became another type of subsidiary (such as an IJV). Regarding mean technology/knowledge-based productivity growth, however, WOS observed gains in productivity growth. However, it is more meaningful to understand how technology-based productivity growth in this ownership range compared to that in other ownership ranges. Therefore, the same analysis was conducted for all other ownership ranges below 90% Japanese ownership.

Ownership range 2:

This range showed an increase in the mean *Thornqvist* index to above 0.46, among 84 observed subsidiaries in this ownership range. Moreover, instability

[22] Mean technology/knowledge-based productivity growth expressed as a fraction of 1. Values can be interpreted as percentages by multiplying them by 100.

decreased. The data shows that only 9 out of 84 subsidiaries terminated, which brings the instability rate to approximately 10%.

Ownership range 3:

A rapid decline in the *Thornqvist* index to a value of 0.26 in the 70 to 80 percent ownership range among 96 observed subsidiaries is observed. The instability rate in this ownership range increased to 16%, with 9 out of 56 subsidiaries exiting.

Ownership range 4:

Among 105 observations in this ownership range, the mean *Thornqvist* index increased to a value of 0.30 (30%). The instability rate continued to increase with 16 subsidiaries exiting, bringing the instability rate to approximately 15%.

Ownership range 5:

For the last Japanese majority-owned category, in which there were 81 observations, there is a decline in technology-induced productivity to a mean value of the *Thornqvist* index of 0.240, and instability among 16 IJVs, which amounts to a rate of approximately 20% - an increase compared to the previous range.

Ownership range 6: (Minority Japanese-owned IJVs)

For minority Japanese-owned IJVs, I included all subsidiaries in which the Japanese partner owned less than 50% into this category, without further breakdowns into more specific ownership ranges. This minority-ownership range thus yielded 290 observations, 68 of which eventually terminated. The corresponding instability rate is approximately 23%. Mean technology/knowledge-induced productivity growth (mean *Thornqvist* index) declined noticeably compared to the preceding ownership range, to a value of 0.14.

Summary of findings

The above data has shown that optimal technology/knowledge-induced productivity growth among both IJV partners likely occurred within ownership range 2 (80%-90% Japanese ownership). Incidentally, this ownership range also yielded the lowest termination rate of IJVs (i.e. lowest instability rate). Therefore, a further narrowing of parameters within this particular ownership range is conducted in order to determine at which level exactly the highest value for the *Thornqvist* index would occur.

Further specifications

Ownership range 2 was further divided into two ranges: one in which ownership was greater than or equal to 85% and less than 90%, and another where ownership was greater than or equal to 80% and less than 85%. Therefore, values for the *Thornqvist* index at the 85% to 90% ownership levels and at the 80% to 85% Japanese ownership levels were calculated (Table 6.2).

The latter ownership range yielded higher results in mean technology-induced productivity growth (mean *Thornqvist* index) at an exit rate of only 3 subsidiaries among 29. I left the results within this 5% ownership range instead of narrowing them to more specific ownership percentages due to the number of observations, which would become too small otherwise.

Table 6.2: Ownership range yielding maximum initial technology/knowledge-based productivity growth

Ownership range	Observations	Mean productivity growth**	Std. Dev.	Min.	Max.
a*	24	.5045867	1.114344	-1.369352	4.883531
b*	29	.536149	.6775801	-.5818416	2.576564

*Notes:
a) Japanese ownership is between 90% and 85%, not including 90%;
(90%>Japanese ownership>=85%)
b) Japanese ownership is between 85% and 80%, not including 85%;
(85%>Japanese ownership>=80%)

6.5 Subsidiary age and ownership

A separate analysis for subsidiary age and ownership was conducted, in which the occurrence of IJVs in specific ownership ranges is discussed. In addition to the same five ownership ranges that were defined previously, an aggregate majority Japanese-owned and an aggregate minority Japanese-owned range were created.

The mean subsidiary age for each ownership range was calculated and the number of observations within for the applicable ownership range recorded. The table below summarizes ownership ranges, mean subsidiary age, and number of observations in a particular ownership range. The mean subsidiary age for all subsidiaries above the 50% Japanese ownership level, including WOS, was 7.35 years (n=1310). The mean subsidiary age for all Japanese majority-owned IJVs (excluding WOS), was 7.75 years (Table 6.3, next page).

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100.

Table 6.3: Mean subsidiary age by ownership range

Ownership range	Observations	Mean subsidiary age (years)	Std. Dev.	Min.	Max.
c*	*1310*	*7.355881*	*2.870199*	*.25*	*18.583*
d*	*593*	*7.758553*	*2.812721*	*.667*	*18.583*
1	77	7.201013	2.898394	.25	17.083
2	134	7.201799	2.342728	1.5	15.666
3	142	7.811296	2.70095	.75	16.5
4	184	7.910027	2.881392	.667	17.083
5	303	8.406208	3.560164	1.333	18.75

*Notes:
c) Japanese ownership is above 50%;
(Japanese ownership>50%)
d) Majority Japanese-owned IJVs (excluding WOS), ownership is above 50% and less than 90%;
(90%>Japanese ownership>50%)

For wholly-owned subsidiaries (ownership range 1) and IJVs in ownership range 2, the mean subsidiary ages were both 7.2 years. However, the highest mean subsidiary age occurred within ownership range 5, which also recorded the highest number of observations. The mean subsidiary age for ownership range 5 was closely followed by ownership ranges 3 and 4, whose mean subsidiary age values were very similar. When compared to the IJV instability findings established previously, these ownership ranges were also among the highest with regard to termination rates. Therefore, subsidiary age and ownership ranges in this context point to the possibility that the oldest subsidiaries were established within ownership ranges of 50% to 70% Japanese ownership.

In the upper ownership ranges, particularly ownership ranges 1 and 2, subsidiaries tended to be younger.

The large quantity of subsidiaries in ownership ranges 4 and 5 will be important in the discussion of ownership adjustment since they provide room for upward adjustment in Japanese ownership.

6.6 Subsidiary age and technology/knowledge-based productivity growth

With respect to the *Thornqvist* index, the relationship between subsidiary age and technology/knowledge-based productivity growth changed depending on the average subsidiary age. The average subsidiary age for the sample of Japanese majority-owned subsidiaries was 7.35 years. The average subsidiary age for WOS was 7.2 years, while majority Japanese-owned IJVs, specifically, recorded an average age of 7.75 years. An analysis of the *Thornqvist* index for those subsidiaries below the average subsidiary age of 7.2 years for WOS and 7.75 years for IJVs yielded a mean value of the *Thornqvist* index of 0.64 for WOS (ownership range 1) and 0.56 for all other majority Japanese-owned IJVs, respectively.

At above their respective average subsidiary ages, the mean value of the *Thornqvist* index for WOS fell significantly to 0.17 (ownership range 1), but was 0.32 for IJVs. This suggests that even though IJVs have a longer productive lifespan, they also take longer to reach full knowledge and technology-based productivity growth. Although the mean *Thornqvist index* for both WOS and IJVs was much lower after subsidiaries had been in operation for more than their respective average subsidiary ages, IJVs showed a twice higher performance in terms of technology/knowledge transfer than did WOS. The majority of these IJVs fell into a Japanese ownership range of between 65% and 75%. The finding suggests that after these periods, raising ownership levels would not necessarily be an effective option with respect to maintaining or raising technology and knowledge transfer and IJV stability. Therefore, I will examine the rate of ownership adjustments with respect to critical subsidiary age values such as lifespan and peak years for technology/knowledge-based productivity growth by ownership ranges more closely starting with Table 6.4.

Table 6.4: Technology/knowledge-based productivity growth by subsidiary age with respect to mean subsidiary age for entire sample

Subsidiary age	Observations	Mean technology/knowledge-based productivity growth**	Std. Dev.	Min.	Max.
Below mean subsidiary age	325	.596395	1.303332	-5.49228	10.11124
Above mean subsidiary age	402	.1520334	1.015707	-6.944955	7.48645

Table 6.5: Technology/knowledge-based productivity growth by subsidiary age with respect to mean subsidiary age for WOS

Subsidiary age	Observations	Mean technology/knowledge-based productivity growth**	Std. Dev.	Min.	Max.
Below mean WOS age	162	.6455738	1.490062	-4.686962	10.11124
Above mean WOS age	199	.1727397	1.140936	-6.944955	7.48645

Table 6.6: Technology/knowledge-based productivity growth by subsidiary age with respect to mean subsidiary age for majority Japanese-owned IJVs

Subsidiary age	Observations	Mean technology/knowledge-based productivity growth**	Std. Dev.	Min.	Max.
Below mean IJV age	178	.5689141	1.019925	-5.49228	4.883531
Above mean IJV age	188	.3169062	.9979929	-5.49228	4.883531

As an extension to the above paragraph, I further decided to find a subsidiary age which would yield an optimal rate in the growth of technology/knowledge-based productivity, within average subsidiary ages.

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100.

An analysis of the dataset showed that within the relevant age ranges, WOS tended to reach their peak with regard to technology/knowledge-based productivity growth exceeding majority Japanese-owned IJVs by almost twice in this regard, within 6 years. Similarly, majority Japanese-owned IJVs also tended to reach peak technology/knowledge-based productivity growth within six years of formation, although they did not reach the same levels as WOS. Furthermore, majority Japanese-owned IJVs tended to be unproductive for the first 4 years and peaked with regard to technology/knowledge-based productivity growth after 9 to 10 years. In contrast, WOS tended to reach highest levels of the *Thornqvist* index within 3 to 4 years of setup and without experiencing significant unproductive periods immediately following subsidiary formation. However, technology/knowledge-based productivity growth of WOS started to decline after 4 years when IJVs were gaining technology-based productivity, and eventually fell below that of IJVs after 7 years.

Moreover, technology/knowledge-based productivity growth of WOS eventually became negative after 10 years. In contrast, technology and knowledge transfer rates (*Thornqvist* index) among majority Japanese-owned IJVs reached a plateau after approximately 11 years after which they declined only somewhat and remained well within positive territory. As such, majority Japanese-owned IJVs did not register negative growth in technology/knowledge-based productivity constantly maintaining positive rates after they had overcome the initial unproductive period following IJV setup.

6.7 Overall effects of ownership adjustments

6.7.1 Instability in IJVs that adjusted ownership

Before analyzing ownership adjustment and its effects on technology/knowledge-based productivity growth (*Thornqvist* index), I tested the effects of ownership adjustment on IJV instability first. The reason is that if ownership adjustment were to cause high termination rates among subsidiaries, the meaning of ownership adjustment as a tool to adjust the *Thornqvist* index would diminish (Felipe, 1997).

6.7.2 Method

I counted those subsidiaries that had already terminated and grouped them into those that had not adjusted ownership and those that had either increased or decreased ownership throughout their lifetime. Among a total of 309 subsidiaries that had terminated, the analysis showed that 262 subsidiaries had never adjusted ownership, while 28 subsidiaries had increased ownership and 19 subsidiaries had decreased ownership.

Since panel data was used, the incidences of ownership decreases and increases were counted and subsidiaries designated as having decreased ownership if two conditions were met: the number of incidences of ownership decrease outnumbered that of ownership increase and the last observed ownership value was less than the first observed ownership value. Otherwise, it would be counted as an overall ownership increase. However, this occurred only once among 309 observations.

6.7.3 Results

The findings show that those IJVs that had never changed ownership were the most likely to exit. By contrast, subsidiaries that had changed ownership in either direction were much less likely to terminate. However, subsidiaries that had changed ownership upwards were more likely to exit than those that had changed ownership downwards.

More specifically, compared to subsidiaries that had increased ownership, subsidiaries with no ownership changes were about 10 times more likely to exit. Compared to subsidiaries that had decreased ownership, subsidiaries with constant ownership were more than 13 times more likely to terminate. In other words, subsidiaries that had decreased ownership were the least likely to terminate in this sample.

6.7.4 Instability in IJVs that adjusted ownership compared to IJVs that did not adjust ownership

Using *STATA*, I counted those IJVs with no ownership adjustment but had terminated within IJV ownership ranges (i.e. ownership ranges 2, 3, 4, and 5). A result of 82 IJVs that had terminated without ever having changed ownership was obtained.

After applying the same procedure to account for those IJVs that had increased Japanese ownership, a result of 16 IJVs that had terminated was obtained. Similarly, *STATA* showed 11 IJVs to have exited after decreasing ownership.

Table 6.7: IJV termination rates by type of ownership adjustment

Type of ownership change (Japanese perspective)	Majority-owned IJVs exited (out of 593 majority-owned IJVs)
None	82
Increase	16
Decrease	11

The previous findings have shown that changing ownership in either direction could extend the lifespan of IJVs, particularly after ownership was increased. Most IJVs in ownership range 4 chose to alter ownership structures. In this ownership range, the average increase in ownership amounted to 8.53% while the average decrease was almost negligible at -0.033%.

With regard to IJV instability, most subsidiaries in ownership ranges 4 and 5 were better off increasing ownership, while IJVs in ownership ranges 2 and 3 could choose the options of either decreasing or increasing ownership in order to extend lifespan to similar extent. IJVs in ownership range 2 – those above 80 percent - however, would likely cross the 90-percent Japanese ownership mark after ownership increase and thus become WOS.

Table 6.8: Mean ownership changes by ownership range

Ownership range	Mean initial Japanese ownership for subsidiaries without ownership change	Mean initial Japanese ownership for subsidiaries with mean ownership increase	Mean initial Japanese ownership for subsidiaries with ownership decrease	Mean ownership decrease in % (Japanese perspective)	Mean ownership increase in % (Japanese perspective)
1	99.1%	93.6%	97.6%	2.93%	2.81%
2	82.1%	83.5%	84.2%	-8.58%	24.5%
3	71.4%	73.6%	75.6%	-46.67%	25.62%
4	61.4%	64.5%	63.8%	-0.033%	8.53%
5	53.5%	54.4%	53.0%	-13.17%	15.14%

6.7.5 Relation to ownership

The mean initial ownership level for IJVs that had increased ownership was 69%, while the mean initial ownership level for IJVs that had decreased ownership was 58%. For those IJVs that did not change ownership, the mean (initial) ownership level was 72% (Table 6.9). Subsidiaries that had increased ownership did so at an average rate of 11% while subsidiaries that had decreased ownership did so at an average rate of 7%.

With regard to instability of majority-owned IJVs, however, the results support the assumption made previously that in the case of existing ownership structures - which may be non-optimal with regard to technology/knowledge-based productivity growth (*Thornqvist* index) – subsequent adjustments of ownership may not have coincided with optimal absolute ownership values with respect to the *Thornqvist* index established previously. This could be due to increasing potential for IJV instability. For example, subsidiaries with 72% Japanese ownership were the least likely to change ownership and thus most likely to result in termination. However, when one compares subsidiaries with no change in ownership with subsidiaries that recorded increases in ownership, it can be seen that an increase in ownership could reduce instability by as much as 10 times. However, when the average rate of increase of 13% was added to the average Japanese ownership rate of 72% for those IJVs that had increased ownership, the result was that IJV stability (non-termination) would be achieved approximately within the optimal ownership range that had been established with respect to the *Thornqvist* index previously (between 80% and 85% Japanese ownership). The average ownership value after ownership increase would be 82% (69%+13%).

For subsidiaries that had decreased ownership from an average ownership value of 58%, the rate of instability was even less; however, these IJVs managed to remain Japanese majority-owned on average only marginally at 51% (58%-7%).

The findings in this section have shown that an ownership ratio of 69% to 72% (two most unstable points) led to instability and that instability could be reduced significantly by increasing ownership at an average rate of 13%. Interestingly, the case of ownership reduction yielded high stability, albeit almost at the expense of Japanese majority equity share.

Table 6.9: Japanese-majority ownership categories

Type of ownership change (Japanese perspective)	Mean initial Japanese ownership level	Rate of ownership change (mean)	Japanese ownership level after ownership change (mean)
Increase	69%	13%	82%
Decrease	58%	-7%	51%
None	72%	0%	72%

I further tested the sample with regard to the subsidiary age at which these IJVs exited by dividing the sample into those IJVs that increased, decreased, or kept their ownership constant. The next table lists the results.

Table 6.10: Mean subsidiary age by type of ownership adjustment

Type of ownership change (Japanese perspective)	Observations	Mean subsidiary age (years)	Std. Dev.	Min.	Max.
None	411	7.43	2.74	.667	18.08
Increase	127	8.64	2.75	4.167	18.58
Decrease	55	8.15	2.99	2.417	17.42

The average subsidiary ages for IJV termination were 7.43 years for IJVs without change in ownership and 8.64 years and 8.15 years for IJVs which had increased and decreased ownership, respectively. Ownership changes seem therefore to increase the lifespan of IJVs (Table 6.10).

I further tested the sample of those subsidiaries that had terminated and changed ownership, with respect to the *Thornqvist* index. I first wanted to obtain an overall idea over relative values of the *Thornqvist* index among the three types of subsidiaries which had terminated– namely those subsidiaries that had not changed ownership and those that had changed ownership.

Table 6.11: Mean change in technology/knowledge-based productivity growth by type of ownership adjustment

Type of ownership change (Japanese perspective)	Observations	Mean technology/ knowledge-based productivity growth**	Std. Dev.	Min.	Max.
None	85	0.016	1.21	-4.51	3.34
Increase	25	0.19	1.25	-2.99	3.15
Decrease	15	-0.23	2.06	-6.27	1.82

The results indicate that IJVs which terminated and did not change ownership remained slightly productive with regard to technology and knowledge transfer in absolute terms, but not relative to IJVs that chose to increase ownership. Subsidiaries which chose to increase ownership had more than 10 times the gains in the mean *Thornqvist* index by comparison, and were therefore much more productive with regard to technology and knowledge transfer.

However, IJVs which had chosen to decrease ownership experienced a contraction in the mean values of the *Thornqvist* index. Even though decreasing ownership had helped extend their lifespan, it did not result in technology-based productivity growth.

It is important to note that this section includes only those IJVs which terminated. For those IJVs that did not terminate, ownership changes, including the reduction in ownership had different impacts on mean values of technology/knowledge-based productivity growth.

The result is not unexpected since the owner of the technology is yielding greater control to the local partner and possibly giving it up altogether by becoming a minority owner. In the previous section, an initial ownership value of 58% for IJVs that became unstable and chose to decrease ownership had been established. As the

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100.

low ownership value suggests, control over technologies was limited and further decrease may have led to withdrawal of technologies, processes, or vital knowledge resulting in the loss of technology/knowledge-based productivity growth (Table 6.11).

I will further test the above findings with regard to the productive lifespan and the rate of change in ownership with respect to technology/knowledge-based productivity growth (*Thornqvist* index*)*. The above analysis has shown that a change in ownership can result in higher IJV stability. However, the next section will address the question of whether changes in ownership also led to higher technology/knowledge-based productivity growth and the extent to which such growth occurred, if any.

The following analysis will establish the effects of ownership changes on the *productive* lifespan of subsidiaries. Additionally, another discussion will focus on optimal employee ratios since employees are an essential component through which new knowledge is communicated and implemented.

6.7.6 Productive lifespan

I wanted to find the productive lifespan of subsidiaries that changed ownership in comparison to those that did not with respect to the resulting amount of additional technology/knowledge-based productivity growth and lifespan that could be achieved. Thus, I found the relevant new lifespan values for subsidiaries that had adjusted ownership either before or after a critical instability age for a given ownership range.

The problem was approached with the purpose of obtaining values for the years at which subsidiaries became unstable, and whether ownership adjustment would have an influence on the productive lifespan of the subsidiaries. In the next instance, the amount of ownership to be changed that would result in the highest technology-based productivity growth was determined. According to the literature review, this process would also result in a longer productive lifespan of a subsidiary.

6.7.6.1 Method: Critical age for instability among subsidiaries

In this section, the age at which instability would most likely occur within a given ownership bracket is analyzed. Using *STATA*, I counted the occurrences of terminated IJVs within each ownership range, which then yielded an average instability age within a given ownership range. The number of observations (N) ranged from a maximum of 88 subsidiary terminations among 690 subsidiaries for ownership range 1 to a minimum of 21 terminations among 142 subsidiaries, in ownership range 3, with the remaining results for JV instability in other ownership ranges. The sample size was therefore large enough to rely on an average figure for subsidiary age at which instability would most likely occur.

Among these ownership ranges, WOS were the least likely to encounter termination or instability, followed by the ownership range 3, while subsidiaries in ownership range 5 experienced the highest rates of instability. Interestingly, subsidiaries in ownership range 2 would, on average, experience termination earliest, while subsidiaries in ownership range 4 would experience them latest. Occurrences of termination were much more frequent for the latter when those subsidiaries eventually did experience instability, which was later than in other ownership ranges. The results are listed in the next table.

Table 6.12: Mean instability age by ownership range

Ownership range	Mean age (years)	Mean instability age (years)	Mean instability rate (n2/n1)
1	6.93 (n1=690)	6.91 (n2=88)	0.127536232
2	7.2 (n1=134)	6.35 (n2=22)	0.164179104
3	7.81 (n1=142)	7.52 (n2=21)	0.147887324
4	7.91 (n1=184)	7.84 (n2=35)	0.190217391
5	8.05 (n1=133)	6.75 (n2=31)	0.233082707

6.7.6.2 Calculation of *Thornqvist* index

Using *STATA*, I summarized the *Thornqvist* index for all IJVs that had terminated within a given ownership range, which resulted in a mean value for the *Thornqvist* index within a given ownership range.

With respect to the lifespan gained, I then proceeded to calculate the changes in lifespan that followed ownership change by generating an average new value for the lifespan using *STATA* for subsidiaries that had increased and decreased ownership within a given ownership range. The results are listed in Table 6.13.

6.7.6.3 Actual ownership adjustments and their impact on technology/knowledge-based productivity growth and productive lifespan

While the previous discussion showed the impact of changes in ownership on the relative levels of technology/knowledge–induced productivity growth beyond the critical instability age, this section discusses the actual ownership changes that subsidiaries had made.

Expected result

Ownership changes made by subsidiaries in their respective ownership ranges before and after their respective critical instability ages were calculated. It is these ownership changes that had led to change technology/knowledge-based productivity previously discussed. The previous section also discussed whether subsidiaries were better off increasing or decreasing ownership with regard to technology/knowledge-based productivity growth. Any increase in lifespan would therefore be an increase in *productive* lifespan accompanied by the corresponding increase in technology/knowledge-based productivity growth through ownership change.

Table 6.13 summarizes the ownership changes required in each category in order to achieve higher *Thornqvist* values in relation to the critical instability age.

The table also lists whether subsidiaries were better off increasing or decreasing ownership levels before and after the critical instability age with respect to technology/knowledge-based productivity growth and productive lifespan. The results show average changes in technology/knowledge-based productivity growth and corresponding average changes in productive lifespan among subsidiaries that followed a particular ownership adjustment strategy before and after the critical instability age.

Table 6.13: Impact of ownership adjustments on technology/knowledge-based productivity growth

Ownership range	Mean instability age (years)	Actual ownership change (in %): decrease (Japanese perspective)	Actual ownership change (in %): increase (Japanese perspective)	Corresponding new mean productivity growth values** (after ownership decrease)	Corresponding new mean productivity growth values** (after ownership increase)	Corresponding new instability age (in years) (after ownership decrease)	Corresponding new instability age (in years) (after ownership increase)
1	<6.91	-0.8666712	5.636666	0.6963496	0.6800398	10.64688	9.483857
	>=6.91	-6.184666	7.397197	0.1928961	0.2015204		
2	<6.35	-27.885	15.72194	0.81285	0.9701316	8.68725	9.37475
	>=6.35	-10.18167	15.33283	0.2738211	0.3196138		
3	<7.52	-28.46	19.64576	0.4605559	0.5304048	9.167	9.874667
	>=7.52	-13.36905	19.34206	0.1861554	-0.0047231		
4	<7.84	-7.358889	8.318	0.5965078	0.5383678	10.3955	11.6163
	>=7.84	-6.971667	12.79333	0.0412633	0.1270515		
5	<6.75	-17.324	15.19	0.6453844	0.7497624	9.57275	7.953444
	>=6.75	-12.50774	6.946296	0.135517	0.1115597		

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100.

6.7.6.4 Discussion of results

The *STATA* analysis has revealed that subsidiaries which had adjusted ownership achieved a longer lifespan across all ownership ranges. However, increased productive lifespan was only slight in ownership range 1 (WOS), but tended to increase as Japanese ownership decreased. Higher values in the *Thornqvist* index, however, did not necessarily translate to higher longevity among subsidiaries.

Ownership adjustment benefited subsidiaries with lower Japanese ownership more. These subsidiaries were able to increase their productive lifespan to a greater extent relative to their critical age for instability, compared to those subsidiaries in higher ownership ranges, where ownership adjustments had less effect on productive lifespan. Generally, the higher the ownership range, the less effect ownership adjustment had on the productive IJV lifespan. The critical instability age for each ownership range was used as a reference point for any additional amount of productive lifespan.

In addition, Table 6.13 also lists changes in the *Thornqvist* index commensurate with added productive lifespan. Except for ownership range 3, ownership adjustment in either direction positively affected the *Thornqvist* index, both before and after the relevant instability ages. In ownership range 3, by contrast, an ownership increase after the critical instability age resulted in a decline in the *Thornqvist* index. In all other ownership ranges, the extent of productivity growth depended on whether a subsidiary increased or decreased ownership.

6.7.6.5 Effects of ownership adjustment on productive lifespan

The magnitude of additional lifespan differed by ownership range and was subject to ownership adjustment. In either case, the productive lifespan increased.

Details for specific ownership ranges are discussed below.

Ownership range 1:

An ownership decrease yielded slightly higher productivity growth if it took place before the critical age for instability. After the instability age, subsidiaries were better off increasing ownership compared to other ownership adjustment strategies (i.e. decreasing or not changing ownership). The values for productivity growth, however, declined sharply once the instability age had passed. The corresponding additional productive lifespan from ownership adjustments amounted to approximately 1.5 years if done before the instability age and 0.5 years if done after the instability age. In sum, subsidiaries in ownership range 1 were much better off adjusting ownership before they reached the instability age.

Ownership range 2:

Ownership increases left subsidiaries better off both before and after instability age. Productivity gains, however, differed significantly depending on the timing of ownership adjustments. Ownership increases yielded higher technology/knowledge-based productivity growth if they were completed before the critical instability age.

As for actual ownership changes, both groups of subsidiaries increased their ownership levels by approximately 15%, which, given this ownership range, would result in them becoming *de facto* WOS by crossing the 90% Japanese ownership mark. The additional productive lifespan gained from ownership adjustments was similar before and after the critical instability age, and amounted to approximately one to two years in both instances. The fact that this ownership range exhibited similar gains in technology/knowledge-based productivity and lifespan of subsidiary age could suggest that this ownership range should be a preferred choice for both IJV partners at when they set up an IJV.

Ownership range 3:

With regard to ownership change, subsidiaries before the critical instability age benefited from increasing ownership, while subsidiaries that had passed the instability age were better off decreasing ownership to attain increases in technology/knowledge-based productivity growth. In fact, once the instability age had passed, increasing ownership was no longer an option since it would result in productivity decline. Ownership changes before the instability age yielded much higher gains in technology/knowledge-based productivity growth, however – with 0.53 as the best achievable value in the *Thornqvist* index versus 0.18 after the instability age had passed if Japanese ownership was decreased. The additional productive lifespan gained was almost identical, however.

Ownership range 4:

Subsidiaries in this ownership range experienced a reverse pattern compared to the previous two ownership ranges. IJVs were better off decreasing their ownership between the time of subsidiary formation and instability age, despite their already low Japanese ownership considering the nature of the industry. However, productivity gains following appropriate ownership adjustments were similar to previous ownership ranges. Ownership had to be decreased by approximately 7% and increased by approximately 12% in order to obtain the respective gains in technology/knowledge-based productivity growth.

The additional productive lifespan gained amounted to about 2.5 years for subsidiaries before they reached instability age and that chose to decrease ownership, and about 4 years for subsidiaries that had passed the instability age and chose to increase ownership.

Ownership range 5:

Subsidiaries in ownership range 5 needed to increase ownership before reaching the critical instability age in order to experience gains in the *Thornqvist* index. The amount of ownership increased was 15% and additional productive lifespan gained was approximately 1 year. Subsidiaries that had passed the critical instability age needed to decrease ownership in order to secure gains in technology/knowledge-based productivity growth. The interesting aspect in this ownership range is that subsidiaries that decreased ownership from here eventually became minority Japanese-owned, i.e. the Chinese partner took majority ownership.

As for the influence on knowledge/technology-based productivity growth, it can be inferred that the Chinese partner's eventually became more valuable to the Japanese partner, or that the Japanese partner reduced the amount of technology, training, and offering of specialized knowledge, to the point of letting the Chinese partner hold higher technologies. This would most likely amount to a downgrading of technological processes and thus new knowledge within the subsidiary. Even so, productivity gains indicate that the Chinese partners have learned and contribute relevant knowledge in order to maintain productivity gains, even though they were much lower than for subsidiaries below the instability age which chose to increase ownership.

Subsidiary age seems to be the more relevant factor since within the same age group neither ownership increase nor decrease resulted in noticeably large differences in gains in technology/knowledge-based productivity growth, which were similar regardless of the type of ownership adjustment chosen. The amount of additional productive lifespan was higher for subsidiaries that had decreased ownership. The difference in additional productive lifespan is most pronounced in this ownership range, yielding about three additional years for those subsidiaries that had decreased ownership compared to about one additional year for subsidiaries that had increased ownership.

6.7.7 Effects of ownership adjustments on technology/knowledge-based productivity growth

In this section I focus on finding the peak productive lifespan of the subsidiaries. In contrast to the last section, this section does not seek to find ownership adjustments relative to the years when subsidiary instability occurred. Instead, ownership adjustments according to levels of technology/knowledge-based productivity growth at particular points in time are determined. The points in time in this section are the years in which productivity started to decline, by ownership range. The method used in this section differs from the method in the previous section in that respective years of peak productivity are used as reference points rather than years of instability.

This method builds on findings presented by Delios and Beamish (1998) with regard to the productive lifespan of IJVs. Similarly, I assume that there is a peak to technology/knowledge-based productivity growth following which growth will decline. Therefore, time points at which the *Thornqvist* index peaked were determined. Then the ownership change that was needed in order to reverse the decline in the *Thornqvist* index was determined. Ownership adjustments, their impact on the technology/knowledge-based productivity growth (*Thornqvist* index), and time values were examined by ownership range. The sample was divided into the same five ownership ranges containing WOS and majority Japanese-owned IJVs.

6.7.7.1 Method

In this section, the years during which subsidiaries could achieve peak productivity growth values were calculated - by ownership range. Using *STATA*, I obtained productivity growth values from the time of IJV setup until the year productivity growth values would start to decline. The rates of decrease in technology/knowledge-based productivity growth, however, varied by ownership range. Lower Japanese ownership would generally result in higher decreases following the year peak productivity growth was reached. Unlike IJVs, WOS did not experience a period of negative productivity growth following setup. The unproductive period varied by ownership range, however.

Findings in this section are based on observations that ranged from n=91 to n=41 depending on ownership range.

6.7.7.2 Determining technology/knowledge-based productivity growth values with respect to time

Using *STATA*, I summarized the maximum values for technology/knowledge base productivity growth for all IJVs within a given ownership range and the years within which these could be achieved. Technology/knowledge-based productivity growth for a given ownership range over the entire lifespan of subsidiaries within that ownership range was used as a reference point. I then continued to narrow the years until productivity values would grow, up until they reached their maximum and started to decline. I then narrowed the time frame from the time of IJV setup at the minimum point and the maximum lifespan of subsidiaries at the maximum point within a given ownership range. For example, if the *Thornqvist* index rose when I applied tighter time constraints to the sample from each subsequent year onwards, it would mean that initial years were less productive than the following years. I would continue to constrain the initial years until a plateau was reached in the resulting technology/knowledge-based productivity growth.

Next, constraints were applied at the upper years and narrowed down. Thus, when the *Thornqvist* index rose, the higher years were more unproductive. I continued to constrain the upper years until the *Thornqvist* index reached a plateau from which it would start to decline following a subsequent constraint in upper years. The result was a time span during which highest technology/knowledge-based productivity growth was reached.

Table 6.14 (next page) summarizes the years of highest technology/knowledge-based productivity growth with the corresponding values in the *Thornqvist* index by ownership range.

Table 6.14: Highest technology/knowledge-based productivity growth values by subsidiary age

Ownership range	Subsidiary age for maximum/peak productivity growth	Corresponding maximum productivity growth**	Productivity growth before peak subsidiary age**	Productivity growth after peak subsidiary age**
1	5-6 years	1.037215	0.8279148	0.1952577
2	4-7 years	0.855548	0.7548917	0.285782
3	6-8 years	0.55403	0.1666157	0.2400653
4	5-8 years	0.515319	Data not available	0.074678
5	7-8 years	0.575283	-0.7115404	0.0889173

Before peak period for productivity growth: Generally, for majority-owned IJVs (ownership ranges 2 to 5), the upper ownership ranges (ranges 2 and 3) tended to yield higher values in the maximum achievable *Thornqvist* index compared to lower ownership ranges. It can also be seen that WOS observed the highest *Thornqvist* index overall. However, this could be due to higher initial productivity growth immediately following subsidiary setup when IJVs tended to experience negative technology/knowledge-based productivity growth.

After peak period for productivity growth: On the other hand, IJVs in ownership range 2 did slightly better with regard to the *Thornqvist* indexes, which remained positive after the peak period had been reached, while WOS experienced a much sharper decline in the *Thornqvist* index, even into negative digits.

The results explain that IJVs with this ownership structure were more conducive to technology and knowledge transfer in the long term.

6.7.7.3 Relevance of findings

The previous section provided answers about ownership and optimal

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100. The term 'productivity growth' refers to technology/knowledge-based productivity growth.

technology/knowledge-based productivity growth values.

However, for the cases of subsidiaries that may not have been set up within optimal ownership ranges, or cases of subsidiaries that may seek to minimize initial subsidiary unproductiveness, the next section can be a decision tool for augmenting technology/knowledge-based productivity growth through ownership adjustments.

Likewise, other subsidiaries may already be past their peak productive time and seek ways to improve technology/knowledge-based productivity growth. The next section will address such scenarios and discuss options for ownership adjustment. Specifically, it will discuss whether it makes sense to increase or decrease ownership with respect to timing; in other words whether a subsidiary is before or past its peak productivity period. I will discuss the specific extent of changes in productivity growth that could be achieved by either increasing or decreasing ownership. In the second part, the extent of ownership adjustments made in order to effect changes in technology/knowledge-based productivity growth is discussed.

6.7.8 Actual adjustment values of ownership with respect to improving technology/knowledge-based productivity growth

6.7.8.1 Method

Subsidiaries are listed in life stages relative to the peak productive lifespan within a particular ownership range (i.e. whether the subsidiary’s life is in the stage before or after the peak productive lifespan). Within each ownership range, productivity gains or losses that coincided with either upward or downward adjustment/movements in ownership before and after the peak productivity period were reviewed.

6.7.8.2 Direction of ownership adjustments

For each ownership range, I first specified *STATA* commands to isolate those subsidiaries which had increased or decreased ownership before and after the year(s) of peak productivity along with the respective values for *Thornqvist* indexes that resulted.

In order to determine the specific ownership adjustments that resulted in subsidiaries within a particular ownership range experiencing gains or lossed in technology/knowledge-based productivity growth, I specified *STATA* to summarize mean changes in ownership within the constraints of ownership range and subsidiary age before and after the year of peak productivity.

Mean values were used for each ownership range, both for technology/knowledge-based productivity growth (*Thornqvist* index) and ownership changes. Results are summarized in Table 6.15 (next page).

Table 6.15: Impact of ownership adjustments on technology/knowledge-based productivity growth by peak year for productivity growth

Ownership range	Subsidiary age for maximum/peak productivity growth	Actual ownership adjustments observed: decrease (in %) (Japanese perspective)	Actual ownership adjustments observed: increase (in %) (Japanese perspective)	Corresponding results for maximum productivity growth** (after ownership decrease)	Corresponding results for maximum productivity growth** (after ownership increase)	Recommended choice of ownership adjustment (Japanese perspective)
1	Before Peak Year 5-6 years	-0.8000069	3.174999	0.9561291	0.9854985	Decrease/ Increase
	After Peak Year	-5.320555	7.371607	0.3984916	0.2107961	Decrease
2	Before Peak Year 4-7 years	-18.75667	13.75702	0.7324859	0.7848325	Decrease/ Increase
	After Peak Year	-11.14983	16.09521	0.2361612	0.2801527	Decrease/ Increase
3	Before Peak Year 6-8 years	-21.6625	18.70306	0.464607	0.532615	Increase
	After Peak Year	-15.64583	19.8925	0.1396247	-0.0291388	Decrease
4	Before Peak Year 5-8 years	-7.358889	8.318	0.5695792	0.5242915	Decrease/Increase
	After Peak Year	-6.971667	12.79333	0.0008957	0.1140432	Increase
5	Before Peak Year 7-8 years	-18.97167	9.597222	0.5916884	0.6473667	Increase/Decrease
	After Peak Year	-8.001296	8.556667	0.0248591	-0.0469448	Decrease

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100. The term ‘productivity growth’ refers to technology/knowledge-based productivity growth.

6.7.8.3 Discussion

For all ownership ranges, there was generally more effect from adjusting ownership before they reached the age for peak productivity growth. Increases in the Thornqvist *index* could still be achieved after the peak years, but mostly at lower rates. Results for each ownership range are discussed subsequently.

Ownership range 1:

Before peak year for productivity growth: For WOS, the significant effects with regard to increases in technology/knowledge-based productivity growth could be achieved by increasing ownership or decreasing ownership before the peak year for productivity growth. The peak period for productivity growth in this ownership range was five to six years, which is less time than what subsidiaries with lower Japanese ownership had managed to attain. WOS also managed to obtain the highest peak productivity growth values in the absence of ownership adjustments. However, they also experienced the largest reduction in technology/knowledge-based productivity growth among all ownership ranges after the peak productivity period had passed (Table 6.15). Technology/knowledge-based productivity growth (*Thornqvist* index) had dropped almost fourfold.

The result for the initial years is not unexpected and could be due to the absence of a local partner and thus lower transaction costs incurred in the setup of the subsidiary. However, the result for the later years is somewhat unexpected but shows that WOS tended to become inefficient with respect to technology and knowledge transfer sooner. As for ownership adjustments before the peak productivity period, both increasing and decreasing ownership expectedly yielded similar results in productivity gains, although ownership increases yielded slightly higher productivity increases, thus indicating that high Japanese ownership at time of subsidiary setup was more beneficial.

The amount of corresponding ownership changes was 3.2% for those subsidiaries that chose to increase ownership while it was around 1% for those that chose to decrease ownership.

After peak year for productivity growth: The situation, however, changed after the peak productivity year. In this scenario, a decrease in ownership would yield higher productivity gains than an increase as a logical result of the sharp productivity decline following the peak productivity year. Compared to the next ownership range, however, ownership changes effected after the peak productivity period resulted in lower gains in technology/knowledge-based productivity growth. Average ownership decrease amounted to approximately 7% while average ownership increase amounted to approximately 5%. With ownership reduction, a WOS would likely fall within the 80% to 90% Japanese ownership range and thus become an IJV. Again, this supports my argument regarding 80% to 90% Japanese ownership as most beneficial. For WOS, which chose to adjust ownership after their peak productivity period, becoming an IJV was the better option with respect to the technology/knowledge-based productivity and thus knowledge and technology transfer.

Ownership range 2:

Before peak year for productivity growth: IJVs in this ownership range attained peak technology/knowledge-based productivity growth after 4 to 7 years, taking slightly longer than subsidiaries in the previous ownership range. It is not unexpected since there are higher initial transaction costs associated with yielding an equity share to the local partner, such as negotiations and trust building. For majority-owned IJVs in this ownership range, IJVs that chose to increase ownership at this time tended to do slightly better with regard to the *Thornqvist* index than did those that chose to decrease ownership before the peak productivity period was reached, indicating that a weaker local partner lowered initial transaction costs and inefficiencies.

After peak year for productivity growth: Ownership increases resulted in slightly better results in the *Thornqvist* index than did ownership decreases. With regard to ownership adjustments, both types could be chosen since results in technology/knowledge-based productivity growth were similar. Compared to the previous ownership range, overall ownership increases yielded higher technology/knowledge-based productivity growth than did ownership decreases, but lower results than ownership decreases in the previous ownership range. The result suggests that optimal ownership still remains in a shared-equity subsidiary.

In another interpretation, the result of the *Thornqvist* index at this time point could also indicate that it was slightly easier to increase ownership (i.e. less partner resistance) at these ownership levels and therefore achieve higher efficiency and hence lower transaction costs. The *Thornqvist* index is a residual value and factors such as partner negotiations could affect its value.

Ownership increases ranged from 13% before the peak productivity period to 16% after the peak productivity period while ownership decreases ranged from 18% to 11%, respectively. Since each ownership adjustment option yielded similar gains in technology/knowledge-based productivity growth, IJVs in this ownership range would have some leeway to decide which option might suit them best.

Ownership range 3:

Peak technology/knowledge-based productivity growth was attained after 6 to 8 years, possibly reflecting higher initial transaction costs that may have led to lower productivity growth in early years. Additional ownership adjustments started to show less effect than in previous ownership ranges, although ownership adjustments still led to increases in technology/knowledge-based productivity growth. As in the previous two ownership ranges, ownership adjustments in this range still yielded higher productivity growth if done in the early years before the peak productivity years of 6 to 8 years.

Before peak year for productivity growth: There was little difference between raising and lowering ownership, although raising ownership produced somewhat higher productivity growth. Thus, subsidiaries could choose to adopt either strategy in raising technology-based productivity growth. As for specific ownership adjustments, IJVs which increased ownership did so at a rate of 18%, while those which chose to lower ownership did so at a rate of 21%. The former would result in a significantly higher share for the Japanese IJV partner, likely in the higher range of 80% or start of the WOS ownership range. On the other hand, a decrease in ownership would affect the equity structure in the sense that the Japanese partner would likely retain only a slight majority share. Both strategies, however, produced similar increases in technology/knowledge-based productivity growth.

After peak year for productivity growth: Ownership adjustments after the peak productivity period yielded little benefit, and even contributed to slight negative productivity growth. Upward ownership adjustment was therefore not an option with respect to technology/knowledge-based productivity growth, and Japanese IJV partners were better off conceding more equity to the local partner instead. IJVs in which the Japanese partner lowered their share by 15 percent would experience increases in technology/knowledge-based productivity growth. Possible reasons are reviewed in the qualitative chapter.

Ownership range 4:

IJVs in this ownership range took a similar amount of time to reach peak productivity growth as did IJVs in the previous ownership range. Default peak productivity values were slightly below those of the previous ownership range, suggesting marginally higher inefficiencies, and therefore higher transaction costs, with an increase in the ownership of the local partner. Contrary to the previous ownership range, however, IJVs experienced a much more pronounced decline in productivity values once the peak productivity period had passed. Productivity growth could still be supported through ownership adjustments which then yielded similar results in productivity growth as in the previous ownership range.

Before peak year for productivity growth: Before the peak productivity age, subsidiaries experienced little difference in productivity growth after either increasing or decreasing ownership. However, decreasing ownership led to slightly higher productivity growth. Specifically, subsidiaries experienced ownership decreases of about 7% and ownership increases of about 8% in order to observe the respective increases in the *Thornqvist* index (Table 6.15).

After peak year for productivity growth: After the peak period for productivity growth had been exceeded, increasing ownership yielded higher productivity growth compared to decreasing ownership. Reducing ownership in this period did not seem to have an impact on the *Thornqvist* index, which tended towards zero. Therefore, IJVs in later stages of their lifespan were better off increasing Japanese ownership.

As for changes in ownership values, subsidiaries could increase ownership by approximately 13% in order to observe productivity gains.

Ownership range 5:

IJVs in this ownership range reached similar productivity as in IJVs in the previous ownership range, taking only slightly longer to reach peak productivity levels (7 to 8 years). Unlike all prior ownership ranges, declines in technology/knowledge-based productivity growth tended to be sharp and reached negative levels, i.e. there was a contraction in technology-based productivity rather than just slower growth. Therefore, this ownership range is not advisable to consider when setting up an IJV in the absence of plans for future ownership adjustments. When ownership adjustments were conducted, IJVs in this still-majority-Japanese owned category experienced productivity increases in both directions of ownership adjustment, if conducted before the peak productivity years. In this ownership range, however, any downward ownership adjustment would result in the subsidiary becoming minority Japanese-owned, and therefore any productivity gains would be at the expense of Japanese control in the subsidiary.

Before peak year for productivity growth: Before the peak productivity age, subsidiaries were better off increasing ownership, and gains in technology/knowledge-based productivity growth were more pronounced than in the previous two ownership ranges (ranges 3 and 4). The difference in productivity gains between ownership increase and reduction were not very large. Corresponding ownership increases amounted to approximately 9% while ownership decreases were more pronounced at 18%. The latter suggests that subsidiaries that chose this ownership range when they set up were better off either not being majority-owned at all or having a more significant Japanese majority ownership stake – at least above 60%, judging by the 9% average ownership increases.

After peak year for productivity growth: After the peak productivity had been reached, however, ownership increases resulted in negative technology/knowledge-based productivity growth and are therefore not recommended. The only method by which subsidiaries could maintain knowledge and technology transfer in theory, was by reducing ownership at a rate of approximately 8% - a move which would leave the Japanese partner with a minority share. The fact that productivity gains were still experienced could suggest high technological capabilities by the local IJV partner and high learning efficiency. It could also suggest the importance of the local partner's contributions to the IJV relative to the reduced contributions by the Japanese partner. The fact that only ownership reductions could help increase productivity growth in the later years of the IJV suggests that this could be likely.

6.7.9 Employee ratios and technology/knowledge-based productivity growth

After application of additional employee-related parameters to the analysis, findings concerning technology/knowledge-based productivity growth values changed somewhat from those in the previous section. Employees are an integral part of knowledge transfer, reception, and processing; therefore, interaction with technology/knowledge-based productivity growth merits further consideration.

The independent variable whose value I sought is the optimum employee ratio with respect to technology/knowledge-based productivity growth within the limits of peak productivity age and that subsidiaries were still operational (i.e. had not terminated). The usual five ownership ranges were used to group the findings.

6.7.9.1 Method

Calculation of employee ratios by ownership range

In the first instance, ratios of Japanese employees by ownership range were determined. Using *STATA*, I then divided the number of Japanese employees by the number of total employees, which yielded a fractional value or percentage, which I have referred to as employee ratio, which is one of the control variables (*empratio*) used in the regressions. The remainder (1-*empratio*) would be local employees.[23]

Table 6.16: Mean employee ratios by ownership range

Ownership range	Mean employee ratios of Japanese to Chinese employees** (without adjustment)	Mean productivity growth values by ownership range**
1	0.1002654	0.3868092
2	0.0452394	0.4659516
3	0.0606748	0.26229
4	0.0262901	0.3067979
5	0.031025	0.2401744

[23] For Japanese subsidiaries in China and the Chinese labor market and availability of manual labor in general, it would be unlikely to encounter employees other than those from the host or home countries, i.e. it is unlikely that manual labor would be imported from overseas. The table lists the average ratios of Japanese employees and average values in the *Thornqvist* index by ownership range.

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100.

6.7.9.2 Optimal employee ratios

In the next step, I calculated optimal employee ratios and segmented this step into calculating optimal employee ratios before the peak productivity age and after the peak productivity age.

Before peak year for productivity growth: Using the same peak productivity ages as in the previous section, I calculated average technology/knowledge-based productivity growth values (mean values for the *Thornqvist* index) by summarizing them relative to ownership range, subsidiary age (i.e. subsidiary age was less than the peak productivity year value), and employee ratios. I determined a range of employee ratios for each ownership range by adjusting employee ratios around the mean employee values and determining whether they would cause mean values for the *Thornqvist* index to increase or decrease. For example, I would broaden the employee ratio upward, downward, or both, in order to determine how mean values for the *Thornqvist* index would react and continued to adjust the ranges of the employee ratios as long as mean values for the *Thornqvist* index continued to rise.

After peak year for productivity growth: I followed the same procedure as in the *before peak year for productivity growth* section, changing only the parameter for subsidiary age, whose value was now set higher than the value of the peak productivity year.

Table 6.17: Optimal employee ratios with respect to technology/knowledge-based productivity growth before and after peak technology/knowledge-based productivity growth year

Ownership range	Peak year for productivity growth	A: Adjusted employee ratio (in %) (before peak year for productivity growth)	A (result): Mean productivity growth** with adjusted employee ratio (before peak year for productivity growth)	Mean productivity growth** with original employee ratio	B: Adjusted employee ratio (in %) (after peak year for productivity growth)	B (result): Adjusted mean productivity growth** (after peak year for productivity growth)
1	6 years	0.1-0.3	1.12232	0.38	0.3-0.4	0.767901
2	7 years	0.09-0.21	1.658661	0.46	0.16-0.24	0.541956
3	8 years	0.02-0.03	0.57835	-0.1349353	0.06-0.1	0.271638
4	8 years	0.03-0.07	0.8569165	0.3384754	0.06-0.08	0.758030
5	8 years	0.04-0.05	0.6079646	0.2357116	0.03-0.05	0.563446

** Values are fractions of 1. Each value can be interpreted as a percentage by multiplying it by 100. The term ‘productivity growth’ refers to technology/knowledge-based productivity growth.

Among the five ownership ranges, the highest unadjusted mean value for the *Thornqvist* index was achieved in ownership range 2 with a mean Japanese employee ratio of 4.5%. It was followed by ownership range 1 with a mean value for the *Thornqvist* index of 0.38 and a mean Japanese employee ratio of approximately 10%.

Other ownership ranges had about twice fewer Japanese employees and achieved lower unadjusted mean value for the *Thornqvist* index than ownership ranges 1 and 2. However, unadjusted mean values for the *Thornqvist* index for the remaining ownership ranges 1, 2, and 3 remained only marginally below those of ownership range 1.

Ownership range 4, however, was higher than ownership ranges 3 and 5. Unadjusted employee ratios were similar for all ownership ranges except ownership range 1. Generally, an adjustment in the employee ratio before the peak productivity year resulted in higher mean values for the *Thornqvist* index than adjustments after the peak productivity year. Ownership ranges are reviewed in more detail in the following sections.

Ownership range 1:

In this ownership range, the average unadjusted employee ratio yielded a mean value for the *Thornqvist* index of 0.38 with a Japanese employee ratio of approximately 0.1 or 10%.

Before peak year for productivity growth: After adjustment of the employee ratio, the maximum achievable mean value for the *Thornqvist* index was 1.12, which corresponded to a Japanese employee ratio that was between 10% and 30%. I decided to leave the rather wide Japanese employee ratio due to the number of observations, which, otherwise would have been too small narrow further the employee ratio were narrowed further.

After peak year for productivity growth: After the year for peak productivity had passed, the maximum achievable mean value for the *Thornqvist* index after adjustment of the employee ratio was lower than if adjustment had been done before, although it was still higher than with the unadjusted employee ratio, at 0.76. The result, however, is based on a small number of observations which should be kept in mind in its interpretation.

Ownership range 2:

In this ownership range, the average unadjusted employee ratio yielded a mean value for the *Thornqvist* index of 0.46 with a Japanese employee ratio of approximately 0.045 (4.5%).

Before peak year for productivity growth: After adjustment of employee ratios, the maximum achievable mean value for the *Thornqvist* index became 1.65, the highest among all ownership ranges. The corresponding adjusted Japanese employee ratio was between 0.09 and 0.21.

Again, I decided to leave the rather wide employee ratio due to the number of observations, which, otherwise would have been too small under more severe employee ratio constraints.

After peak year for productivity growth: After the year for peak productivity had passed, the maximum achievable mean value for the *Thornqvist* index following an adjustment of the employee ratio was lower than if adjustment in the employee ratio had been completed before the peak year for productivity growth and stood at 0.54. The corresponding adjusted employee ratio ranged between 0.16 and 0.24. The result, however, is based on a small number of observations and should thus be interpreted accordingly.

Ownership range 3:

In this ownership range, the average unadjusted employee ratio yielded a mean value for the *Thornqvist* index of 0.26 with a Japanese employee ratio of approximately 0.06 (6%). The mean values for the *Thornqvist* index declined considerably compared to the previous ownership range while the employee ratio remained similar.

Before peak year for productivity growth: After adjusting the employee ratio, the maximum achievable mean value for the *Thornqvist* index rose to 0.57, with a corresponding Japanese employee ratio of between 2% and 3%. The employee ratio was thus lower than in the unadjusted state, suggesting that companies that dispatched fewer Japanese managers to an IJV observed higher gains in technology/knowledge-based productivity growth.

The result could also suggest higher knowledge transfer from Chinese staff to Japanese staff, due to the lower ratio of Japanese employees. Subsidiaries in this ownership range and time phase would strongly require the intangible assets of the local partner.

After peak year for productivity growth: The scenario changed after the peak productivity year had passed. The maximum achievable mean value for the *Thornqvist* index was lower by 0.3 than before the peak productivity year, at approximately 0.27. The corresponding ratio of Japanese to Chinese employees rose to a value of between 6% and 10%. The result suggests that more Japanese managers or engineers were needed in order to maintain technology/knowledge-based productivity growth. However, the slower rate of productivity growth suggests that knowledge from previous years had been absorbed, and that any productivity increase occurring at this time could be due to technology transfer from Japan and its gradual absorption. The result, however, again is based on a relatively small number of observations.

Ownership range 4:

In this ownership range, the average unadjusted employee ratio yielded a mean value for the *Thornqvist* index of approximately 0.3 with a corresponding Japanese employee ratio of approximately 0.026 (2.6%). The unadjusted mean value for the *Thornqvist* index rose compared to the previous ownership range, even though the ratio of Japanese employees became smaller, which again suggests that the productive contribution of the local partner became more important.

Before peak year for productivity growth: An adjustment of the employee ratio before the peak productivity age, expectedly, yielded a higher mean value for the *Thornqvist* index of approximately 0.85, with the corresponding employee ratio spread between 3% and 7% Japanese staff. The ratio of Japanese staff, however, was higher than in the unadjusted state, which in this ownership range suggests higher initial influence of the Japanese staff compared to the previous ownership range. Given the comparatively low Japanese ownership ratio, the result is somewhat unexpected but could be explained by the local partner's higher motivation in contributing their knowledge to the IJV more pro-actively due to higher local ownership. A framework and discussion are provided in the qualitative chapter. The corresponding mean value for the *Thornqvist* index after adjustment was also higher than in the previous ownership range, which could point to the possibility that local partner motivation and new technologies and processes learned from the

Japanese partner could have contributed to the growth in technology/knowledge-based productivity growth in the beginning phase of the IJV.

After peak year for productivity growth: The mean value for the *Thornqvist* index after the peak year for productivity had passed declined only slightly, while the ratio of Japanese employees also changed slightly to between 6% and 8%. Therefore, a combination of an ownership structure favorable to the local partner and the value of employee ratio combined could have contributed to the relatively high sustained long-term productivity growth in this ownership range. However, results in this ownership range were based on relatively low numbers of observations with complete data and should therefore be interpreted accordingly

Ownership range 5:

In this ownership range, the average unadjusted employee ratio yielded a mean value for the *Thornqvist* index of approximately 0.24 at a corresponding Japanese employee ratio of 0.031 (3.1%). Compared to previous ownership ranges, the employee ratios show little change, with the mean value for the *Thornqvist* index decreasing slightly. However, this could be an issue of low Japanese ownership which would diminish the incentive to transfer technologies and knowledge from the point of view of the Japanese IJV partner. From the point of view of the Chinese partner, high Chinese ownership contributes to a high willingness to cooperate and engage in knowledge sharing by the Chinese partner.

Before peak year for productivity growth*:* A slight adjustment in the employee ratio to between 3% and 4% was followed by a noticeably higher mean value for the *Thornqvist* index. The fact that the ratio of Japanese staff remained little changed could be reflective of weak Japanese control (low ownership share).

However, it could also be reflective of higher local partner contributions because of its higher ownership share. There could also be high initial learning by the Japanese partner, who is exposed to a greater pool of knowledge from the higher share of Chinese staff.

After peak year for productivity growth: Both mean values for the *Thornqvist* index and employee ratios for the period after the peak productivity year observed the smallest change among all ownership ranges. Both values changed only marginally lending further support to the explanation of ownership in lower Japanese ownership ranges as a motivation for the local partner to contribute more to the IJV.

7. Qualitative analysis

In this chapter, I will discuss the results of the quantitative data analysis from a qualitative perspective using the example of four case studies. The cases are Sino-Japanese joint ventures that were shortlisted from the quantitative analysis according to their technology/knowledge-based productivity growth. Case studies were categorized by subsidiaries that had shown very high, high, medium, and low technology/knowledge-based productivity growth.

Questions were designed to seek answers about causes for different magnitudes of technology/knowledge-based productivity growth among subsidiaries and explore the feasibility for changes to ownership structures to improve technology/knowledge-based productivity growth and drew upon previous studies of entry modes, technology, and knowledge transfer (Currie, 1995; Tye and Chau, 1995; Lee and Kim, 1997). Accordingly, the case studies focus on the process of subsidiary setup and ownership choice, which had previously been identified as the independent variable. Further topics focus on theoretical aspects discussed in the literature review. These relate mainly to control, information asymmetry, ownership adjustments, human resources and learning.

The questions covered four main parts: The first part covered the background of the IJV and the setup process. The second part covered ownership structures and their utility in the transfer of tangible and intangible assets. The third part consisted of the implementation of transferred tangible and intangible assets within the IJV, while the fourth part sought answers about the feasibility and utility of ownership adjustment with regard to technology and knowledge transfer.

Answering the above questions the case studies show that the perceived benefit of higher ownership share and thus control by the technology transferor may not be beneficial. This is in line with the previously conducted data analysis which has shown that equity distribution that is skewed towards one partner does not necessarily result in higher levels of technology transfer and knowledge absorption. Several interviews I conducted have shown that ownership slanted overly in favor of the Japanese partner could be harmful to the Japanese partner as the local partner became unpredictable over time and began to act against the interest of the IJV. Bounded rationality and information asymmetry played a strong role in the relationship between both IJV partners. This finding enhances a previous finding by Makino and Delios (1996) who asserted a negative relationship between ownership that is skewed towards one IJV partner and an IJV's financial performance (Makino and Delios, 1996).

7.1 Background of case studies and sources

7.1.1 Choice of subsidiaries for interview

Subsidiaries were chosen from a shortlist of the analysis of growth in technology/knowledge based productivity in the previous chapter. The list of subsidiaries yielded a sample of 692 in total, of which 212 were given further consideration. They were categorized further into subsidiaries with ownership change and without ownership change. Furthermore, I narrowed down the list further choosing to interview those subsidiaries with at least 8 years of subsidiary age due to the high likelihood of impending performance decline (Makino and Delios, 1998). They were then categorized by very high, high, medium, and low productivity growth, for which one typical case study is presented in the chapter selected among a total of 38 subsidiaries that were interviewed.

Interviews were conducted with both the Japanese and the Chinese IJV partners in order to obtain a clear impression of both side's motivations to enter into an IJV relationship. The GM of the IJV was selected as the interviewee representing the Japanese side, while the Vice-GM (a Chinese national) was interviewed as the representative of the respective Chinese IJV partner.

In each instance, the GM and Vice-GM were interviewed separately. Follow-up interviews were conducted occasionally in order to clarify and/or seek additional information. In several instances, engineers and supervising staff were also present and furnished additional information. In order to ascertain the extent of knowledge asymmetry, it was necessary to interview both IJV partners. In sum, more than 80 individuals were interviewed.

7.1.2 Interview location and administration

In a few instances, the locations of the IJV and its Chinese partner company were far from each other, and even required travel to other cities within a province. The interviews took place in several cities in China, including Beijing, Tianjin, Jinan, Suzhou, Shanghai, and Zhuhai.

Interviews with a GM were conducted on-site at the subsidiary's meeting room or the GM's office. Interviews with the Chinese Vice-GMs were conducted either at the Chinese partner company's headquarters (usually an SOE's headquarters) or at the IJV itself in cases where the Vice-GM had an on-site office or was present there.

Interviews were conducted during a period of five months over a time period from early February, 2007 to late June, 2007. The interviews were semi-structured. According to Mintzberg (1979), ''semi-structured interviews provide a controlled framework which facilitates analysis but also allows for the collection of 'soft' anecdotal data'' (p. 587). The latter means that I asked additional questions to probe what respondents were saying further.

Interviews were recorded to increase the accuracy of data collection (e.g. Khalfan, 2004). Recordings were later transcribed, and the data categorized.

Before the interview, participants were asked permission to record the interviews and document their permission.

In one instance where the interviewee did not agree to be recorded on tape, the content of the interview was recorded by note-taking instead.

All participants were assured of their anonymity and confidentiality of their responses. Companies and individuals are therefore not identified by their names. All interview data will be deleted once all requirements for the dissertation have been fully completed.

7.1.3 Interview language and validity of questions

Questions were asked in the respective languages of each IJV partner – Japanese and Chinese (*Putonghua*). The questions were reviewed by native speakers of Japanese and Chinese (*Putonghua*) and back-translated into English to ensure they conveyed the meaning I intended. They were then followed by a pilot test which was carried out on the first three IJVs, which are not included in the case studies. A revised version of the questions was then completed, translated, and back-translated.

7.2 Framework

7.2.1 Arm's-length and non-arm's length IJV relationships: an overview

The cases follow a framework that classifies subsidiaries into those where ownership was either concentrated (in favor of the Japanese partner) or diffused. I considered an ownership structure in which the Japanese partner held 70% of equity or less as diffused with the local partner owning the difference (Fernandez and Underwood, 2006). Minority Japanese ownership was not considered. Fernandez and Underwood (2006) have previously used this framework in the set up of IJVs. Instead of using a pure equity approach in deciding whether a particular IJV relationship is arm's length or non-arm's length, they argue that an IJV relationship can still be arm's length despite the equity held by the local partner. Instead, the extent of the local partner's active involvement in the IJV can determine the type of IJV relationship (arm's length or non-arm's length). As such, two factors – amount of ownership and participation – determine the type of relationship.

Accordingly, the case studies are categorized into these two main categories. Due to the two main determinants (above) of the type of IJV relationships, two more subcategories emerge. Cases have been further sub-classified as conventional and non-conventional arm's length and non-arm's length relationships.

For example, a conventional arm's length relationship is one in which the local partner holds low equity share (e.g. ownership is concentrated in Japanese hands) and exercises a low amount of participation in the IJV.

A non-conventional arm's length relationship is one in which the local partner holds a high equity share (e.g. ownership is diffused), but exercises disproportionately low participation in the activities and decision-making of the IJV relative to its equity share. A silent local partner would be an example for the category of non-conventional arm's length relationship.

As for non-arm's length relationships, the conventional type is one in which ownership is diffused, and the local partner exercises a proportionate amount of participation in the IJV (e.g. management, HR, as supplier) relative to its level of ownership.

By contrast, an example of a non-conventional non-arm's length relationship is one in which ownership is concentrated in the Japanese partner (i.e. low equity for local partner), but the local partner nonetheless exercises a high degree of participation in the IJV relative to its ownership share. Figure 7.1 illustrates the categories of IJV relationships used in framing the case studies and their impact on technology/knowledge-based productivity growth.

Figure 7.1: Framework for case studies by IJV relationship and ownership

Ownership	IJV Relationship			
	Arm's Length		Non-Arm's Length	
Diffused	***Type:***	*Non-conventional*	***Type:***	*Conventional*
	Technology/ knowledge-based productivity growth:	*Low*	***Technology/ knowledge-based productivity growth:***	*High*
	Case C		***Case B***	
Concentrated	***Type:***	*Conventional*	***Type:***	*Non-conventional*
	Technology/ knowledge-based productivity growth:	*Low*	***Technology/ knowledge-based productivity growth:***	*Medium*
	Case D		***Case A***	

Source: *Compilation of various sources*[24]

The following discussion provides a summary of the Japanese and Chinese partners' goals from the IJV according to the categories established. The categories are discussed in descending order of technology/knowledge-based productivity growth within the two relationship categories.

[24] Main source: China Europe International Business School (2006). http://www.ceibs.edu/knowledge/strategy/11867.shtml. Accessed February 24, 2010

7.2.2 Arm's length relationships

7.2.2.1 Conventional pattern

(*Technology/knowledge-based productivity growth: low)*

The conventional pattern of arm's length relationships (i.e. concentrated or majority ownership skewed towards the Japanese partner) tended to result in low technology/knowledge-based productivity growth owing to factors such as insufficient incentives for the local partner to contribute to the IJV.

Even in cases where the local IJV partner volunteered to contribute significantly in the early stages of the IJV, acquisition of technological knowledge and experience eventually led the local partner to seek other business opportunities. This became a problem in cases where both IJV partners were from the same or similar industries, and the IJV was founded on the premise to localize production. As special state-owned enterprises affiliated with the Chinese Academy of Sciences (CAS), which was a frequent occurrence in this relationship category, the local partners' technological capabilities were already high at the time of IJV setup, and the technological gap was thus low. As a result, the Japanese partner was more worried about technology protection relative to other cases. The local IJV partner that was to be the main local supplier eventually, however, sought opportunities to become supplier to other large MNCs due to a lack of financial incentives from the ownership structure of the IJV and marginal representation in its managerial decisions. Eventually, the local partner diverted its resources from the existing IJV to pursue other contracts – mainly as supplier to MNCs. This arrangement resulted not only in low productivity growth but also instability induced by the local partner. From the point of view of the Japanese partner, a highly undesirable situation of uncontrolled instability ensued.

Expectations of Japanese partner

The Japanese partner wanted to gain the local partner's sophisticated technological tangible assets for localization of components production but failed to do so due to non-alignment of interests (through ownership), resulting in a dichotomy between technology protection and technological cooperation.

Role of local partner

The local partner was not likely to be involved in higher management of the IJV, with its management functions limited to HR and the recruitment of workers. Nonetheless, this area was still important as the Japanese management could more easily implement policies and reach consensus among both locally hired engineers and assembly staff. The legitimacy of policies increased when conveyed by local HR managers. Interview data showed that this scenario also impacted residual values with regard to technology/knowledge-based productivity growth favorably. Subsidiaries where the local partner was in charge of HR despite low management involvement had higher technology/knowledge-based productivity growth versus those IJVs in which the local partner was absent from all managerial functions.

Furthermore, the Chinese partner would act as a supplier of simple tangible assets that were necessary in setting up the IJV and provide a range of limited intangible assets such as access to government officials, tax negotiations, and procurement of operating permits.

In terms of technology contributions, the Japanese partner did not, from the beginning of IJV, require the Chinese partner to make any contributions related to its present or future technological capabilities, and had no intention of doing so in the future.

Common occurrences of relationship pattern

This relationship pattern occurred when the Japanese partner needed a local partner only for initial and subsequent contributions such as land, permits, and tax negotiations. The difference to the previous relationship pattern, however, was the lack of efficiency by the Chinese partner to provide complementary assets. The IJV with the Japanese partner was not a top priority for the Chinese partner since it already had other IJVs with western MNCs. Forming the first IJV with a Japanese partner was more akin to testing the waters. However, involving the local partner in a key HR function could positively impact technology/knowledge-based productivity growth. In the absence of such involvement, however, productivity growth values tended to be low in this relationship.

7.2.2.2 Non-conventional pattern

(Technology/knowledge-based productivity growth: low)

This relationship pattern resulted in low technology/knowledge-based productivity growth in the long term, despite high initial productivity growth at IJV formation. The partner was motivated to contribute what the Japanese partner requested (usually non-technological tangible and intangible assets) by means of high profit share and the opportunity to upgrade technological and some managerial capabilities. Normally, this relationship occurred when the technological gap was large and both partners came from either the same or similar industries.

It also occurred in cases where the IJV partners came from different industries resulting in low product complementariness, and the Japanese partner did not need to worry about technology leakage. Although both instances allowed for high initial productivity growth, this could not be maintained and decreased over time.

Expectations of Japanese partner

With regard to ownership, the Japanese partner sought a strong local partner, but one who was silent in terms of daily operations and management. The Japanese partner expected the Chinese partner to be content with high ownership and the resulting high share of profits. Therefore, the local partner should be motivated enough to contribute non-technological tangible and intangible assets to the IJV efficiently and without delay.

The Japanese partner did not generally seek the local partner's tangible (e.g. technological) assets since no localization that would potentially involve the local partner was planned. Moreover, the Japanese partner would not generally provide opportunities for capability upgrading.

This relationship worked well as long as the Japanese partner did not decide to change plans by e.g. localizing component production. Components continued to be imported from Japan and used in final assembly locally even when capabilities to localize component production clearly emerged over time.

Role of local partner

The local partner provided tangible assets necessary in the setup and daily operations of the IJV, and contributed a limited range of intangible assets, which included government and business connections, and limited local market access.

It chose to leave the management fully to the Japanese partner because it was believed that the Japanese partner was experienced and skilled. The local partner would willingly limit itself to providing support for local matters in which it was competent.

With regard to growth in technology/knowledge-based productivity, the relationship is still at arm's length in which the local partner did not gain significant managerial or technological knowledge despite diffused ownership. In addition, the Japanese partner was largely able to protect its technologies from the local partner.

Common occurrences of relationship pattern

This form of relationship was useful for Japanese companies that did not seek to localize production by making the local partner a supplier or finding local suppliers through the local partner's contacts. However, the Japanese partner still required other intangible assets that the local partner would readily provide due to an alignment of the local partner's interest with a high ownership share. With regard to ownership change, the following two scenarios emerged:

Depending on whether the local partner voluntarily chose to be treated at arm's length, i.e. if it chose not to participate in management, changing ownership was difficult - for instance if the Japanese partner were to seek a deeper involvement by the local partner through technological contributions (e.g. components) in cases of localization. However, if the local partner had been treated at arm's length involuntarily, the Japanese partner could more easily accomplish the task of involving the local partner in the IJV on a more involved level, provided the local partner had a foundation of relevant technological capabilities.

Either case limited technology/knowledge-based productivity growth in the long term (beyond 8 years) but provided a high degree of technology protection and high initial technology/knowledge-based productivity growth.

7.2.3 Non-arm's length relationships

7.2.3.1 Conventional pattern

(Technology/knowledge-based productivity growth: high)

The conventional non-arm's length relationship tended to produce the highest level of technology/knowledge-based productivity growth among the four types of relationships. In this type of relationship, many IJVs exhibited a high degree of product complementariness, and the Japanese partner could systematically develop the local partner's capabilities in order to achieve higher rates of localization over the life of the IJV for activities that were originally conducted in Japan. These are mainly component supply and, increasingly, R&D.

Several IJVs indicated they were considering localizing R&D functions that were being conducted in Japan at the time. Most IJVs, however, did not achieve successful localization of R&D due to still significant technology and knowledge gaps. A case study of an IJV in this category will show the example of successful capability upgrading through strong technological involvement in the IJV by the local partner, which eventually resulted in the creation of a new wholly-owned R&D subsidiary from the existing IJV.

Expectations of Japanese partner

The Japanese partner required a strong partner with respect to both ownership, managerial, and technological participation. The main reason for forming the IJV was that the local partner's products or components were required. In addition to the common intangible complementary assets (e.g. government connections, tax negotiations, and procurement of permits), the Japanese partner required a high degree of specific tacit knowledge from the local partner. The Chinese partner was expected to bring knowledge-based, technology-related intangible assets to the IJV, including those derived from its own R&D experience.

Role of Chinese partner

Due to high ownership, active participation in management, and a strong sense of both financial and learning achieved from technological cooperation on a high level, the interest alignment was such that the local partner efficiently provided its contribution in an environment of minimal information asymmetry. In this relationship, interest alignment was strongest.

Common occurrences of relationship pattern

A successful relationship was possible in the presence of comparable technological understanding and capabilities between both partners and a high degree of asset complementariness. It was useful where the Japanese partner entered China with a long-term strategy of localizing the supply chain by using the partner as supplier of components and intermediary for sourcing other suppliers in China. Additionally, components had to be technologically sophisticated with a perspective for further R&D activities.

7.2.3.2 Non-conventional pattern

(Technology/knowledge-based productivity growth: medium)

Subsidiaries in non-conventional non-arm's length relationships tended to display medium productivity growth relative to the other categories. Even though ownership was concentrated on the Japanese side, local partners with low technological capacities and high determination to learn were successful, and the

Japanese partner relatively cooperative in skills upgrading, supporting productivity growth.

In cases where the Chinese partner's technologies were already advanced, this arrangement did not work well. In these cases, interests were misaligned and the Chinese partner was not compensated adequately in terms of profit sharing relative to its perceived contribution. By contrast, new technological capabilities were a compensating factor for local partners with fewer advanced technologies.

However, local partners with relatively advanced technologies and high degrees of product complementariness still entered into this type of joint venture relationship because they sought managerial knowledge. The Japanese partner usually required the local partner to contribute as a supplier of components in the future, in addition to the usual contributions (e.g. *guanxi*, tax negotiations, licenses and permits, labor, land). Therefore, efficiency still tended to be high in the initial years. However, dependencies between Japanese and local partners were not even. The local partner's dependence on the Japanese partner tended to decrease (relatively) more over time compared to the Japanese partner who increasingly depended on the local partner to localize production and decrease production costs. Productivity growth slowed as a result. Nonetheless, this type of relationship yielded medium growth in technology/knowledge-based productivity over time.

Expectations of Japanese partner

The Japanese partner essentially wanted a weak local partner with regard to ownership but strong with regard to managerial and technological involvement.

As in conventional non-arm's length relationships, the Japanese partner required the local partner's contribution of immediate complementary assets necessary in setting up and operating the IJV (e.g. land, labor, *guanxi*). The Japanese partner would later require higher-level technological complementary assets from the local IJV partner, such as components.

Role of Chinese partner

Direct management participation and the opportunity to learn technologies and new skills were initially a greater incentive than the ownership share. However, the marginal benefit to the Chinese partner eventually declined when it realized that its contributions gradually began to exceed its rewards from the IJV relationship. As such a small share of equity and profits was no longer enough to justify the level of the local partner's contributions.

Common occurrences of relationship pattern

This IJV relationship was useful where the Japanese partner wanted to retain equity control of the IJV. Otherwise, the arrangement was not useful with regard to the increasing unpredictability of the local partner at a later time when it realized it should be entitled to higher equity relative to the value of its contributions to the Japanese partner. Consequently, the local partner's displeasure resulted in potential IJV instability. High initial productivity growth was followed by lower growth rates.

7.3 Structure of cases

Each case is structured into a table summarizing conditions at the time the IJV was set up and at the time the interview was conducted, a general section, and two sections on interview results. The tables provide information on the motivation for each IJV partner to enter the IJV and remain IJV partners. The general section contains information about the significance of the case, ownership structure, historical background of the IJV, as well as background information about both IJV partners. The first section on interview results provides analysis of interviews conducted with the Japanese IJV partner, while the second section on interview results provides interview data from the Chinese IJV partner.

As a result of the structure of the cases, some repetitions occur. However, by separating the different perspectives, I seek to discuss the motivations of both sides in choosing to enter into IJV agreements and to highlight instances of interest misalignment and information asymmetry that resulted from given ownership structures over time.

7.4 Case A

7.4.1 Case characteristics

- Year of subsidiary formation: 1995
- Ownership structure: 85% (Japanese); 15% (Chinese)
- Productivity growth: Medium
- Feasibility of changing ownership structure: Low
- Instability: High
- Type of IJV relationship: Non-conventional non-arm's length

Table 7.1: Interview results - Japanese perspective (Case A)

JAPANESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Chinese partner meet expectations?**	**Comments**
Experience in foreign market entries	*High*	*High*	*N/A*	
Experience in China	*High*	*High*	*N/A*	
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Items:				
- Land	*Low*	*Low*	*Yes*	
- Factory (building)	*Low*	*Low*	*Yes*	
-Operating permits	*Low*	*Low*	*Yes*	
- Utilities	*Low*	*Low*	*Yes*	
- Labor	*Low*	*Low*	*Yes*	
- Capital	*Low*	*Low*	*Yes*	
- Partner's technology	*Medium*	*High*	*No*	
- Partner's products	*Low*	*High*	*No*	
INTANGIBLE ASSETS				
Guanxi				
- Tax negotiations	*Medium*	*Medium*	*Yes*	
- HR	*Medium*	*Medium*	*Yes*	
- Localization	*Low*	*High*	*No*	
- Market access	*Medium*	*High*	*No*	
OTHER ITEMS				
Government influence (China)	*Medium*	*Low*	*N/A*	*Government was not inclined to interfere much. The company already had other subsidiaries in China*
Efforts by Chinese partner to secure large ownership share (as perceived by Japanese partner)	*Medium*	*Medium*	*N/A*	
Knowledge spillovers from Chinese partner	*Low*	*Medium*	*N/A*	*In beginning, little contact with Chinese partner, other than skill upgrading with respect to explicit knowledge*
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*Medium*	*Low*	*N/A*	
Knowledge transfer (transfer of intangible assets, e.g. tacit knowledge)	*High*	*Medium*	*N/A*	*Chinese partner acquired a high level of technological sophistication owing to the close location of both partner companies despite arm's length relationship*
Knowledge uncertainty towards Chinese partner	*Low*	*High*	*N/A*	*Chinese Local partner successfully diversified its base of international clients/MNCs, e.g. Korean MNCs*

Table 7.2: Interview results - Chinese perspective (Case A)

CHINESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Japanese partner meet expectations?**	**Comments**
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Capital Partner's technology Partner's products	*High* *High* *High*	*High* *High* *High*	*Yes* *No* *Yes*	
INTANGIBLE ASSETS				
Managerial experience Other tacit knowledge (e.g. problem-solving skills, access to training)	*High* *High*	*High* *High*	*Yes* *No*	*Local partner acquired knowledge and then became innovative and sought other customers*
OTHER ITEMS				
Government influence (as reported by Chinese partner)	*Medium*	*Low*	*N/A*	
Efforts to secure large ownership share	*Medium*	*Weak*	*N/A*	*Chinese partner will oppose ownership change if its ownership share were to decline*
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*Medium*	*Medium*	*N/A*	*Equipment and production line transferred to IJV were state-of-the-art, but local partner had limited benefit due to arm's length relationship with Japanese partner*
Knowledge uncertainty towards Japanese partner	*Medium*	*Medium*	*N/A*	*Local partner did not know Japanese partner's investment plans, needed to keep up investment itself to defend its equity share*

7.4.2 Background of IJV

The IJV was set up in 1995 with two partners – a Japanese parent company with 85% and a Chinese SOE that owned 15%. It coincided with more flexible laws on market entry and therefore allowed the Japanese partner to retain high equity control while the Japanese partner's policy to transfer state-of-the-art technology and upgrade the local IJV partner to that of a full supplier was welcomed by the national-level economic development zone and city government officials. The Japanese parent company already had a sales-related wholly-owned subsidiary and another manufacturing IJV in different locations in China. For the current subsidiary, the Japanese parent company therefore had more confidence to operate independently due to its prior experiences in both sales and manufacturing within China. The accumulated experience was therefore perceived as a replacement for a local IJV partner as a contributor of intangible assets (General Manager C, 2007). From the Japanese partner's perspective, the JV was set up with the intent of using the local partner as the main supplier. As an SOE, the local partner's objectives from the JV were common among SOEs. These included obtaining capital, technology, technological know-how and managerial skills. The setup was accomplished in a short time, and high productivity was achieved initially due to the local partner's low equity share and the Japanese partner's prior experience from two other IJVs in China. The ownership structure, however, turned into a disadvantage for the Japanese in the later life of the IJV.

Case A is an electronics company which produces motherboards and intermediate electronics equipment for computers, laptops, mobile phones, and mainframes. The Japanese parent company is a market leader in producing motherboards for laptops.

Some of the IJV's main clients are large international PC makers, which use integrated circuits made by Company A. Although the subsidiary is an equity IJV, it is notable for being managed like a WOS, due to the high share of Japanese ownership (85%). The local partner's equity stake is 15%.

The IJV partner was only to be the main supplier of components needed for integrated circuits, and was otherwise kept at arm's length with respect to both ownership and management. It is worth mentioning, however, that the IJV's new plant was set up next to the Chinese IJV partner's plant (an SOE) in order to facilitate just-in-time (*kanban*) production and to retain the ability to resolve technological matters and other issues in the local partner's own SOE plant since this plant was to be the main supplying plant. The Japanese partner had high confidence technology leakage would not occur.

This IJV was also fully localized since the local IJV partner's company supplied the full range of components. Activities in the IJV included assembly of the final product and product design. At the time of the interview (2007), the IJV's production was fully exported. There was thus little need for the local IJV partner to contribute its market knowledge and knowledge relevant to local market access in the opinion of the Japanese manager, and thus justified the arm's length relationship for the Japanese side. Any products to be sold internally in China were first exported to Japan and then re-imported and sold locally through the Japanese parent company's sales subsidiary in China.

The importance of this case is to illustrate the local partner's quick acquisition of technologies and production knowledge from its already high platform of technological sophistication.

7.4.3 Significance of case

Case A presents a case of uncontrolled instability in its later years due to a misalignment of interests between the Japanese and local IJV partners. The subsidiary has been characterized by declining technology-induced productivity over time, in which the local partner internalized technologies and knowledge offered by the Japanese partner but failed to use its capabilities to the benefit of the IJV in its later years. The local partner was an electronics maker that had already been producing components for mobile phones and communications equipment, and therefore entered the IJV with a relatively high level of technological sophistication. At the time, the local partner had already benefited from the cooperation with the Japanese partner and had been able to further upgrade its technologies and processes. One of the main achievements was the implementation of the *kanban* system, under which the Chinese partner made and delivered its components to the Japanese IJV partner. The local IJV partner was later approached by other MNCs to supply components to.

At the time of IJV set-up, the ownership structure had been fixed contractually between both partners. This meant that equity proportions could not be changed throughout the life of the IJV. Any additional investment had to be proportional so as to preserve the ratio. The length of the IJV contract was set at 30 years. The IJV ownership structure was slanted in favor of the Japanese partner, and neither reflected the importance of the local partner's contributions in the early years of the IJV nor in the later years. The Japanese company was not supportive of the idea of changing these terms.

This case thus highlights a subsidiary in which the local partner had acquired a relatively high level of technological capabilities through its function as a supplier to the Japanese parent company, in the process of which it had been able to absorb new technological and process knowledge, despite the arm's-length relationship it was in. Technology learning and upgrading, however, has led the Chinese partner to expand its own supplying network to other MNCs from the same industrial park. The local partner was also kept out of management participation. Other commitments the local partner was beginning to make with other MNCs induced the process of instability in the IJV as the local partner was diverting resources and focusing its commitment to more lucrative contracts. The case highlights an undesirable scenario for the Japanese IJV partner. Despite the retaining a high ownership share and what the Japanese partner thought control, the opposite had occurred. The local partner had little motivation/incentive to continue the IJV partnership. Instead, it took its augmented knowledge and technologies elsewhere. The scenario works only if the local IJV partner joined the IJV with an already high level of technologies and asset complementariness. In this case, the strategy of according the local partner low ownership in order to retain high control and removing the possibility of adjusting ownership by fixing its ratio in the IJV contract proved to effect the opposite.

To make up for the local partner's complete non-involvement in management, a close location for the new IJV plant to the local partner's parent firm (an SOE) was chosen to facilitate communication between management and engineers.

As its third subsidiary in China, the Japanese partner already had experience and a sales network in China; therefore it had no particular need for the local partner's intangible assets (e.g. *guanxi*, access to distribution channels, or access to other suppliers). The main purpose for the Japanese partner was thus to develop the local IJV partner into a full components supplier.

7.4.4 Local IJV partner

Similar to the prior cases, the local partner was a large SOE with similar background. Its main products included electronic components used in integrated circuits and components for telecommunication equipment. At the same time, the SOE was developing its semi-conductor capabilities, and implemented its first clean room for semiconductor finishing in 2002. By 2005, the SOE was a sought-after supplier of electronic components among international firms in the electronics and telecommunications industry, including PC and cellular phone makers from the US and notably Korea. At the time of JV formation in 1995, the local partner was facing capital challenges, outdated product lines, and outdated production equipment. It therefore had an urgent need to acquire capital and new technologies. Similar to the acquisition strategies of other SOEs, capital and technology acquisition was to be accomplished through a JV partnership as well.

7.4.5 Technology and knowledge transfer

The special case of technology transfer here is that the local partner acquired a high degree of technologies quickly, until the year 2003, as the data shows, after which the rate of technology implementation/skill absorption started to decline. Two conditions distinguish this local partner company from other cases. First, the local partner company in this case was a subsidiary of a large SOE which had been attached to the Chinese Academy of Sciences (CAS) until the year 2000 and specialized in computer equipment. Therefore, the IJV's second-tier partner already had a high-level of technology and engineering skills relative to IJV partners in other case studies. Its rate of learning and technology absorption was also likely to be higher. The local partner was then able to acquire the skills of the Japanese partner in a shorter time. Table 7.2 shows that the Chinese partner's priorities were similar to those of others, placing high priority on the acquisition of both tangible and intangible assets. However, compared to the Japanese partner, who did not place much importance on the local partner's intangible assets, the Chinese partner's tangible assets played a greater role. These were mainly components.

As for the distribution of incentives, however, the Chinese partner had more to gain from the Japanese partner: the Chinese partner still needed to obtain both tangible and intangible assets in order to upgrade its capabilities. The Japanese partner, however, only needed the local partner's tangible assets. All else being equal, the Japanese partner would then be obtaining less from the local partner than vice versa, and less compared to the other Japanese partners from other case studies, who did depend on the local partner's intangible assets. This would seemingly justify a higher ownership share for the Japanese partner. However, the local partner also provided all of the components needed for the IJV to maintain production, and therefore the Japanese partner's dependence on the local partner can be argued to be greater than in other case studies and relationships. The high dependence on the local partner, however, is not reflected in the equity structure. Therefore, the distribution of ownership may not be optimal, and diminish the Chinese partner's loyalty towards the Japanese partner by giving it opportunity to seek higher returns elsewhere, particularly in the later life of the IJV. During the life of the IJV, the Chinese partner's technological capabilities had reached a level where it started to supply state-of-the-art components to other foreign MNCs in China which included Korean and US MNCs. Eventually, this move reduced the local partner's dependence on orders and technology assistance from the Japanese JV partner while it managed to absorb its technology and knowledge. Case A, therefore, highlights a situation where IJV instability originated from the Chinese partner. In other words, the Japanese partner lost control over the act of continuing or the timing of IJV termination - a highly undesirable situation for the technology transferor.

7.4.6 Technology protection

To prevent technology leakage, the Japanese parent company set up an arm's-length relationship with the local partner by keeping its equity involvement as low as possible. As such, the management of the JV resembled that of a wholly-owned enterprise. Employees were also separated. Different from other IJVs, this IJV preferred to hire its own employees from the beginning instead of relying on the local partner to contribute its employees. Moreover, the entire hiring process and HR function was overseen by Japanese management – which had some experience because of the parent company's previous subsidiaries in China. The Chinese partner was not further involved in the recruitment process.

Since state-of-the-art-equipment was transferred to the newly formed IJV, there was no option to involve the partner in the daily operation/management of the JV to prevent the Chinese partner from learning the technology. The Chinese partner was therefore kept at a distance with some exceptions. In order to assume the role of supplier, the Chinese partner needed to learn the *kanban* process and certain production processes required for the production of electronic components. Both partners therefore agreed to set up the new IJV next to the plant of the local partner. This location should facilitate communication, knowledge exchange, and troubleshooting, which was important as the IJV had implemented the kanban system, and the local partner had to supply according to the kanban system. By choosing this site, the Japanese company hoped to enable the local partner to learn the kanban process, while it intended to prevent further technological know-how to leak to the local partner by otherwise keeping it arm's length.

7.4.7 Technology/knowledge-based productivity growth

Technology/knowledge-based productivity growth in this IJV continued to rise until 2003, after which it started to decline. Since the Japanese partner did not place much importance on the local partner's tacit knowledge (intangible assets), not much learning took place in the opposite direction (Chinese to Japanese partner). From the perspective of knowledge exchange, the IJV had already become obsolete. In terms of learning, the JV had reached its peak when the Chinese partner acquired enough skills and technological sophistication when it became supplier to another Korean electronics MNC, with whom it commenced a supplier relationship in 2003. It was in the same year that technology-induced productivity growth started to decline and the IJV entered potential instability induced by the local partner.

7.4.8 Objectives for ownership

With regard to ownership objectives, the Japanese side wanted to have higher ownership because of the technology it was going to use in the JV while still giving the partner equity in order to align motives and reduce the possibility for unpredictable actions caused by the partner’s bounded rationality. Therefore, the Japanese company preferred not to set up a WOS. The ownership structure was meant to ensure the loyalty of the local partner.

However, the equity participation was less than the SOE management desired, but entered the JV because of the potential for the acquisition of new technologies and suasion by the city government was actively promoting the setup of companies with advanced technologies in the industrial park.

7.4.9 Interview results: Japanese partner

7.4.9.1 Tangible assets

The orientation of the parent company towards localizing production using an exclusive supplier in China has been planned from the beginning. Therefore, the Japanese company did not place great importance on the local partner’s contribution of initially required tangible assets such as land, factory space, and utilities, which the other companies demanded. The Japanese parent company already had several subsidiaries in China whom it could contact for help with setting up a factory. Although the local partner contributed some initially required simple tangible assets, their importance to the Japanese company remained low. The only initial contribution required of the local partner was labor. However, the IJV began to recruit its own labor after the local partner's initial contribution. This is reflected in the table, where the importance of labor contributed by the local partner decreases.

As for technology-related tangible assets, the Japanese partner's strategy to localize the supply chain with one partner thus placed great emphasis on the JV partner's contribution of complementary products. However, as most SOEs, the local partner did not have the equipment, technologies, nor capital necessary to produce components at the required quality and with the required production processes such as *kanban*. However, compared to other SOEs, the local partner already had a higher technological knowledge level and experience with R&D from its affiliation with CAS, which would result in higher technology-induced productivity levels initially, and therefore a shorter unproductive IJV lifespan. With regard to the partner's capability to contribute tangible assets, however, the GM had confidence in the technological capability of the local partner:

> *We helped the partner to acquire the skills to make their own production entirely… They had experience in product design, and they also had the skills to design the necessary production equipment and prototypes… Their company had experience in robot development! We started out with kanagata first, our kanagata requirements were high, and their skills did not yet match our requirements. That's when we sent engineers over to their factory help them…They were soon able to make their own kanagata to our standards… We followed the same pattern for other products for some time…until two years ago when they started to accommodate our orders immediately…* (General Manager A, 2007)

The quote highlights how the Japanese partner improved the ability of the local partner to contribute complementary products. A further reading of the quote also suggests a declining relevance of the Japanese partner in building the local partner's technological capabilities since the local partner's absorption of technological assistance resulted in its acceleration in designing and producing new components. The Japanese partner's technical help thus became less relevant as a result of the local partner's higher learning rate.

From the Japanese side's point of view, the increase in capabilities of the local partner that led to shorter lead times for component production made the local partner an invaluable asset. Furthermore, the local partner's ability to contribute high-quality components within *kanban* production methods further raised asset specificity of the partner's products and made the local partner indispensable. An important outcome is that the Japanese partner became dependent on the Chinese partner but did not consider the motivation of the Chinese partner to contribute and remain a partner to the IJV. The Chinese partner company, on the other hand, had more options to use the skills acquired and offer them to other MNCs. IJV instability thus began to originate from the local partner.

7.4.9.2 Intangible assets

The Japanese partner entered the IJV with a perceived higher level of intangible assets due to its prior experience in foreign market entries in both China and other countries. Therefore, the Japanese partner did not deem the local partner's potential intangible contributions such as *guanxi* and the ability to negotiate with Chinese bureaucracy important to the IJV set up or the subsequent life of the IJV. The Japanese partner, however, did hope to gain a long-term supplier relationship from its local partner. This strategy, however, was problematic. The Chinese partner entered the IJV with a high level of technological knowledge as a result of being directly affiliated with CAS before.

The small ownership share the Japanese partner accorded to the Chinese partner was too small to create a financial incentive for the local partner, and the local partner's motivation to learn had reached a ceiling without further incentives in terms of intangible assets added by the Japanese partner such as additional training in Japan. The relationship became one-sided in that the Japanese partner was benefiting from the local partner through the supply of components, but the local partner was stagnating in terms of learning and profit sharing due to its small ownership share. The local partner thus had an incentive to seek other financial and technological opportunities. With regard to the objective of obtaining intangible assets from the local partner, the GM noted:

> *Precisely because of our strategy of transferring state-of-the-art technology here, we needed a partner with state-of-the-art knowledge and technology. The main reason we chose this partner is because of its advanced technological level and product similarity… We did not need the partner to negotiate for us or do day-to-day administrative things on our behalf… Our parent company had asked another subsidiary in Wuxi to do it for us… They also introduced the local partner from the CAS [Chinese Academy of Sciences]-affiliated Zhonghuan Group to us…* (General Manager A, 2007)

With regard to exchanging intangible assets with the local IJV partner, the GM added: "We did not expect the Chinese partner to reach the current technological level in (such) a short time since we didn't provide much training… We thought that they would be content with the orders and income received from being our supplier…" (General Manager A, 2007) The GM's statement thus shows that the Japanese partner did not consider the continuous acquisition of intangible assets through learning to be a decisive motivator for the Chinese partner to remain a partner to the IJV.

7.4.9.3 Ownership

The Japanese partner's ownership share was high, which was unusual for the time at which the IJV was set up (1995). The ownership share of this IJV is a manifestation of the government's policy of pressuring foreign companies into transferring advanced technologies in return for being allowed to keep a high ownership share (General Manager A, 2007).

When asked about the ownership structure with reference to the Chinese partner's ownership share, the GM offered an explanation based on incremental foreign-market experience and level of technology:

> *When we set up the JV, we considered our own experience, technology level, and capital. We already had two JVs in China, the first was set up with a 60% to 40% structure, and the second with 80% to 20%. We tried to secure higher ownership each time we set up a new subsidiary. In this JV, we have state-of-the-art production technology, so we needed to take it into account and manage the subsidiary as if it were wholly-owned.* (General Manager A, 2007)

With regard to changing the ownership structure in favor of the local partner, and thus having a flexible ownership structure, the GM recognized the asset specificity arising from the transfer of advanced technologies and the resulting dependence on the local partner (asset specificity):

> *We are concerned about our partner's latest diversification efforts. We cannot do without our partner… We would have to stop our production… It is not realistic to find a supplier with the products and skills tailored to our needs… If we start to treat them (JV partner) like a regular market supplier, we will lose our cost and kanban advantage, they will have other customers. But we cannot change the JV contract easily…*(General Manager A, 2007)

Therefore, for the reason of asset specificity alone, the Japanese side has no other choice but to continue to involve the local partner in the IJV. Due to high asset specificity created through the supplier relationship with the local partner, becoming a wholly-owned subsidiary and continuing to source complementary products through arm's-length market transactions without increasing transaction costs would be difficult.

The manager's statements reveal that ownership change in favor of the local partner was presumed to be useful eventually and discontinuing the IJV out of the question. Ownership change, however, entails potential government involvement, which is discussed below.

7.4.9.4 Government influence

Government influence was limited during the set up of the IJV. Due to its prior experience in China, the Japanese parent company did its own search of potential IJV partner companies and shortlisted the current company. Unlike other cases, the government did not explicitly interfere by assigning or persuading the Japanese parent company to form an IJV with this particular partner. In fact, the government was even liberal towards the ownership share. It accepted the current high ownership share for the Japanese partner as a tradeoff for a state-of-the-art production line and the *kanban* production process. Since there is little room to change ownership upwards, any subsequent ownership would be in favor of the local partner; therefore government resistance would be expectedly low. According to the GM, the government was cooperative for the following reason:

> *The government was helpful, they gave us the plot of land in the location we needed. When we came here, everything was already prepared for us. The communication between our other subsidiary and the government here was effective. Our subsidiary in Wuxi acted as a proxy for the set*

up of this joint venture… (General Manager A, 2007)

However, the GM expected government objections if the Japanese partner were to try to acquire the Chinese partner's share and convert the subsidiary into a WOS. According to the GM:

> *When we applied to set up the JV here, the government assured us that we would continue receiving tax benefits, tax write-offs, and fast service as long as we kept renewing our product lines, production equipment, and localize training. Another important reason we continue to operate as a JV is that we do not want to jeopardize these benefits…* (General Manager A, 2007)

It is clear from the manager's words that the Japanese IJV partner company believes that government benefits and preferential treatment can deteriorate if conditions such as localization, equipment transfer, and shared ownership were not fulfilled.

7.4.9.5 Technology transfer and technology leakage

As discussed in the sections *Tangible Assets and Intangible Assets*, the leakage of technology was a consideration when the current ownership and management structures were selected. The Japanese partner insisted that IJV be managed similar to a wholly-owned subsidiary, which therefore meant that the Chinese partner was to be left out of management. Therefore, processes that were mutual in other IJVs were kept separate in this IJV. The effort by the Japanese partner to keep the local partner at arm's length stemmed from the Chinese partner's higher technological levels (*through its prior affiliation with CAS*), and therefore the local partner's faster learning capabilities. According to the GM, the Chinese partner could not receive a greater share without getting more voting rights. The Japanese partner, however, could not accept. According to Harris and Moure (2006), treating the local IJV partner as such is rare in China. However, it has offered advantages to those IJVs in which the foreign partner tries to leverage on its increased experience in the host country. In addition to transferring staff from its previous IJVs, the current management could hire local staff without the fear that the Chinese partner could bring in “friends, family, or other acquaintances we [Japanese partner] don’t know well.” (General Manager A, 2007) With regard to leakage of technology, the GM further stated that,

> *We do not involve the partner in vital tasks and the sharing of vital information. This is how we can best prevent leakage of technology and knowledge. For example, we do not let our partner hire the staff, and we do not trust staff unless they have been here for a long time… This is how we reduce the possibility that staff are friends or relatives of our partner. Since our partner does not know the staff, we have equal conditions. If our partner had known the staff members beforehand, we would not trust our partner.* (General Manager A, 2007)

In addition to hiring practices, technology leakage is also controlled through systematic training programs and deployment of expatriate managers and engineers. Similar to other cases, these are Japanese engineers from the headquarters who are stationed at the IJV for a period of time to oversee the introduction of new production equipment and to train workers to use it. It is mostly a process of explicit rather than tacit knowledge transfer since anything beyond operating the machines and conducting simple repairs are not taught. Consequently, adjusting production equipment to customized product requirements by clients is done by Japanese engineers. However, the proximity of the IJV to the Chinese partner’s company moderates the impact of the withheld tacit knowledge. Japanese engineers also conduct training at the local partner’s SOE and train the local partner adjust their technology to supply components to the new production line within three to six months.

7.4.9.6 Knowledge transfer

According to the table, the Japanese partner rated its knowledge transfer to the Chinese partner in both instances as medium. The Japanese partner avoided teaching theoretical aspects of new products and their production to the Chinese employees and the Chinese partner SOE. The design of new products was left entirely in Japan. Similar to other case studies, however, the GM acknowledged that it would only be a matter of time that the Chinese partner will understand the design aspects. By then, he argues, "new equipment will have replaced the old equipment, and their [local partner's] knowledge about the old equipment will help them to understand new equipment faster each time it is introduced…" With regard to the learning of technology's tacit knowledge, therefore, General Manager A (2007) conceded that "some technology and knowledge leakage cannot be helped, we do our best to maximize the utility of the new technologies we bring here…"

7.4.9.7 Knowledge uncertainty towards Chinese partner

The perceived knowledge uncertainty towards the Chinese partner has increased over time. The Japanese partner is now aware that with the local partner's diversification towards other suppliers, it has become extremely difficult to predict what the partner's next step will be with regard to a) remaining a partner to the IJV, b) demanding a higher ownership share within the IJV, and c) retaining a reliable supply of components from the partner since the partner's diversification to other suppliers has caused disruptions in the timing of the partner's deliveries under the *kanban* system. The latter have caused the Japanese partner company to send engineers to the local partner's company to ensure *kanban* schedules were met. The cause for the delays had been "a diversion of their [local partner's] engineering and production resources to develop samples/prototypes for another [Korean MNC]," according to General Manager A (2007).

The GM also mentioned that the local partner would need to have a higher ownership share in the near future. "We realized our JV partner was searching for new sources of income. Through a higher ownership share, we thought we could alleviate the problem, so that they [local IJV partner] could have a higher share of the profits." (General Manager A, 2007) The quote shows that the necessity to make adjustments to the ownership structure had been recognized as important in order to create incentives for the local partner to remain loyal and continue its role as supplier.

7.4.10 Interview results: Chinese partner

7.4.10.1 Ownership

In addition to contributing value-added products, the Chinese partner wanted active involvement in the management of the IJV for which it sought a reasonable equity share. However, the local partner did not pursue its ownership requests further since the central government had backed the Japanese partner's investment application owing to its plans to transfer state-of-the-art product technologies and plans for long-term and full localization. The Chinese partner, however, knew that the ownership structure did not reflect its (local partner's) contribution and importance to the Japanese partner as the single most important supplier in China. However, the Chinese partner also hoped that the lack of any significant ownership in the IJV would be compensated for by the learning of technology and R&D skills, because it had to show progress reports to the local government Appliance Measurement Bureau (□表局). Despite low ownership, frequent initial training and exchange of engineers (which later became more restrained) enabled the Chinese partner absorb new knowledge at a high rate in the beginning. High absorption rates were a result of the local partner's already high level of technology as a result of its prior affiliation with CAS. However, knowledge absorption reached a plateau when the Japanese partner reduced technology assistance after the local partner had reached the capability to supply components. Technology/knowledge-based productivity of the IJV decreased subsequently. Since the IJV was managed as essentially two separate companies, the values therefore can be interpreted as a decline in technology/knowledge-based productivity growth that resulted from the Japanese partner alone, rather than productivity decline due to discrepancies between IJV partners. In the meantime, the Chinese partner had used its high initial technological capabilities and started supplier agreements with other electronics MNCs. The Vice-GM (2007) explained that,

> *Financially, the partnership with our Japanese partner was limiting. They [the Japanese partner] had been our technology supplier for several years, and we were loyal to them. On the other hand, our requests for a higher share in the JV went unheard. Naturally, we took the next step and looked for new opportunities – we were very lucky that [a Korean MNC] approached us. We are now a large supplier to them [Korean MNC]…* (Vice-General Manager A, 2007)

The Vice-GM's quote shows the Japanese efforts to increase the Chinese partner's ownership share after they learned about its other supply contracts. The Chinese partner, however, is determined to expand the business with the Korean company. The Japanese now have little leverage because the local partner is their only large-scale local supplier. High asset specificity prevents sourcing components from other suppliers in the short term.

7.4.10.2 Tangible assets

Similar to other IJVs, the importance of obtaining tangible assets from the Japanese partner was expectedly high. There was less emphasis on obtaining capital compared to other IJVs. This was due to the arm's length supplier-manufacturer relationship between the two partners and the separate nature of the local partner company and the IJV itself. Although the Vice-GM stated that new capital was needed, he also explained that not needing to invest capital in the IJV meant that capital could be used to invest in the local partner company's own product development and quality. The SOE already had the advantage of higher R&D capabilities, which meant that capital invested would have greater effect in terms of sophistication of result and time taken. In a period of only three years, the SOE managed to design production equipment including a robot-arm that could make high-precision mechanical parts for DVD drives. Later the partner opened a clean room in which semiconductor-based integrated circuits could be made. The Vice-GM (2007) stated that,

> *Our JV expanded a lot since we set it up. We were able to increase our product range using the profits from the JV. Because our share was small, we needed to think about the future of our own company more, so we kept investing almost all of our profits in hiring engineers and some new production equipment. It was risky, but we have come out with new products much faster since then… Our own productivity has increased tremendously, and we have made more new products than our Japanese partner since 2002…* (Vice-General Manager A, 2007)

Therefore, it can be interpreted that the Japanese parent company's arm's length strategy ultimately benefited the Chinese SOE. The benefit for the IJV in the short-term was that the Japanese partner still achieved technological progress without disclosing vital technologies. In the long-term, however, both partners' interests became misaligned. The arm's length relationship did not provide a foundation for the Chinese partner's continued loyalty, and low profit that came with low ownership ultimately caused the Chinese partner to look for opportunities with other customers.

7.4.10.3 Intangible assets

As in other the other cases, the importance of intangible assets was high for the Chinese partner at the time of IJV set-up but declined over time as the partner's capabilities rose. As discussed previously, however, the decline in the importance for the Japanese partner's intangible assets was due to the local partner company's own strengths in product design and R&D capabilities. The Vice-GM expressed, "We wanted to expand our company and seek new customers for our products… We needed to put our potential to make new products according to custom requests to good use. So we started looking for other MNCs…" (Vice-General Manager A, 2007) With respect to the Japanese partner he said, "When we found [the Korean MNC], we knew we really did not need the Japanese partner for technology transfer anymore… We knew we could not get their know-how, at least not with the current ownership structure… Koreans were more cooperative…" (Vice-General Manager A, 2007).

However, the Vice-GM added that shortly after IJV set up, engineers from the

SOE were sent to the IJV for training. The IJV was located next to the SOE in the same industrial park. The training, however, was limited to operating the machinery and did not include the teaching of know-how or problem-solving skills.

As a previous member of CAS, however, the Chinese IJV partner already had advanced technological capabilities. For example, the Chinese partner company was able to develop the prototype for a new electronic component to be used in cellular phones within eight months and mass-produce it within one year.

Vice-General Manager A (2007) declared that the product development and engineering capability gap between the Japanese company and the Chinese partner was closed when "[the Korean MNC] approached us [Chinese partner company] to supply telecommunication components." Noting this, he added that with the status quo in the number of order maintained by the Japanese IJV partner, "there is no reason to consider dissolving the joint venture." (Vice-General Manager A, 2007) In other words, the IJV was now being kept stable at the control of the local partner since the burden of keeping the IJV together had shifted to the Japanese partner which had to maintain its order level. Otherwise, there may not have been adequate financial incentive and the Chinese partner may have left. Ironically, the Japanese side's tendency for technology protection and lack of a long-term technology assistance strategy has resulted in the Chinese partner considering leaving the IJV. The Japanese partner would thus lose control of IJV stability.

7.4.10.4 Government influence

Due to its state-of-the-art technology the government left the SOE with a high degree of independence, which included IJV formation. The Japanese partner located the Chinese partner through its previous network of subsidiaries, and the Chinese partner agreed to become an IJV partner for the purpose of supplying complementary products (components) because it needed order predictability and large order volume. It also wanted to upgrade technological and managerial knowledge. The two partners then negotiated the ownership structure, and the government approved the IJV without further intervention. The low ownership share of the Chinese partner is partly a result of the company's shortage of capital. During its affiliation with CAS, the partner company had received R&D funding, but this was not the case when it became independent. The company also lacked marketing experience. Regarding the partner company's commercial experience, the Vice-GM explained that,

> *The government encouraged us to enter a JV with [the Japanese company], but said they would leave the decision on ownership up to us. We did not have much capital to invest, and we needed their [Japanese partner's] marketing experience… The setup negotiations ended quickly, and we settled for a 10% share. We did not request financial assistance from the Appliance Measurement Bureau, it would have slowed down the process by at least a year…* (Vice-General Manager A, 2007)

4.4.10.5 Knowledge uncertainty towards Japanese partner

The previous discussion has shown that the Japanese partner's sole source of locally sourced components is the Chinese IJV partner's company (SOE). In terms of intangible assets, the Japanese partner has effectively not made use of the Chinese partner's tacit knowledge, which encouraged the Japanese partner to keep the Chinese partner at arm's length.

Even though the Chinese partner was kept at arm's length, it has managed to upgrade its own capability through the Japanese partner's initial assistance in upgrading technologies and skills (i.e. explicit and tacit knowledge). The partner's embedded technological knowledge embodied by its high-ability pool of engineers from the time of the company's affiliation with CAS enabled it to process both new explicit and tacit knowledge fast. According to the Vice-GM (2007),

> *We had less knowledge on equipment technology, so for some complicated, sophisticated problem, we had to consult the Japanese. We sought active communication with them… We tried to learn their technologies, and after a short time we could already apply them… Eventually, we did not depend on the Japanese partner's training anymore…* (Vice-General Manager A, 2007)

High existing technological capabilities helped the local partner to become relatively independent of the Japanese company even to the extent of training. Many other local partner companies complained about the inaccessibility of training and problem-solving skills (i.e. transfer of tacit knowledge). The Chinese partner in this IJV, however, had effectively absorbed tacit knowledge to the extent that it could develop its own problem-solving skills (tacit knowledge). In this sense, the Chinese partner depended much less, if at all, on the Japanese partner for the transfer of tacit knowledge. Therefore, the motivation to remain loyal to the IJV had faded due to the non-transfer of tacit knowledge from the Japanese partner and the lack of financial incentives due to the low ownership share. The rapid self-sustained technological development of the Chinese IJV partner eventually became a pull factor for its interest in diversifying its customer base away from the Japanese IJV partner. As for knowledge uncertainty, it was now the Chinese partner who had gained the upper hand over the life of the IJV. It had successfully diversified its component making to other international customers while benefits from remaining in the IJV were small. The Japanese partner, however, stood to lose its main supplier. In theory, the Chinese partner could therefore initiate termination of the IJV first. Vice-General Manager A (2007), however, denied by saying "there has been no talk of changing the [IJV] structure on both sides so far…" Despite his quote, the potential for IJV instability induced by the local partner is high. As such, the Japanese partner is justified in maintaining a high level of knowledge uncertainty towards the Chinese partner.

7.5 Case B

7.5.1 Case characteristics

- Year of subsidiary formation: 1995
- Ownership structure: 65% (Japanese); 35% (Chinese)
- Productivity growth: High
- Feasibility of changing ownership structure: Medium
- Instability: Low
- Type of IJV relationship: Conventional non-arm's length

Table 7.3: Interview results - Japanese perspective (Case B)

JAPANESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Chinese partner meet expectations?**	**Comments**
Experience in foreign market entries	*Low*	*Medium*	*N/A*	*Japanese parent company had subsidiaries overseas*
Experience in China	*Medium*	*High*	*N/A*	*Second subsidiary in China*
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Items:				
- Land	*High*	*Low*	*Yes*	
- Factory	*High*	*Medium*	*Yes*	
- Operating permits	*High*	*High*	*Yes*	
- Utilities	*High*	*Low*	*Yes*	
- Labor	*High*	*Low*	*Yes*	
- Capital	*High*	*Medium*	*Yes*	
- Partner's technology	*Medium*	*Medium*	*Yes*	
- Partner's products	*Medium*	*High*	*Yes*	
INTANGIBLE ASSETS				
Guanxi				
- Tax negotiations	*High*	*High*	*Yes*	
- HR	*High*	*High*	*Yes*	
- Localization	*High*	*High*	*Yes*	
- Market access	*Low*	*High*	*Yes*	
OTHER ITEMS				
Government influence (China)	*Medium*	*Low*	*N/A*	*Govt. influence declined when IJV was profitable and transferred technologies*
Efforts by Chinese partner to secure large ownership share (as perceived by Japanese partner)	*High*	*Medium*	*N/A*	*Chinese partner kept up with subsequent investments*
Knowledge spillovers from Chinese partner	*Low*	*Medium*	*N/A*	
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*High*	*High*	*N/A*	*Transfer of new equipment*
Knowledge transfer (transfer of intangible assets, e.g. tacit knowledge)	*High*	*Medium*	*N/A*	*Knowledge was increasingly being created within the subsidiary*
Knowledge uncertainty towards Chinese partner	*Low*	*Low*	*N/A*	

Table 7.4: Interview results - Chinese perspective (Case B)

CHINESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Japanese partner meet expectations?**	**Comments**
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Capital Partner's technology Partner's products	*High* *High* *High*	*High* *High* *High*	*Yes* *Yes* *Yes*	
INTANGIBLE ASSETS				
Managerial experience Other tacit knowledge (e.g. problem-solving skills, access to training)	*High* *High*	*Medium* *Medium*	*Yes* *Yes*	*Chinese side complained about increasing lack of training, relied on own engineers' high capabilities*
OTHER ITEMS				
Government influence (as reported by Chinese partner)	*High*	*Low*	*N/A*	
Efforts to secure large ownership share	*Strong*	*Weak*	*N/A*	
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*Medium*	*Medium*	*N/A*	
Knowledge uncertainty towards Japanese partner	*Low*	*Medium*	*N/A*	*Partner could not predict timing of additional investment by Japanese partner, purpose of training methods not clear*

7.5.2 Background of IJV

The IJV was formed in 1995 between a Japanese electronics company that specializes in automotive and aviation GPS and mobile communications equipment and a Chinese SOE that specializes in navigation and telecommunications equipment. The IJV was set up at an ownership ratio of 65% and 35% for the Japanese and Chinese partners, respectively. Ownership in this IJV has not changed since. Productivity growth has been high.

7.5.3 Significance of case

The significance of this case is that despite no change in ownership, productivity has risen over time, which shows that the partner's value of contribution to the IJV relative to its ownership share began to match more closely over time. The case is an example of a conventional non-arm's length relationship with diffused ownership structures. The local partner has high ownership and is actively involved in management.

The ownership the local partner received at the time of IJV set-up was high relative to its level of contribution in the early stages of the IJV. In other words, the IJV partner was overcompensated (relative to its initial contribution to the IJV). Despite the local partner's high ownership share, the Japanese company still transferred key knowledge necessary to upgrade the local partner's know-how and production capabilities, including drawings of integrated circuits in incremental steps. The incentive for the partner to remain loyal to the IJV was therefore established; in other words, the partner did not become complacent in receiving profits. Instead, the local partner upgraded its own capabilities which would enable it to become the main supplier of semiconductor and other high-tech components to the IJV. Therefore, the overcompensation from the high ownership share eventually became worthwhile in retaining the local partner's loyalty, in contrast to the previous case study. The high value for productivity growth was ultimately resulted from a carefully planned and incremental technology transfer to the local partner who helped the Japanese parent company almost fully localize its component supply chain in China. The learning effect in this subsidiary eventually went further leading to the set-up of a new R&D subsidiary. The initial overcompensation of the IJV partner with regard to the ownership share was successful in combination with the planned and incremental technology and knowledge transfer to the subsidiary, so that it became unnecessary to renegotiate the ownership share in the later life of this IJV, which also means that no further inefficiencies arose from ownership renegotiation.

The IJV was founded on an initial understanding to gradually and systematically upgrade the local partner's skills through a technology contract in which the partner would receive technological assistance by using expatriate Japanese technical personnel/engineers without charge to the IJV. This was different from the other cases, where the local subsidiary had to pay a fee for engineers who were sent from the Japanese parent company, and which both IJV partners split according to their equity. The setup and required assets that the local partner would provide made such no-fee engineer-import arrangement possible. An important expectation of the local partner was that it would increase its supply of component types to the JV and help the JV achieve full or near to full localization rates within a 10-year time frame, following which the Japanese parent company planned to transfer most R&D functions to China and ultimately localize its entire supply chain in China including the supply of yet-to-be-developed components through the R&D process. In the meantime the JV partner was to learn the production technology together with some sensitive know-how.

7.5.4 Local IJV partner

The local partner is an SOE and a market leader in China in GPS and OEM communications equipment. At the time of IJV formation, this SOE already had four IJVs with US and European MNCs, and the current case was its first IJV with a Japanese company.

Therefore, the Chinese partner had relatively high product complementariness and greater knowledge symmetry with the Japanese company. It was already capable of supplying about 10% among all types of GPS navigation components that the Japanese partner required at the IJV setup stage; eventually the localization rate with regard to these components was to be raised to above 80%. The areas that needed improvement were the quality of existing products and new product development. The localization rate of 10% could have been higher, but some quality issues had to be resolved first.

7.5.5 Technology protection

From the perspective of the Japanese partner who sought a local partner to localize most of its component supply, technology protection was approached differently from case A (previous case). Although the Japanese parent company transferred first-generation equipment to the newly formed IJV, it did not attempt to protect knowledge by keeping the local partner arm's length. Active involvement in management, such as employing Chinese staff at both upper management and lower management levels (i.e. line supervisors) was done in the interest of imparting new knowledge. Moreover, the Japanese parent company arranged for technical staff to supervise new production equipment and processes when they were introduced, and offer free technical assistance in the same form when problems arose. The goal was to localize activities at the highest level – the R&D level. In the meantime, the Japanese parent needed the local partner to provide regular contributions necessary to operate in China, such as the contribution of HR functions, clearing bureaucracy (customs, taxes, etc.), and liaising with the government. The regular introduction of new technologies motivated the local partner to learn and make counter-contributions in the form of new or improved components.

7.5.6 Productivity growth

Technology/knowledge-induced productivity growth in this IJV has attained a high level. Both partners later agreed to create a new R&D subsidiary from the existing IJV at the wish of the Japanese parent company. A new wholly-owned subsidiary would allow the Japanese partner to engage in R&D without a local partner but with some of the local partner's employees trained previously in the IJV. This option, the GM explained, would enhance the protection of know-how, or tacit technical knowledge, since asset specificity between the two IJV partners had become low as a result of their close cooperation.

The engineering background of Chinese managers often enables them to learn and internalize Japanese technology and implement it in the production process, particularly within the open culture of this IJV. Furthermore, the local partner's management participation has compensated for the insufficient management skills, which have limited the local partner's ability to "engage in fundamental changes that concern managerial tasks such as work processes and delegating decision making and responsibility."

(Nguyen and Meyer, 2005:48). Therefore, participation at all management levels has ultimately compensated for the lack of management skills and aided in the implementation of production and innovation processes. As a result, technology/knowledge-based productivity has risen over the years.

7.5.7 Objectives for ownership

By giving the local partner high ownership and preserving a flexible ownership agreement, the incentive structure of the IJV remained largely intact throughout the life of the IJV. For the Japanese partner, it meant that majority ownership enabled it to retain control of the joint venture, technologies, and strategy in the short term. In the long-term, the Japanese partner could focus on developing the joint venture, increasing product lines, and increasing the local partner's capability to act as supplier and provider of other tangible and intangible assets. For the Chinese partner, the ownership structure meant that at IJV setup time and the short term, they could contribute what they were competent in such as tangible assets which included finding and negotiating land, building factory space, providing utilities, labor, and contacts to local and national governments. In addition, the local partner was also able to supply a limited range of components. As for intangible assets, the local partner's most important contribution at the time of IJV setup included mainly contacts to national and local governments and negotiating favorable tax terms for the production.

7.5.8 Interview results: Japanese partner

7.5.8.1 Tangible assets

Contrary to case A, the difference with regard to securing contributions from the Chinese partner has been long-term and systematic planning of upgrading the IJV partner's capabilities from the time of IJV formation. The Japanese partner has actively pursued a higher value-added strategy towards the subsidiary and acknowledged that the key in securing an effective relationship was to upgrade both partners' capabilities. The IJV in this case study was the Japanese parent company's second IJV in China and overseas; therefore it had limited experience in foreign market entries. Another IJV was located in southern China, but had been built on an export-oriented and low-value added strategy several years before. The company's goal had been to localize component production in the long term. The current IJV therefore needed a number of the local partner's simple tangible assets at setup time and more sophisticated tangible assets later. These included operating permits, land, labor, factory space, and tax concessions initially, while locally-produced and locally-sourced components would be sourced locally later . The latter, however, could only be attained after exchange and absorption of tacit knowledge (intangible assets) had taken place successfully. The significance is that the shift from simple tangible assets to value-added sophisticated tangible assets required internalization of intangible assets (e.g. tacit knowledge). The GM not only wanted to localize production but also wanted to do away with the strategy of exporting finished products to Japan and re-importing them to China to be used mostly by other foreign MNCs. Most of the products the subsidiary was producing at the time were intermediate industrial products.

The subsidiary's full export orientation was part of an IJV setup requirement by the government, which signals its weak bargaining power vis-à-vis the Chinese government and the local IJV partner. In the future, however, all production was to be sold in China directly. While the Chinese industrial market continued to increase rapidly, the subsidiary also began to diversify its production to include products for individual consumers. The subsidiary eventually shifted from a full export orientation to a partial export orientation for both industrial and individual consumers.

The GM was aware that the utility of these simple tangible assets would eventually decline and the partner overcompensated if a future flow of increasingly value-added contributions from the local partner was not maintained in order to justify the ownership share. According to the GM (2007), "We wanted to ensure the local partner would continue to be of value to us after their initial contributions when we set up the company". Doing so, however, would not be possible without the transfer of high technology, to which the GM delivered the following comment:

> *Our customers are MNCs that demand the latest technology and best product quality… We have a strong reputation which we have to maintain… We had already decided at the negotiation stage that in the future we would be setting up R&D facilities here… We were going to implement it systematically, and we needed a competent local partner… We could not afford to lose a good local partner.* (General Manager B, 2007)

Furthermore, the GM added that over time component production would be incrementally localized as the Chinese partner learned new production technologies.

7.5.8.2 Intangible assets

The shift from a reliance on the partner's simple tangible assets to higher value-added tangible assets and their requisite intangible assets had been a set strategy since the time of IJV set up. Therefore, the local partner knew its role from the start, and knowledge uncertainty was minimized. Moreover, the non-fixed ownership structure in this case simplified the process of any change in ownership that would reflect the local partner's higher value-added contributions.

Even though the Japanese partner in this IJV did not intend to change the ownership in the future, the GM also did not rule it out for the sake of preserving a harmonious and long-term oriented relationship with the local partner. According to the GM, the reliance on the local partner's intangible assets had transgressed the increasingly important roles of dealing with government agencies and sourcing local suppliers to one in which the local partner had been increasingly made part of the Japanese parent company's R&D network. Despite the fear about weak intellectual property protection in China, the GM believed that so long as they created incentives for the partner to stay, the problem of knowledge leakage could be kept to a minimum. Ownership and new knowledge were indispensable in maintaining the local partner's loyalty.

The local partner, whose engineers were eventually to be employed in a separately-created R&D subsidiary first received experience and training to increase their capabilities in quality control, product knowledge, and knowledge of the production process with the eventual goal of product development for the industrial market.

The company's customers were large MNCs which also exported their products and therefore had high quality demands. The GM believed that in order to transfer know-how necessary for the production of high-quality, advanced industrial goods, the subsidiary should first expose local staff to product development in consumer goods when the skill level had been reached. Unlike industrial customers, among whom the company had been highly regarded, the subsidiary was still relatively unknown among end-users, which made it less risky to test the acceptance of locally developed products with end-users first.

> *We decided to transfer our consumer goods development to China first, while maintaining industrial R&D in Japan. We had decided to enter the consumer goods when we set up the JV. Setting our JV up in China was a method to test locally developed consumer goods among consumers in China and assess the potential for further R&D localization for our industrial goods. We were new in the consumer market, so we could afford to experiment since we had no reputation to lose… We will assess our R&D subsidiary first and its success in the R&D of consumer goods, but it will take a few years until we reach a decision on whether we will conduct R&D for our core industrial products there.* (General Manager B, 2007)

The main mechanism for transfer was the use of experienced transfer teams and temporary expatriate engineers together with extensive education and training (three to four months) of managerial and engineering personnel in the parent company in Japan from early on in the project. Considerable on site involvement by engineers from headquarters in Japan has also been critical for the successful transfer of essential tacit knowledge and problem-solving skills. According to the GM,

> *We wanted to establish a culture of innovation, but we had to start almost from scratch. The (local) engineers had some training and theoretical knowledge but did not know how to apply it… They also had no idea how to use the research budget, so we had to create this knowledge first. We tried to increase their knowledge systematically.* (General Manager B, 2007)

7.5.8.3 Ownership

According to the GM, the IJV was set up on the premise that the ownership structure had to be adjustable in order to reflect the partner's contributions in the future. When the IJV was formed, the goal of localizing production and expanding sales in the Chinese market directly (as opposed to re-importing) was already in existence.

However, at the time of setup, the GM also mentioned that the Japanese parent company did not consider entering the Chinese market immediately because the Japanese partner wanted to accumulate experience in China first, including experience with the Chinese partner. Furthermore, the GM believed the Chinese consumer market did not have the purchasing power and quality orientation for high-quality and high value-added end products at the time of IJV setup. Therefore, he believed it would be useful in the meantime to learn from the Chinese partner and expand the Chinese partner's technological skills and tacit knowledge.

He also mentioned that in the course of time, the Japanese parent company expected the Chinese partner's contributions to shift to more value-added tangible and intangible assets in connection with the upgrading of the partner's capabilities along with the gradual increase in capabilities of manufacturers within China. The GM explained with regard to reflecting each partner's contributions through the ownership share,

> *We gave up a higher share as a bonus to the Chinese… Their share did not initially reflect their contributions or their value-added to our joint venture, but we hoped to create goodwill and gain the partner's trust through it. We entered China for the long-term and we were sure that in the future we would gain the appropriate value-added contribution from our local partner.* (General Manager B, 2007)

The ownership structure was thus used a tool to motivate the Chinese partner; or, as the GM maintained – it would eventually deliver higher value-added contributions from the partner in the future. At the time of the interview, the ownership share did not have to be changed yet.

7.5.8.4 Government influence

Government influence was perceived by the GM as strong:

> *The government seemed eager to get us to form a JV with them [SOE]. The government should not even have tried so hard because our trading company already advised us to form a JV with this particular SOE before. We had a clear plan for the JV partner to become part of our production network and possibly R&D network later. First, we needed the partner to set up our production facilities speedily and with all the necessary production equipment.* (General Manager B, 2007)

The general manager further added that,

> *Taxes and duties were complex, opaque, and illogical... This has not improved much in recent years despite China's entry into WTO, we will always need the partner for negotiating the arbitrary duties on components and equipment… Sometimes the import and depreciation tax we are assessed depends on the mood of the official. At least we are now able to localize more of our production thanks to our partner. As for new production equipment, we will still need to import it for a long time, and we cannot cope without our partner in this regard.* (General Manager B, 2007)

The quote shows the extent to which the GM depends on the local partner to negotiate with the government. Even though localization of production has taken some pressure off tax negotiations for components supplies on one hand, increase localization had resulted in more frequent equipment imports, where the Japanese partner had a difficulties in negotiating import taxes. The quote above also implies that localizing anything but final component production is unlikely, and that despite strong tax pressures, the company would not consider sourcing or developing any production equipment locally. As a required intermediate step, production technologies remain the core of technological know-how, and these will not be localized, despite higher tax liabilities (GM, 2007). This indicates strong unwillingness and inability with regard to local technological capabilities to transfer production equipment, in spite of the fact that transferring production equipment would mean time and cost savings. However, it is not likely because of the variety of contractors involved. The GM mentioned that,

> *We do not know of any local company that could make the equipment to our specifications within the time, advancement, and quality we require. At this time, we would not develop the design of production equipment with our partner, since we would be giving essential know-how away…In the future, we will still receive it from Japan...* (General Manager B, 2007)

Accordingly, the Chinese partner will remain an essential link between the IJV and the government. In this sense government connections – an intangible asset contributed from the start of the JV, (thus a simple intangible asset) have and will likely remain important throughout the life of the JV. The above quote highlight the pressure companies can face to transfer and impart know-how to China and discourage the sole importation of key technologies. The Japanese partner, by contrast, chose to protect the know-how. In addition, the transfer of sophisticated intangible assets, such as technological knowledge, has perpetuated the Japanese partner’s reliance on the simple intangible assets that the local partner can provide, such as government connections. Therefore, the local partner’s role has retained and possibly increased in importance. The Japanese partner has required more of the Chinese partner’s tacit knowledge over time. With regard to obtaining the local partner’s intangible assets, the strategy by the Japanese parent company to concede a higher ownership ratio to the Chinese partner in the beginning was therefore justified. The local partner did not have reason to claim that the value of their contributions to the IJV exceeded the value of their ownership share.

7.5.8.5 Knowledge transfer

According to the summary of the interview results in the table, it can be seen that tacit knowledge transferred to the local partner increased over time from a reported level of ‘medium’. According to Kremic (2003), a higher rate of knowledge absorption by the technology transferee over time is the result of increasing absorption of tacit knowledge that could be internalized only after explicit knowledge had been absorbed. Therefore, the indication from the data in the previous chapter and the self-reported results stated by the GM indicate that the transfer of explicit knowledge resulted in tacit knowledge being implemented more efficiently later. According to the GM,

> *We wanted to train our engineers and managers to be capable of conducting R&D later. They already had the skills to modify products for the local market; we also knew they had the potential for further R&D… But local staff had weak managerial skills..they could not manage the R&D budget… we could not trust them to spend the R&D budget wisely... We spent a long time teaching them…* (General Manager B, 2007)

The above quote highlights the importance of a wide range of tacit knowledge that ranges from product-specific knowledge (modification of products, R&D) to managerial knowledge such as managing the R&D budget. The linkage between skills upgraded from absorbing tacit knowledge and skills upgraded from learning explicit knowledge became evident in the retention of local engineers. The GM further mentioned that,

> *We also wanted our engineers to be challenged and avoid letting them feel underused by limiting them doing product modifications; this is why we let them manage the R&D budget… We did not want them to feel that they were just wasting their time here when they could have acquired other skills from other companies... We had already invested in their training…* (General Manager B, 2007)

He also explained that retaining these engineers was important since they had already invested in their training, and they had reached a higher skill level. State-of-the-art R&D, however, could not be conducted in the IJV for fear of leakage of proprietary knowledge. A newly created wholly-owned subsidiary for R&D had therefore been spun off from the IJV one year before the interview. The GM mentioned that engineers and managers were transferred to the newly set-up WOS, where product design was initially conducted. As for technology leakage through staff turnover, the GM had the following to say:

> *We cannot control staff turnover or knowledge leaking through engineers that leave the company. However, we pay them a high salary, we give them job autonomy, and continuous training programs in Japan…So we don't think they will go back to working at an SOE…They cannot take any technical drawings (設計図面) outside the premises, but whatever they memorize and take out, we cannot help…*(General Manager B, 2007)

The above quote highlights that engineer retention plays an important role. As for knowledge transfer, although this case shows that R&D is most likely achieved in wholly-owned subsidiaries (WOS), it also highlights that newly-formed R&D-focused WOS had been formed from an IJV that had laid the necessary infrastructure in both tangible and intangible assets for R&D activities to occur in the future. With regard to knowledge transfer, this type of IJV with its ownership structure has been useful.

7.5.8.6 Knowledge uncertainty towards Chinese partner

With regard to knowledge uncertainty about the misappropriation of the Japanese partner's technology, the manager mentioned two concerns. The first concern was leakage of technology through structural market failure; in other words, government action (Dunning, 1999). Structural market failure outweighed concerns about leakage through company-internal channels. For both, however, fears about technology leakage seem to be greatest in the first two years of operation. According to the manager:

> *The largest potential for leakage of our intellectual property (proprietary knowledge) was during the establishment phase. We had to obtain a business license, and in the process of applying for it we were required to submit drawings, which were then reviewed by government departments. We do not know who gets to see the drawings…* (General Manager B, 2007)

Such structural failure was perceived as the first instance where commercially sensitive information could be leaked. In order to obtain a business license, the company had no choice but to abide. As for the leakage of technological knowledge within the subsidiary, the GM was more confident of the Japanese side's ability to control it, citing ownership structure as a useful tool:

> *From what we heard from other managers, we knew that the Chinese partner would try to study our products and techniques within the first two years of operation… We wanted the partner to learn but didn't want them to use this knowledge against us. So we tried from the start to make sure their goals were the same as ours so they would have no incentive to act against us.* (General Manager B, 2007)

The GM further elaborated on the determination of the Chinese partner's equity share and its role in reducing uncertainty about the local partner's behavior:

> *If the Chinese side had a lower than 30% share, we felt they would not be of use to our JV. In the short term, we had their cooperation because*

> *they had contributed part of the land, capital, management staff, and engineers, and together with their ownership share, they would have a strong incentive to ensure our company would succeed… In the long term, we thought they would be interested in seeing their profits increase and participate in management, so we decided to give them a proper ownership share.* (General Manager B, 2007)

The quote shows that the Japanese partner had given consideration to the motivation of the Chinese partner when determining the ownership share. As for the technology aspect, the manager further mentioned that the local partner would "benefit from the continuous upgrading of production technologies and skills unless they [local partner] since they knew that we were in the process of localizing most of our production and R&D…why should they go elsewhere?" The Japanese GM thus believed there was interest alignment between both partners, and that uncertainty and that ownership and systematic technology transfer would ensure continued non-adverse behavior by the local IJV partner.

7.5.9 Interview results: Chinese partner

7.5.9.1 Ownership

- High management participation
- High ownership wanted
- Important to obtain capital first and technologies later

Similar to other SOEs formed in the mid-1990s, the Chinese IJV partner also pursued a strategy of high ownership. Initially, a higher ownership strategy was pursued for higher immediate returns. Later, the focus shifted to obtaining technologies and managerial knowledge. As a large leading SOE in the electronics industry in China, the local IJV partner had already formed IJVs with other foreign MNCs in the same industry, such as Philips and Siemens. Its expectations of the IJV with the Japanese company were moderated by its other IJVs with western companies. This was the SOE's first IJV with a Japanese company. The Vice-GM described the goal of the IJV with the Japanese company cautiously as one where "we would get to know what it is like to work with Japanese managers… we already had other sources where we could acquire technological knowledge and expertise… we hoped to learn Japanese management style first and technologies later…" (Vice-General Manager B, 2007). As for the local partner's high ownership share, the Vice-GM mentioned that "We thought we could at least benefit from higher profits in case there was no other benefit to this joint venture" (Vice-General Manager B, 2007).

The last quote is somewhat contradictory to the long-term orientation under which the IJV was set up. Further comments revealed that the importance to acquire new technologies was high and that the Chinese partner was selected as an IJV partner because of its high technological level. As such, the local partner felt its future contributions justified its high ownership share. According to Vice-General Manager B (2007), "we wanted our share to reflect our importance to the Japanese partner, and they gave in easily; we secured a share of 35% without much effort. The most we had initially hoped for was 30%... "

The Vice-GM's quote shows that the Chinese partner had indeed considered the ownership share as an important tool in the exchange of knowledge and the SOE's (its) value to the Japanese company.

In this sense, the Chinese partner was also aware that the Japanese partner could secure its contributions reliably only by means of ownership share first and technology second.

With regard to ownership, the Vice-GM's goals differed with regard to the specific amount and possible ownership adjustment. He showed more determination to defend its company's ownership share at a 35% level, below which he was not willing to adjust it. The Japanese partner, however, showed more willingness in adjusting ownership in either direction in order to account for the contributions and changing nature (sophistication) of complementary assets received from the Chinese partner. Therefore, any ownership adjustment in favor of the Japanese partner's share could become difficult.

7.5.9.2 Tangible assets

As a capital-challenged SOE, the Chinese partner agreed to form another IJV in order to secure an additional stream of finances through the profits expected from the IJV. This priority remained high throughout the life of the IJV. Subsequent investment increases were financed through its share of profits that the Chinese partner re-invested, which enabled the Chinese partner to maintain its equity share and shifted its focus to a more long-term one.

Other tangible assets such as the Japanese partner's products and production technology were high, and their importance grew with time. Technology-induced productivity, or the implementation rate of new knowledge and technologies, was high, which suggests that adequate technologies and skills were being introduced and absorbed. A negative value in technology-induced productivity (*Thornqvist* index) would suggest a declining implementation rate or absorption of technologies and knowledge transferred. The importance of the Japanese partner to the Chinese partner therefore remained high in terms of capital, capital-intensive technology, and its accompanying tacit knowledge.

At the time of IJV setup, the Vice-GM mentioned that his SOE did not have the confidence in the Japanese partner's providing long-term benefits in terms of new technology. Rather than blaming the Japanese partner, however, the Vice-GM acknowledged a lack of suitable technologies and skills within his SOE and admitted that absorption and learning capacities might not be enough to close a "large technology gap" (Vice-General Manager B, 2007). The Chinese partner had less confidence in its capabilities than the Japanese company had judged it to have.

Similar to other cases, the local partner first provided simple tangible assets such as land, contractors to build the factory, and labor and later shifted to component production. The Vice-GM attributed the role as component supplier to the Japanese partner's willingness to have let the Chinese partner a high ownership share that reflected the importance of contributions. By becoming a component supplier, the SOE became indispensable to the Japanese partner due to the asset specificity of specific components and the tacit knowledge they involve.

As reported by the Vice-GM, the SOE would not have been motivated to contribute to the IJV beyond simple tangible assets if ownership had been below 33% when it was formed. Therefore, the issue of ownership has been important in the context of this case. The Vice-GM's following quote emphasizes the importance of the ownership share again:

> *We contributed a lot of things to the new JV. First, we found and negotiated the land, we took them to see many places and we put in our*

best effort to find the best location and land deal. Second, we helped them with all formalities, and obtained operating permits from the government, which saved a lot of time. Third, we organized the construction of the factory, so we had to find a suitable construction company and negotiate the contract conditions with them. Fourth, we had to lend our management personnel in the beginning in order to recruit workers and to teach the Japanese about how to adapt to Chinese HR practices… They [the Japanese managers] didn't understand how to treat Chinese workers, how to reward and punish them, and they [the Japanese managers] lacked credibility among local staff… Without a proper ownership share, we wouldn't have helped them to the extent we did, and we may not have been able to get favorable set-up conditions in a short time. (Vice-General Manager B, 2007)

The Japanese partner's policy of giving an adequate ownership share to the Chinese partner was essential in receiving the Chinese partner's support, as the Chinese partner's quote has shown. The Japanese partner had thus correctly expected the ownership share to play an important role in obtaining complementary assets efficiently. In later stages, the Chinese partner's improved learning and improved capabilities resulted in an increasing importance to the Japanese partner for more advanced tasks such as localization of component production. According to the Vice-GM,

We expected the IJV to reflect our contribution. In the end, we adapted our learning, and we became faster at understanding new technologies. Our engineers could add greater value and we were able to become a supplier to the IJV. This had been the plan when the IJV was set up. We would not have been happy with a lower ownership share. (Vice-General Manager B, 2007)

As such, the Japanese partner was able to obtain higher value contributions from the Chinese partner later at the same ownership structure with which the IJV had been formed.

7.5.9.3 Intangible assets

The Japanese partner's goal was to involve the local partner in the IJV actively, both through high ownership and participation in management. According to the table, the significance of intangible assets, such as managerial experience, problem-solving skills, and access to training has shifted from either high in the beginning to medium in later stages of the IJV or remained at a medium level. In comparison, case A benefited from its own high initial level of technological capabilities by the local partner, where transfer of intangible assets seldom took place, and the local IJV partner eventually sought new business partners, which resulted in partner-induced IJV instability. By contrast, in non-arm's length transactions, I have shown an initially high need for intangible assets. The benefit of non-arm's length transactions is that they are more suitable for the transfer of intangible assets. A decline in learning incentives over time, such as through the non-development or transfer of new knowledge or technology, could explain why the Vice-GM indicated that the need for intangible assets in the later stages of the IJV became lower. A lower need for intangible assets could in itself become a problem since it could signal the end of the productive lifespan of the IJV. It coincides with Makino and Delios' (1998) findings with regard to the productive lifespan of IJVs which tends to decrease after ten years. This IJV tends to fit the theory in that the local partner's need for the Japanese partner's intangible assets declined after 13 years of IJV operation. According to the Vice-GM:

> *Our engineers had reached a level skill and they wanted to be involved in R&D activities. We experienced a short period of higher turnover among our engineers before plans for an R&D subsidiary became finalized. Our productivity was bound to decline without the R&D subsidiary.* (Vice-General Manager B, 2007)

However, the Vice-GM also pointed out that productivity growth was declining was pre-empted by the opening of a new R&D-focused wholly-owned subsidiary, which could only be run with engineers and management personnel who were previously trained in the IJV. The creation of a new wholly-owned R&D subsidiary from the IJV, however, should not be interpreted as a sign that the IJV became unstable. Instead, the IJV had reached a stage of technological maturity beyond which it was unlikely to advance in its existing ownership form. However, this case has also shown that the transfer of R&D would not have occurred without the setup of the IJV itself first. Therefore, IJVs remain relevant as an entry mode choice for the gradual localization of activities with high asset specificity.

7.5.9.4 Government influence

As with many other SOEs that became IJV partners, government influence during the setup process was relatively strong, but declined over time. At the time the IJV was formed, the Vice-GM said that the SOE was ordered by the local enterprise promotion agency to make sure it would receive a share of 30% or more in an investment with the Japanese (Vice-General Manager B, 2007). Ideally, the share should be within a range that the Chinese partner could finance immediately or obtain through a government loan (Vice-General Manager B, 2007). However, the Vice-GM also mentioned that he wanted his SOE to remain independent from the government as much as possible; otherwise, it would not gain the trust of the Japanese partner. He further said that, "We are satisfied with our current ownership share and that we have been able to maintain it without any loans from the government…" (Vice-General Manager B, 2007)

This quote shows that government intervention could have remained strong after the formation of the IJV if the SOE had not been able to raise its share of capital. The ownership share of 35%, however, is higher than what the government had initially asked for (30%). Consequently, government influence did not extend significantly beyond the stage of IJV formation.

Another factor the government placed importance on during the initial stages of negotiation was a commitment by the Japanese company to set a goal for future transfers of R&D to China. Conditions remained broad, however, and left the Japanese partner a large amount of discretion to decide how and when to transfer R&D. According to the Vice-GM,

> *As an SOE, the government's first priority was to ensure our survival in financial terms first and later in competitiveness terms. The Japanese IJV partner was a tool to achieve both. When it became clear that the IJV did all right in both, interference from government officials stopped. When we decided to open an R&D subsidiary, there was strong support from the government at that point.* (Vice-General Manager B, 2007)

7.5.9.5 Knowledge uncertainty towards Japanese partner

The case is an example in which high technology-driven productivity within the IJV has been the result of high partner involvement. Among the cases presented in this chapter, this IJV has remained stable without either partner inducing instability, despite having reached the limits of technology transfer that were achievable under an IJV setup. The next activity with higher asset specificity was R&D, for which a separate wholly-owned subsidiary was established mainly to protect proprietary knowledge. The Chinese partner had been informed of possible plans for R&D under different ownership conditions at the time the IJV was being negotiated. According to the Vice-GM,

> *We knew from the start that we would not be able to have R&D here under as an IJV. But we didn't mind, ultimately, we would profit from the close cooperation with the (wholly-owned) R&D subsidiary in terms of new orders and personnel transfer. That we didn't get a share in the R&D subsidiary didn't matter so much… We still receive profits from the R&D subsidiary because as its parent [IJV], we still handle sales for the new company [R&D WOS]…* (Vice-General Manager B, 2007)

As for benefiting from the learning of new technological knowledge that was created within the R&D WOS, the Vice-GM answered:

> *We could still take advantage of the know-how from our close relationship… We often need their [the R&D subsidiary's] engineers to come over and help us with setting up new production equipment, or whenever there is a problem. As the local partner, we still retain financial and technological incentives for a successful cooperation.* (Vice-General Manager B, 2007)

The Vice-GM's quote thus highlights an important issue with regard to the incentive structure. The spin-off of the R&D WOS does not seem to have affected the local partner's incentive structure adversely. The local partner retains a high share in a continuously profitable IJV that supports some functions of the newly formed R&D WOS (e.g. sales, marketing).

With regard to technology, there are still spillover effects that benefit the Chinese partner as the quote has shown. From the Chinese side's point of view, inducing IJV instability thus seems unlikely.

In this relationship, the Japanese partner retains full control over IJV termination. Reduced knowledge uncertainty towards the Japanese partner is likely to have reduced the potential for IJV instability and positively affected technology/knowledge-based productivity growth.

7.6 Case C
7.6.1 Case characteristics

- Year of subsidiary formation: 1996
- Ownership structure: 63% (Japanese); 37% (Chinese)
- Productivity growth: Low
- Feasibility of changing ownership structure: Low
- Instability: Low
- Type of IJV relationship: Non-conventional arm's length

Table 7.5: Interview results - Japanese perspective (Case C)

JAPANESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Chinese partner meet expectations?**	**Comments**
Experience in foreign market entries	*High*	*High*	*N/A*	*Parent company has several subsidiaries in US, EU, SE Asia, China*
Experience in China	*High*	*High*	*N/A*	
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Items:				*Interest alignment/ reduction of uncertainty from partner*
- Land	*High*	*High*	*Yes*	
- Factory	*High*	*Low*	*Yes*	
- Operating permits	*High*	*High*	*Yes*	
- Utilities	*High*	*Low*	*Yes*	
- Labor	*High*	*High*	*Yes*	
- Capital	*High*	*High*	*Yes*	
- Partner's technology	*Low*	*Medium*	*No*	
- Partner's products	*Low*	*High*	*No*	
INTANGIBLE ASSETS				
Guanxi				
- Tax negotiations	*High*	*High*	*Yes*	
- HR	*High*	*High*	*Yes*	
- Localization	*Low*	*Low*	*No*	
- Market access	*Low*	*Medium*	*Yes*	
OTHER ITEMS				
Government influence (China)	*Medium*	*Medium*	*N/A*	*Medium govt. interference in JV set-up, but less later*
Efforts by Chinese partner to secure large ownership share (as perceived by Japanese partner)	*Strong*	*Weak*	*N/A*	*Ownership share Japanese partner's willingness to align Chinese partner's interest/reduce knowledge uncertainty*
Knowledge spillovers from Chinese partner	*Low*	*Medium*	*N/A*	
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*High*	*High*	*N/A*	
Knowledge transfer (transfer of intangible assets, e.g. tacit knowledge)	*Medium*	*Medium*	*N/A*	*Local IJV partner and suppliers learned through formal training, daily interaction, and observation*
Knowledge uncertainty towards Chinese partner	*Low*	*Low*	*N/A*	

Table 7.6: Interview results - Chinese perspective (Case C)

CHINESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Japanese partner meet expectations?**	**Comments**
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Capital Partner's technology Partner's products	*High* *High* *High*	*Medium* *High* *High*	*Yes* *No* *Yes*	*- New products made in IJV* *- New Equipment imports*
INTANGIBLE ASSETS				
Managerial experience Other tacit knowledge (e.g. Problem-solving skills, access to training)	*High* *Medium*	*High* *Medium*	*Yes* *No*	*Only explicit knowledge transferred/ problem-solving skills not transferred*
OTHER ITEMS				
Government influence (as reported by Chinese partner)	*Medium*	*Low*	*N/A*	*Govt. assigned Chinese partner*
Efforts to secure large ownership share	*High*	*N/A*	*N/A*	*Chinese partner will oppose change of IJV contract*
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*Medium*	*Medium*	*N/A*	*Equipment transferred usually one generation behind (1-2yrs)*
Knowledge uncertainty towards Japanese partner	*Low*	*Medium*	*N/A*	*Chinese partner unsure of timing and amount of investment increase/must follow any change in invested capital proportionately*

7.6.2 Background of IJV

This subsidiary is an IJV between a Japanese electronics maker, a Chinese automotive-affiliated SOE, and a trading company. The setup of this IJV was commissioned by the head office of the Japanese parent company for China in Dalian in 1995 because locally-sourced parts were needed for the supply of the parent company's other 30 subsidiaries in China. Due to the size of this company, the setup of the IJV was a priority for both the Japanese company and the Chinese government. Due to the large network of subsidiaries, the head office in Dalian tasked its other subsidiaries to research and propose a location and partner for the subsidiary to be set up. Eventually, Tianjin was proposed as a location for its close proximity to Beijing (central government), its proximity to the local IJV partner's main production location, as well as its moderate distance from Dalian, (where the regional head office for the Japanese company was located). The IJV was eventually set up in 1996. The IJV's main products are GPS systems used in automotive, shipping, and aviation navigation systems.

The Japanese company is a maker of telecommunication and navigation parts, while the Chinese partner company – part of an SOE – is a large automotive conglomerate, whose SOE in this case study was involved in the assembly of cars. Therefore, product complementariness was reasonably high at the beginning, even though product similarity was not. Therefore, protection of technology was not the main concern for the Japanese company. The diffused ownership structure was an indication. However, the IJV would be involved in the production of key components in which the Japanese partner had a core competence. These could be used in domestically-built Chinese cars and technologies used in other industries. The IJV became a priority for the Chinese government, which wanted to retain a high amount of control in the IJV. At 37%, Chinese ownership is highest among all case studies. The Japanese parent company owned 60%, while an affiliated Japanese trading company retained the remaining 3%.

The Japanese parent company has 32 manufacturing subsidiaries in other countries including the US, EU, and territories in Asia such as Taiwan, Malaysia, and Thailand. This IJV is the Japanese parent company's first subsidiary in mainland China, and therefore had a certain amount of accumulated tacit knowledge with regard to foreign market entries. However, the GM has had four years' prior experience as managing director of the parent company's subsidiary in Thailand.

7.6.3 Significance of case

The Japanese trading company was familiar with both the Japanese parent company and the Chinese company through previous business relationships and therefore acted as an intermediary in introducing the Chinese company to the Japanese parent company. The Japanese parent company could also draw on the experience of the trading company, which limited the dependence on the Chinese partner. Despite the presence of the trading company, the Chinese partner retained a high ownership share.

This case illustrates a situation in which a high ownership share went to the Chinese IJV partner during IJV setup in order to secure the local partner's full cooperation initially by reducing unpredictability of the partner's behavior. The Japanese partner justified giving the local partner a high ownership share in order to avoid adverse behavior and secure the local partner's full contributions that were required when the IJV was set up. Low initial product complementariness between both IJV partners also alleviated the Japanese partner's fears about technology protection at the IJV setup stage. The IJV partners were from different industries with no significant technology similarities that would warrant special caution in technology protection. The ownership share was contractually fixed. With changing customer needs and new product development over time, however, product complementariness between both partners increased and led the Japanese partner to have concerns about technology leakage. However, ownership adjustment was no longer possible with the local partner's high ownership share which gave weight to its strong objections to having its ownership reduced.

Due to the surfacing of technology protection motives, technology-induced productivity did not grow after the year 2001 and remained below its optimum thereafter.

The important point to keep in mind for this case is the comparatively high initial ownership share for the Chinese partner and stagnating technology-based productivity growth for the IJV without the possibility for ownership adjustment. In comparison, IJV contracts in other cases allowed for ownership adjustments, even though not every partner opted to proceed with it. The Japanese partner later attempted – unsuccessfully - to adjust the ownership structure when it introduced new product lines in which product similarity between the local partner's SOE and the IJV increased, following which control of technology became an issue.

Since the IJV was in the key automotive and electronics industries, the Chinese government regarded the IJV a high priority for which it had made a large investment from cash obtained from trust funds through the SOE. Despite the high priority the government gave to the IJV, technology-based productivity growth, however, remained moderate alongside an increase in controlled instability when the Japanese partner signaled intent to dissolve the IJV.

The Japanese partner depended on the local partner to contribute a number of simple tangible assets which included capital, land, and business licenses as well as non-technological but nonetheless sophisticated intangible assets. For example, the local partner was involved in the management of the IJV and was responsible for HR functions which included recruitment, contract drafting, and supervision of local staff. Other intangible assets were already available to the Japanese IJV partner through the main office in Dalian and the large subsidiary network and experience it already had in China. At the time of IJV setup, the Japanese partner did not depend on the local partner for access to the local market or other local suppliers. As such, the high equity share that the Chinese partner held was no longer justified in the opinion of the Japanese IJV partner.

Since the local IJV partner company was an SOE, the trading company had to approach the local government to apply for the setup of the new IJV. The trading company's main contribution was in choosing among and introducing a suitable local IJV partner to the Japanese parent company. The purpose of the local IJV partner was to act as a supplier of simple tangible assets, such as capital, land, and labor, in addition to *guanxi* and market knowledge as intangible assets. At the time, the Japanese partner was not interested in using the local partner as a supplier, citing unbridgeable technology and quality gap (General Manager C, 2007). Localization had not yet occurred at the time the interview took place.

The new IJV was set up before the main company's plant became operational because the IJV was required to meet *kanban* requirements from the day the main company started its production.

7.6.4 Local IJV partner

In order to set up a subsidiary within 10 months, the Japanese company needed a local partner with capital, an ability to provide land, factory space, and qualified labor within a short time. Moreover, the local government granted tax exemptions, building infrastructure, and free training of labor at state-owned technical colleges due to the importance of this IJV. The Chinese partner's SOE had several other IJVs with foreign automotive companies. However, this IJV was the local partner's first IJV with a Japanese company and the first IJV in a different industry; i.e. the Chinese company was an automotive company while the Japanese partner was an electronics company. Therefore, there were no products that the Japanese parent company could use directly from the local partner, (or vice versa), and most experience was drawn from the Japanese parent company's network of subsidiaries in China. As such, the degree of product complementariness with regard to both tangible and intangible assets was low, and any possibility of technology or knowledge leakage to the local partner was unlikely. From this perspective, the diffused ownership was justified. However, interest alignment still did not occur; since the Japanese company had no long-term plan to involve the local partner's tangible and intangible assets in the long-term development of the IJV. The utility of the local IJV partner came from its industry background which was the same as the main customer company's to which this IJV was going to be a supplier. Therefore, the local partner understood the issues that arose from being a supplier to an automotive company. This may have been a compensating factor for technology-induced productivity over the life of the JV. From the Japanese partner's perspective, however, the benefit received from the local partner in the long term did not justify the ownership structure.

7.6.5 Technology transfer and technology protection

The Chinese government was seeking to cultivate engineers and improve managerial skills. However, the local partner did not involve its staff in the management of the IJV, instead preferred to learn technological skills and basic Japanese communication skills that would facilitate communication with the Japanese management. At the time of the interview, Japanese managers were still communicating with local staff and engineers through interpreters. The GM had been with the subsidiary since 2001, and was still making use of a Chinese interpreter in addressing local staff. Local engineers were therefore eager to learn Japanese. Training for engineers took place in Japan. Based on the responsibilities of the job, engineers were sent to Japan for periods ranging from three months to one year. For instance, five of the seven Chinese section chiefs (課長) were sent to Japan for half a year, reported that the training was useful, even if the focus was non-technological. Acquiring Japanese language skills and an understanding of Japanese culture became priorities. Eventually, it helped them improve product quality and accelerated new product development by "learning Japanese methods" (General Manager C, 2007). The example shows that non-specific language and some management training helped the Japanese partner to extract higher value-added from its engineers while not revealing technologies.

The IJV had increased production and product development for other types of cars as a result of the familiarization by section chiefs and engineers with the Japanese parent company, even though no specific engineering skills had reportedly been acquired and highlighted as a point of dissatisfaction. Therefore, technology protection was successful, while training in Japan elicited the goodwill of Chinese staff whose knowledge could be more readily implemented. As such, medium technology-based productivity growth could be a result of exploiting more fully the potential of local engineers, rather than a result of active technology transfer and implementation from Japan. It also means that the quality of locally-hired engineers is high and that by learning the language, the knowledge/technological plateau of the subsidiary could be raised initially by enabling local staff to ‘understand’ the Japanese.

7.6.6 Objectives for ownership

The contractually fixed structure of the ownership entailed mixed results. It was counter-productive with regard to technology protection when product lines changed and product complementariness increased. However, the policy was helpful in that the Chinese partner was required to contribute a proportional amount of new investments and therefore motivated to contribute its knowledge and help. As a priority IJV for the Chinese government, the Chinese partner was not capital-constrained to the same extent that other SOEs were and therefore made all required investments without delay. The Chinese partner could contribute 40% of capital which it had accumulated as a large supplier to a domestic car manufacturer. The State Asset Commission reserved the right to influence the policy of the IJV through the Chinese partner by way of its board members. The high share for the Chinese partner, however, does not reflect the importance of its contributions to the IJV in terms of complementary products, locally sourced parts, labor, or the potential for providing access to the Chinese market. The Japanese partner eventually regretted this ownership structure and sought to dissolve the IJV. Instability was therefore high; however, unlike case A, it was not induced by the Chinese partner. The Japanese partner has thus still managed to retain control.

7.6.7 Interview results: Japanese partner

7.6.7.1 Tangible assets

The Japanese parent company had no firm initial plans to use the local partner's products in its parts production. Localization, however, became an issue soon after the IJV was set up. Prior to IJV setup, the Japanese parent company was seeking to diversify its sales network within China. The company had been too dependent on a single main customer that was located nearby. The reason the Japanese partner felt it could do so was that problems with *kanban* (just-in-time) production had been overcome, and the IJV was able to open new production lines and cater to more customers. New customers, however, were mostly non-Japanese, including foreign MNCs in China and, increasingly, Chinese companies. A more internally-oriented market strategy necessitated a higher percentage of local components due to higher cost pressures from non-Japanese MNCs. The percentage of local components used in production was higher among Western competitors. The cost of locally sourced components is about 30% the cost of importing them from Japan (General Manager C, 2007).

Although any reliance on the local partner's products was low at the time of IJV setup, the Chinese partner eventually became more important as its capabilities increased. However, increased capabilities were not necessarily a result of technological knowledge imparted by the Japanese side. Instead, increased capabilities by the Chinese partner were a combination of the Chinese partner's own high initial technological level within its own industry, an ownership structure that favored the Chinese partner, and the ability of Chinese engineers to put their skills to better use when they returned from their training in Japan as speakers of Japanese.

The local partner's capabilities increase the Japanese partner's expectations that orders from other customer could lead to higher product complementariness with the local partner in the future, and that products could be modified faster with the help of the Chinese partner now that its capabilities had increased. However, when the product range was to be expanded in support of new customers, the local partner could not contribute new components. On the other hand, the local partner's increased technological capabilities enabled it to source locally made components from manufacturers in China more efficiently. This signifies an addition in the local partner's contribution of intangible assets, as *guanxi*-building now extended beyond government negotiations to new potential business partners. In this sense, the local partner's added capabilities compensated for its high ownership share and initially higher technology-based productivity, but resulted in little technology transfer, unlike the Japanese partner had expected.

The GM had been confident that the Chinese IJV partner "could adjust to changing product life cycles quickly and that this was exactly their advantage". (General

Manager C, 2007) As far as local technological knowledge was concerned, the GM opined that “It could be improved with proper training and experience…” (General Manager C, 2007) He added that due to their “willingness to work for long hours and a combination of their increased knowledge and creativity they would achieve speedy product development through which we would be able to meet short production-to-market times…” (General Manager C, 2007), particularly since the focus started to shift towards Chinese customers. According to him, “local workers lacked the experience in dealing with modern production equipment and the quality orientation that we would expect… This has improved with time, though.” (General Manager C, 2007)

7.6.7.2 Intangible assets

From the GM’s words, one can therefore conclude that the importance of the partner’s tangible assets has increased over a relatively short period of five years. As the discussion above has shown, the increase in the importance of tangible assets has partly been the result of the transfer/imparting of the Japanese partner’s tacit knowledge on the Chinese partner through the IJV mode of entry (e.g. training in Japan). The above discussion, however, has shown that the Japanese partner has also acquired tacit knowledge about the working culture in China including customers. In reference to their local partner, the GM aptly acknowledged that, “We need to be able to respond to local market needs more quickly; customer-wise we can do it now, production-wise, we could do it now, but quality-wise won’t be able to for some time” (General Manager C, 2007). The quote highlights the limited impact of tacit knowledge spillovers that have not resulted in the Chinese staff’s increased orientation towards quality even though the

GM believes that their ability to deal with new technology and production processes was firmly a result of their introduction by the Japanese partner.

The Japanese partner's accumulation of intangible assets related to working in a Chinese environment was beneficial and led the Japanese partner to believe that it could extend the utility of the Chinese partner's contribution in tangible and intangible assets. However, intangible assets transferred by the Japanese partner have had limited impact on the Chinese partner so that there was no evident combined practical utility beyond a theoretical intent to localize production and product development, which, however, could not materialize.

The significance of the Chinese IJV partner to the Japanese IJV partner has outgrown the significance of the Japanese partner to the Chinese partner. The Chinese partner was essentially only benefiting from tangible assets (share of profits, hardware) while it was increasingly not benefiting from the transfer of the Japanese partner's tacit knowledge (e.g. quality control, technological knowledge).

As for the Chinese partner's contribution of intangible assets, their importance has remained high and likely increased by shifting to new areas such as an intended localization of production. Sales to the Chinese market have also resulted in product modifications and more equipment imports. More negotiations with the government for import clearance, tax, and depreciation terms became necessary as did a higher need for labor in order to meet rising production demands. Sourcing local labor, creating employment advertisements, and drafting employment contracts all remained responsibilities of the Chinese partner. The following quote by the GM highlights the dependency of the Japanese partner on the local IJV partner.

> *We needed our [local] partner to liaise with government and local entities. This is China and everything runs on relationship basis. Our partner has these relationships. We just need to tell them our conditions, and they will take care of them… We also need them to recruit workers, they understand the local employment market better, and they have more trust among local workers…* (General Manager C, 2007)

The statement is significant in the sense that it attests to perception/image problems among local employees towards Japanese companies and emphasizes the local IJV partner's importance towards Japanese companies.

7.6.7.3 Ownership

The previous discussions have explained the incentives in terms of the exchange of tangible and intangible assets to each partner. From the point of view of the Japanese partner, the importance of tangible and intangible assets has shifted over time in terms of sophistication. As for tangible assets, the Japanese partner initially required simple contributions from the Chinese partner, such as land, factory space, and basic utilities. Over time, however, some absorption of new skills and technologies has resulted in a limited increase in the capabilities of the Chinese partner.

The high ownership share of the local partner and thus its high share of profits, and high stream of new production equipment and product development would likely act as a disincentive for the local partner to act against the interests of the subsidiary. The GM was aware that unpredictability and the partner's bounded rationality were an important issue when the JV was formed. Since each partner's share was fixed for the duration of the IJV contract, as a result of which incentives did not change.

The GM maintained that the purpose of fixing the ownership share as part of the

IJV contract was to "reduce unpredictability and assure the Chinese partner that we needed them for the long term." (General Manager C, 2007) He also stated that it was done to reduce the possibility the Chinese partner to "suddenly withdraw the capital if they needed it for their own company [SOE]. The proportion of each partner in this JV is fixed, so if one partner invests more, the other has to match the investment proportionally. We are constrained by this condition…" (General Manager C, 2007)

Therefore, this type of ownership contract gave an additional incentive for the local partner not to withdraw from the IJV. However, it ultimately adversely affected the Japanese partner's incentive to remain with the IJV.

7.6.7.4 Government influence

Government negotiations provided by the Chinese partner have remained high in importance for the Japanese partner both at the time of IJV set up and present. In reference to the table, it can be seen that the Japanese partner came to China with the expectation that government influence would be high. In fact, government influence was high in the beginning, particularly in the spheres of partner selection, land cost, and tax related matters. Due to the industry and size of the investment, the national-level development zone decided to grant a nine-year tax break to the IJV. Regarding the local partner's *guanxi* and ability to negotiate with local authorities, the GM mentioned:

> *We require favorable conditions; until now, these have been tax-related to our production equipment. The procedures for company set up are very different here, especially with regard to taxation. There are many bureaucrats with individual powers and they decide everything case-by-case. We need our partner to speed up their [bureaucrats] decision-making and make sure they [bureaucrats] give us good and fast service in the future. This can mean the difference between several years and one week for an important decision to be made. For this, we*

still need the local partner… (General Manager C, 2007)

The ability to navigate bureaucracy therefore remains an important asset that the local partner contributes to the IJV in that it can significantly affect time and costs. However, even despite this requirement, the Japanese partner still openly talked about terminating the IJV.

7.6.7.5 Moderating effects of experience in company's prior foreign market entries

As for the company's prior experience in foreign market entries, and whether they would have a moderating effect on the need for a local partner, the GM had the following to say: "We used the experience from our other subsidiaries as a reference…, but we knew that *guanxi* would be necessary in China, and that is why we considered entering only as an IJV with sufficient local partner involvement..." (GM, 2007) Therefore, considering that the parent company had prior experience in China, it can be inferred that prior experience overseas did not result in a higher share of ownership for this subsidiary. The Japanese parent company has 32 subsidiaries in culturally and geographically close territories such as Taiwan and Southeast Asia. The importance of *guanxi* as an intangible asset in China was highly regarded and building an ownership framework that would ensure long-term access to *guanxi* became important.

With regard to ownership, the GM explained the importance of the presence of a trading company, main company, and other Japanese companies in the region as follows: "We used other Japanese companies' experience and opinions as a reference. They advised us to form the current ownership structure… We understood the importance of local connections [*guanxi*] here, and we listened to our trading company…"(General

Manager C, 2007)

7.6.7.6 Technology transfer and knowledge spillovers

The table and previous discussion have shown that the Japanese partner's need for the local IJV partner had increased in terms of the sophistication of the partner's contributions. In the category of *Tangible assets,* the Japanese partner needed the local partner to make basic contributions such as land, factory space, and utilities. As expected, the importance of these assets declined over time, while the local partner's contributions in terms of local component sourcing, *guanxi*, labor recruitment, and capital contribution increased in their importance to the Japanese partner over time. Higher expectations with regard to the local partner's contributions, however, raises the question of where the limit is to providing the local partner with technological knowledge.

Productivity growth results have shown slowed growth in technology-based productivity and therefore a medium implementation rate of new capabilities in the IJV. Thus, when asked whether technology leakage was a problem, the GM answered:

> *Presently - we cannot do component design here. Basically, any change/increase in demand by our main customer results in the Japanese home branch designing a new design and technical drawings… We would like to do them here but have to keep them in Japan… In the future we want to localize both component production and component design… Right now, we are only getting a small percentage of components from other locally-based Japanese and Taiwanese companies; we do not have the confidence to localize a greater share of component production or produce them in our subsidiary with the current ownership structure...* (General Manager C, 2007)

According to the quote, existing ownership structures are a hindrance to transferring higher value-added production and design activities to China.

7.6.8 Interview results: Chinese partner

The table suggests that the Chinese partner relied strongly on the Japanese partner's tangible and intangible assets. The need for the Japanese partner has remained strong. As the discussion with the Japanese GM has suggested, the Chinese partner values the Japanese partner's capital, production technologies, products, and tacit knowledge.

The Chinese partner reported that the government's influence in exercising its will on the IJV through the Chinese IJV partner (an SOE) was limited and tended to decline over time. Moreover, the SOE remained neutral about assuming management participation, and preferred to leave it to the Japanese partner as long as the subsidiary remained profitable. Profitability was seen as confirming technological advancement and competitiveness.

In summary, the Chinese partner's perception of the Japanese partner's transfer of tacit knowledge has remained medium. A reason for tacit knowledge transfer not being rated as "high" could be the reported experience by engineers of their training in Japan, which was limited to cultural and language instruction. As a result, there was little accumulation of technological skills. However, a steady rating of 'medium' rather than 'low' with regard to the transfer of tacit knowledge could indicate the subsidiary's increased orientation towards the local market and localization in which new mutual product development played an increasing role.

As for knowledge uncertainty, an increased cooperation between both partners could signal a lower level of distrust. However, the Japanese partner constantly rated knowledge uncertainty towards the local partner higher than vice versa, which affected technology transfer negatively.

7.6.8.1 Ownership

When asked about their ownership strategy, the Vice-GM answered that they required a share which reflected their contribution. The Chinese partner therefore sought equitable profit sharing. The Chinese partner was confident in the Japanese parent company's technological and managerial competencies. Reflecting their lack of management experience, the Chinese partner entrusted most management functions to the Japanese side. With regard to how the ownership was initially determined, the Vice-GM replied:

> *We determined the ownership percentage through the board member meeting. However, we were not interested in management participation… Because we needed to borrow the products and production technology from Japan, and in return, our part was to contribute capital, labor (manpower), and land. We wanted our share to reflect our contribution… Our share is greater than we expected.* (Vice-General Manager C, 2007)

The quote suggests that the Japanese partner had overcompensated the Chinese partner with shareholder equity. From the Japanese partner's perspective, the demands for ownership by the Chinese partner were a tool to align the Chinese partner's interest in the company and reduce knowledge uncertainty for the Japanese partner. In this sense, the ownership structure could readily be accepted by both partners when they formed the IJV.

For the Chinese IJV partner, the fixed ownership structure also created the incentive of a predictable and significant share of profits. In this sense, the long-term relationship could be maintained by both the IJV's profitability and a positive, albeit decreasing, rate of technology transfer.

The local partner's orientation gradually began to expand to one where capability building through re-investment of profits was put into greater focus, which thus lowered the possibility of ownership change in favor of the Japanese partner. The following quote by the Vice-GM suggests:

> *We would oppose any movement by the Japanese partner to increase their ownership share… We can re-invest our profits. Since 1996, we have increased investment twice already, once in 2002, and again in 2003. For now, we have the capital and the motivation to maintain additional investment…* (Vice-General Manager C, 2007)

The Chinese partner is thus satisfied with the current ownership structure and wants to keep it. The quote also suggests re-investment of profits and a potential for technological innovation, which, however, has not materialized.

7.6.8.2 Tangible assets

The local IJV partner previously established IJVs with several western MNCs in the early and mid-1990s. The IJV with the Japanese partner was the first IJV with a non-western company. The Vice-GM's response (below) confirmed that this SOE was in need of capital and protection of its workers' jobs. However, rather than simply providing jobs for local workers, he emphasized the need to obtain equipment and technologies through the IJV so that there could be a buildup of new capabilities. Therefore, the local partner's tendency to build long-term capabilities through the learning of new technologies became evident. Emphasis was thus on long-term orientation rather than only maintaining jobs for state-employed workers. The Vice-GM stated that,

> *We had invested a large amount of cash in the IJV, so any mis-investment could have put us at risk of extinction. Many people would have lost their jobs. Forming the joint venture gave us the confidence (and knowledge) to overhaul/ exchange our dated production equipment with the Japanese partner's help… Since we formed the joint venture, we [the Chinese partner] have come out with some new components such as keypad sensors that are now used in the mass production of [IJV's] final products.* (Vice-General Manager C, 2007)

7.6.8.3 Technology

Child's (2000) argument states that Chinese partner firms' behavior becomes increasingly unpredictable as they learn from the foreign IJV partner and where product complementariness is high. The Japanese partner's cautious transfer of knowledge (e.g. training methods) keeps new technologies at arm's-length from the local partner, while new knowledge is still being received from the local partner, which is still an incentive for the Japanese partner not to terminate the IJV as long as such knowledge remains needed. According to Child (2000), the partner with the lower technological knowledge advancement (i.e. Chinese IJV partner) will take a longer time to absorb new knowledge than the partner with the higher technological sophistication. In application to this IJV, this would mean that the Japanese partner will take less time to acquire the Chinese IJV partner's knowledge. Therefore, by acquiring new knowledge at a faster rate than the local partner, the Japanese partner would at some point lose the incentive to remain in the IJV, whereas the Chinese partner would still be in the process of learning from the Japanese partner. This condition applies unless there is a substantial change in the needs for the local partner's tacit knowledge, such as a shift of focus of the IJV to the internal Chinese market. However, this was neither the case with regard to the customers nor with regard to internal processes. There was a main customer and high knowledge-intensive processes such as product development and design were kept in Japan.

The Vice-GM had taken notice of the Japanese partner's technology transfer strategy when he reflected on the achievement of their company's original purpose for entering the IJV. According to him, "Although we obtained technologies and management skills from the Japanese, our technology gap has not closed at all..." (Vice-General Manager C, 2007).

Therefore, the transfer of technological capabilities was carefully controlled by the Japanese partner, and this ensured that there would be a continued reliance on the Japanese partner's technologies by the Chinese partner. The Japanese partner was relatively less dependent on the Chinese partner's contributions of tacit knowledge compared to the Japanese partner's reliance on the Chinese partner to provide market access or access to local suppliers.

With regard to the ownership structure and its role in technology protection, the Japanese company largely managed to exert control over its technology despite the diffused ownership structure.

7.6.8.4 Intangible assets

The Chinese partner's high ownership share and difficulty to obtain new technological knowledge has led the Chinese partner to doubt whether the ownership structure is still appropriate in current times despite defending the share vis-à-vis the Japanese partner. From the Vice-GM's point of view, his side's ownership share and the fixed structure potentially provide a disincentive for the Japanese partner to improve training beyond basic training on how to operate machines - particularly problem solving, adjusting machines to custom orders, and machine repair. The Vice-GM conceded that,

> *Because the ownership structure is fixed, we realized the Japanese partner will not share more knowledge. In a way, we've traded financial gain for knowledge – we keep receiving profits, but we do not get new knowledge. At the moment, we are okay with the profits, though. We think the current structure has so far worked well for us.* (Vice-General Manager C, 2007)

While expectations at the time of IJV set up were to "attract technologies and management skills from Japan and to develop our own technologies and management skills from those," (Vice-General Manager C, 2007) the reality is that these expectations have not been met. Accordingly, the Vice-GM expressed that, "Our problem in every aspect is that we do not understand the technology beyond operating its standard functions, and we cannot train our staff to cope with any non-standard problems ourselves, and the Japanese won't…Sometimes we feel we contribute more than they do." (Vice-General Manager C, 2007) While the incentive of tangible assets in terms of capital, profits, and new equipment still exists, the Vice-GM believes their ownership share could be too high to induce higher-level knowledge transfer.

7.6.8.5 Government influence

The discussion in this case study has shown that the entry mode decision was mainly a result of the Japanese partner's efforts to achieve interest alignment with the local partner rather than active government suasion towards such ownership share. Therefore, government involvement regarding ownership became redundant since the

Japanese partner actively chose such ownership structure. Regarding government involvement, the Vice-GM confirmed the limited involvement of the government in setting the ownership structure:

> *The city government gave us general guidelines, and introduced the Japanese company to us according to their (technology) industrial strategies/goals. Officials just told us to form a joint venture with the Japanese and they told us to be profitable and to make sure new equipment and products frequently arrive. They left the internal management and ownership negotiations up to us. The city government overlooks that we contribute to the development of the local/city's electronics (car) industry and that we make profits...* (Vice-General Manager C, 2007)

Beyond matching the foreign company to the SOE, government involvement through the local IJV partner remained limited. The local IJV partner retained enough latitude to negotiate the ownership share with the Japanese partner and divide management functions within the subsidiary.

7.6.8.6 Knowledge uncertainty towards Japanese partner

According to Hoffman and Hammonds (1994), two parties to a business transaction are faced with two kinds of knowledge uncertainty. The first type of knowledge uncertainty can result from a fixed but unknown outcome at a future point in time, while the second type can result from the endpoint being an unknown distribution of results. This theory is applicable to this IJV because the IJV contract fixes ownership proportions. In order to maintain the proportion, the Chinese partner must follow by investing a proportional amount of capital when the Japanese partner acts to change investment.

Thus, the fixed nature of the IJV contract eliminates the unpredictability of the relative outcome but not the absolute outcome. Since ownership proportions are fixed, the local partner will know the relative amount to invest; in other words, a relative percentage amount which is equal to its ownership share, but not the absolute amount of an additional investment or the timing of such investment. The Japanese partner gets to decide the timing and the amount. With regard to any possible investment increases, the Vice-GM answered:

> *Then we have to follow... Currently the development of our subsidiary is quite good. Profits, productivity…all are there. We are satisfied with our current investment structure, but investment increases may follow. We don't want our partner to change either in the foreseeable future, but we don't know. We are prepared to take on any additional investment…* (Vice-General Manager C, 2007)

It is mandated in the IJV contract that ownership structure cannot change with changes in capital (additional investment). The Chinese partner has no choice but to invest if the Japanese partner chooses to invest in order to maintain the same ownership structure. The quote also implies that the local partner was not dissatisfied with the ownership structure despite some knowledge uncertainty. However, the ability to re-invest profits means the local partner was satisfied with its share of the profits and would likely not agree to have its share of profits diminished if the ownership structure were adjusted in favor of the Japanese partner. As a further disincentive to change ownership, a formal change to the IJV contract would be necessary.

At the present ownership structure and conditions, there is knowledge uncertainty towards the Japanese partner's actions regarding investment, but the Chinese partner seems to be able and willing to manage this perceived uncertainty towards the Japanese partner.

7.7 Case D
7.7.1 Case characteristics

• Year of subsidiary formation:	1994
• Ownership structure:	88% (Japanese); 12% (Chinese)
• Productivity growth:	Low
• Feasibility of changing ownership structure:	High
• Instability:	Medium
• Type of IJV relationship:	Conventional arm's length

Table 7.7: Interview results - Japanese perspective (Case D)

JAPANESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Chinese partner meet expectations?**	**Comments**
Experience in foreign market entries	*High*	*High*	*N/A*	
Experience in China	*High*	*High*	*N/A*	
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Items:				
- Land	*High*	*Low*	*Yes*	
- Factory	*High*	*Low*	*Yes*	
- Operating permits	*High*	*High*	*Yes*	
- Utilities	*High*	*Low*	*Yes*	
- Labor	*High*	*Medium*	*Yes*	
- Capital	*High*	*Low*	*No*	
- Partner's technology	*Low*	*Medium*	*No*	
- Partner's products	*Medium*	*High*	*No*	
INTANGIBLE ASSETS				
Guanxi				
- Tax negotiations	*Medium*	*Medium*	*Yes*	
- HR	*High*	*High*	*Yes*	
- Localization	*Medium*	*Medium*	*No*	
- Market access	*Medium*	*Medium*	*Yes*	
OTHER ITEMS				
Government influence (China)	*High*	*Medium*	*N/A*	
Efforts by Chinese partner to secure large ownership share	*Medium*	*Weak*	*N/A*	*Partner could not raise capital to maintain ownership share and could not object to a buyout later*
Knowledge spillovers from Chinese partner	*Medium*	*Medium*	*N/A*	*Japanese managers often have to communicate through interpreters*
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*High*	*High*	*N/A*	
Knowledge transfer (transfer of intangible assets, e.g. tacit knowledge)	*High*	*High*	*N/A*	*Japanese partner accepted that local JV partner and suppliers learned through formal training, daily interaction, and observation*
Knowledge uncertainty towards Chinese partner	*High*	*Low*	*N/A*	*Knowledge uncertainty toward assets obtained on the open market higher than towards JV partner*

Table 7.8: Interview results - Chinese perspective (Case D)

CHINESE PERSPECTIVE				
	At time of IJV formation	**At time of interview**	**Did Japanese partner meet expectations?**	**Comments**
TANGIBLE ASSETS	**IMPORTANCE**	**IMPORTANCE**		
Capital Partner's technology Partner's products	*High* *Medium* *Medium*	*High* *High* *High*	*Yes* *No* *Yes*	
INTANGIBLE ASSETS				
Managerial experience Other tacit knowledge (e.g. problem-solving skills, access to training)	*Medium* *Medium*	*High* *High*	*No* *No*	*No problem-solving skills taught during training, sophisticated problems must be solved by engineers from HQ*
OTHER ITEMS				
Government influence (as reported by Chinese partner)	*High*	*Medium*	*N/A*	
Efforts to secure large ownership share	*Medium*	*Weak*	*N/A*	
Technology transfer (tangible assets, e.g. machinery, products, manuals)	*Medium*	*Medium*	*N/A*	*Equipment transferred usually one generation behind (1-2yrs), actual tech. gap is about 20 yrs.*
Knowledge uncertainty towards Japanese partner	*Low*	*High*	*N/A*	*Knowledge uncertainty toward assets obtained on the open market higher than towards JV partner*

7.7.2 Background of IJV

This subsidiary was set up by a large Japanese electronics company with about 30 subsidiaries in China, including joint ventures and wholly-owned subsidiaries. The parent company has pursued a strategy of wholly-owned subsidiaries in its newer subsidiaries, which it began opening in the late 1990s. The company began investment in China in 1992, and 1993 through equity joint ventures, and later re-focused its strategy into WOS, although in the first joint ventures, the ownership structures were revised and adjusted with time. The subsidiary interviewed for this case is one of the first Sino-Japanese Joint Ventures in China, which has gone through two phases of ownership adjustment in its lifetime. Its early products included (motherboard, conductors, transformers, signaling equipment.

A first step was taken in 1995, when Company D opened an electronics parts subsidiary in (close to Beijing) with an annual capacity of 500,000 units. The plant, similar to other plants that the company would open in China in the years to come, imported most of its necessary parts and materials from Japan. Company D believed this strategy would allow the company to maintain its traditional advantage of high-quality Japanese production components while still benefiting from the economies associated with China's low-cost labor and land. The subsidiary was successful in reducing costs, but only temporarily, since all companies in China were not only benefiting from low labor and land costs, but also capitalizing on less expensive local production components and increasingly sophisticated technical expertise. Due to its high cost structure and slow product innovation, Company D started facing the problem of declining sales. Recognizing this, Company D moved to reform its supply-chain management in China for which the local partner would become essential. This included four steps: 1) movement of all manufacturing activities to China, 2) establishment of R&D in China, 3) procurement of most supplies in China, and 4) establishment of more effective distribution channels in China. Part of this strategy was the re-organization of the ownership structures of the subsidiaries. The case study will examine the example of one subsidiary.

Although the partners had different priorities on which their entry into the JV was based, the shift to a wholly-owned strategy to achieve higher localization and local competence for the Japanese partner had limited positive impact on productivity growth. It is argued that the shift away did not help Company D increase its local competence, nor did it help achieve higher localization levels. By becoming a wholly-owned subsidiary, the Japanese partner had lost its main vehicle for internalization of such intangible assets as connections, knowledge of the local market, knowledge of local suppliers, and access to local markets through the JV partner. As a result, localization rates have remained low increasing from 2% in the beginning to about 16% currently, compared to a target of achieving at least 70% of localization rates. The case study also discusses the importance of having had a local JV partner in the beginning, and how the use of IJV partners in China does not decline if interests can be aligned correctly through ownership.

The following aspects were revealed as important during the interviews:

For the Japanese partner, as expected, the initial need for basic items such as land, utilities, and labor was important (tangible assets). The local partner was going to provide these. From an intangible asset perspective, the local JV partner was indispensable for recruiting workers and provide legitimacy to the company before the workers, it was responsible for drawing up employment contracts, explaining employment conditions to the workers, and taking care of other HR functions (punishment, reward) within the local context, which the Japanese were "not knowledgeable about" at the time. From an ownership perspective, the Japanese partner wanted the Chinese to have a large share in the subsidiary to, as Japanese GM believed, ensure an alignment of interests to some extent, so that the Chinese partner would "not act to the detriment of the company," (General Manager D, 2007), despite Company D being able to draw on extensive experience in managing overseas subsidiaries.

7.7.3 Significance of case

This case shows an example of an IJV with a non-fixed ownership structure. The local partner in this case study held a low ownership share at the time of IJV setup but with support for higher ownership share from the Japanese partner in the later stages of the IJV, when the local partner was able to contribute more capital. The intended larger share for the local partner was thus intended to align its interests towards those of the IJV later.

As an IJV established in the mid-1990s, the gap in technological capabilities between the two partners was large. Therefore, in the early life of the IJV, the local partner contributed simple tangible and intangible assets necessary in IJV setup and initial operation. The opportunity to learn new management style and technological knowledge, however, served as a compensating factor for the initially low ownership share. Over time, however, this compensating factor diminished as the local partner was catching up and increased its own capabilities. Since the IJV implemented a flexible ownership structure, there was opportunity to increase the local partner's ownership share through additional investment in the IJV. However, the small initial ownership share prevented the local partner from re-investing its share of the profits in the IJV since it used the profits to invest in its own SOE first. The low overall growth in technology/knowledge-based productivity growth could be attributed to inefficiencies that occurred when the Japanese partner became dissatisfied with the Chinese partner. The latter had reduced its contributions to the IJV as it thought that the value of contributions given no longer reflected its ownership share.

7.7.4 Local IJV partner

The local partner company is one of the largest SOEs in China. It is manufacturer of computer and telecommunications hardware and software and developer of software. It is one the top ten electronics firms in China and has formed several alliances with companies from the US, EU, and Korea. The Chinese partner company has a network of 30 factories across China that are highly specialized and only loosely linked together. Each of the sub-companies is city-specific, and is thus managed by city or provincial governments. However, the SOE as whole (the group) is funded and supervised by the central government's administrative body. The companies within this SOE also do not closely cooperate with one another, and do not invest in each other. Even so, this particular sub-company of the SOE has a strong reputation in China, and it is the number three electronic equipment and semi-conductor maker by sales in China. The local partner company has 14,000 employees and specializes in electronic equipment and semi-conductors. Its primary function within the newly formed joint venture was to supply parts and source local suppliers in the future. Due to the large size of the newly formed joint venture, the deal was lucrative and the Chinese partner wanted a relatively large share in the joint venture in order to be able to share in the profits later. Being an early joint venture, the Japanese partner in fact wanted the Chinese partner to have a large share in the JV, so long as the Japanese side would keep a controlling majority, due to a lack of experience in the Chinese market. The Japanese side also wanted to make sure the Chinese partner had a substantial investment in the newly formed JV in order to prevent the local partner from acting selfishly. According to the GM of the JV, the strategy was for the local partner to hold at least one-third stake in the subsidiary.

7.7.5 Technology and knowledge transfer

Company D has prevented the technology from spilling over. The Japanese partner focused on keeping training methods relevant to the transfer of explicit knowledge, which has been adequate in maintaining its manufacturing activities. It has kept training methods within a time frame of two to three months of problem anticipation, which has effectively prevented the Chinese partner from learning problem-solving skills. Tacit knowledge has thus not been transferred. From a manufacturing point of view, this can be a tradeoff for technology protection since for any sophisticated problem, an engineer had to be sent from Japan.

Although the Japanese partner gained confidence in running the subsidiary as a wholly-owned unit after a few years of IJV experience, substantial transaction cost factors have prevented Company D from internalizing tangible and intangible factors on open markets after becoming wholly-owned. These are discussed in the 'Interview results' sections subsequently.

A viable option for Japanese high-tech companies is to allocate a separate entity for R&D purposes. Company D has located a separate R&D subsidiary in China as a wholly-owned entity, rather than concentrating R&D in its existing manufacturing subsidiaries. In 2001, Company D decided to move much of its R&D activities to China, creating the second largest R&D center of 16 worldwide, in Beijing, as a separate entity and under full ownership. Only the company HQ R&D center would be larger. Company D hoped that this would create a link to the Chinese consumer, and depend on the employment of Chinese engineers and R&D staff. Engineers and researchers for the new subsidiary were transferred from existing IJVs and recruited on the open market. Company D was confident about its own ability to operate in China.

7.7.6 Interview results: Japanese partner

7.7.6.1 Tangible assets

This IJV follows a pattern in which technology complementariness did not rank high in importance at the time of IJV set up. The Japanese partner, however, gave high priority to reducing knowledge uncertainty instead, which resulted in its favoring diffused ownership. Reasons that it did not initially seek any technological involvement from the Chinese partner included the large technology gap, technology protection, as well as the desire to keep key technologies and processes requiring sophisticated tacit knowledge (R&D) in Japan.

However, this view was dynamic and changed over time. Product complementariness became an issue as the IJV evolved. According to the GM (2007), "Our Chinese partner's learning capacities had increased, and we even began to consider making them one of our suppliers." Successful technology transfer can occur through complementary products if the local partner takes on a role of supplier to the Japanese IJV partner. In this IJV, the adaptation of the local partner as a supplier, however, was met with obstacles due to strong objections by the head office in Japan. The possibility of letting the Chinese partner become a supplier was remote because "The entire management strategy was overseen and dictated by our headquarters (HQ) in Japan. HQ is not very knowledgeable about our subsidiary, they were not receptive to our suggestions to localize more of the supply chain and build a network of local suppliers…" (GM, 2007) In the early stages the rationale for choosing an IJV partner was limited to simple tangible assets:

> *They had to find suitable land for us, negotiate the terms of the land, negotiate tax terms, set up utilities, and provide us with an initial pool of workers and engineers… Capital was important in so far as to ensure our partner's stake was large enough so they would act in the*

interest of our joint venture. (General Manager D, 2007)

Both sides' desired capital ratio was not achieved, which means that interest alignment did not materialize to the extent desired by the Japanese partner. This would provide a valid justification for higher distrust towards the local IJV partner, and thus higher knowledge asymmetry between the IJV partners.

7.7.6.2 Intangible assets

Intangible assets at the basic level affected the choice of local IJV partner and structure of the IJV relationship. The Japanese partner relied on the Chinese partner to handle tax negotiations for the import of production equipment and utilize its *guanxi* with local officials. Market access was also sought. Subsequently, utilization of the local partner extended to the Japanese partner being able to access the Chinese market through the partner's distribution networks, access to wholesalers, and marketing skills. These were assets that the local partner provided despite its low ownership share. Compensating factors are discussed under the same section for the Chinese partner subsequently.

Targeting the local market had not initially been an important issue since production was meant for export and so were the initial functions of the Chinese partner. The Chinese partner acted as negotiator and liaison with decision-making individuals in government to negotiate favorable taxation terms on imported equipment. In addition, the local partner kept managerial involvement in the IJV, through the HR function.

In the later life of the IJV, the Japanese partner contemplated localization of some components, for which the local partner's *guanxi* would become valuable. With regard to the importance of tax negotiations, the GM said:

Part of our strategy was to find local suppliers, and we wanted our JV partner to be the main supplier. We also wanted the partner to maintain good contacts with the Government for us…
We needed fast import clearance on equipment with as little tax as possible. (General Manager D, 2007)

With regard to subsequent efforts to localize components, the GM said that,

We had several expectations of our partner. First, we expected them to do the recruiting and take care of the labor relations and contracts. Second, we wanted to increase our own production of electronic components in China and reduce production and import cost. We could get parts supplied in China at 30% of the cost than Japan for our DVD/TV production with their [local partner's] help. They should help us find suppliers on the local market. (General Manager D, 2007)

In the first instance, the Japanese partner did not consider the local partner's potential role in the supply chain. However, the Japanese partner recognized the potential of the local partner as a means to overcome their lack of experience and knowledge in the Chinese market. According to the GM, the partner's contribution of intangible assets was important:

We considered our partner's most useful contribution their ability to negotiate with any Chinese entity on our behalf…We knew we needed their knowledge, experience, and connections in dealing with government agencies and local businesses…There are many problems we could not resolve on our own in China. (General Manager D, 2007)

The GM cited two examples that were of immediate concern in the areas of HR and negotiations: "We depended on our partner for two items: their ability to provide us with staff and engineers immediately and their ability to negotiate (favorable) tax rates for our production equipment in a short time." (General Manager D, 2007)

New production equipment was frequently imported. Equipment in production lines had to be replaced every two years. Therefore, the localization gained importance within this IJV and the local partner's *guanxi* were utilized to "locate and negotiate with local suppliers, and provide product samples fast." This also increased the demand for engineers at the IJV, where the local partner fulfilled the requirement to "find engineers fast." (General Manager D, 2007) With regard to the local partner's providing HR and related services, the GM mentioned:

> *Hiring people was an important contribution by our partner. They created and ran the advertisements, and we left it to them to create the employment contracts and explain the terms and conditions of employment to our staff. Initially, we did not know how to recruit people here. Now we have learned how manage the HR function in the local context, but we still think the Chinese partner is better suited. It is difficult for us to get the trust of the staff.* (General Manager D, 2007)

An important benefit of the local partner's HR management was its credibility among local staff. According to Barro (1998) residual productivity values and therefore technological efficiency can benefit if potential for conflict is minimized.

7.7.6.3 Ownership

For the Japanese partner, the goal was to "follow the example of other companies in China and to contribute experience from our more than 100 own subsidiaries overseas to this JV… However, foreign companies were not allowed to set up wholly-owned subsidiaries then, so this left us with little choice other than to seek a local partner." (General Manager D, 2007)

On what the goals were for the ownership level, the GM said that, "We had to start thinking about how to best protect our property including… technology, capital…, so we began thinking of how to involve our partner without jeopardizing them… so we thought the best method would be to give them enough share of the ownership." (General Manager D, 2007) He added: "However, this was difficult for us to negotiate because we had very little prior experience with JVs, our subsidiaries overseas [Thailand, Malaysia] are all wholly-owned." (General Manager D, 2007)

With regard to the specific ownership share, a prior lack of experience with IJVs played an additional role. The GM continued to explain that, "We did not want them to own a large share… Our existing subsidiaries in Thailand and Malaysia were wholly-owned. We were afraid of interference and disagreements with the local partner." (General Manager D, 2007)

The quotes clearly show the tendency of the Japanese manager towards low ownership levels for the Chinese partner in order to reduce (knowledge) uncertainty concerning possible access to proprietary knowledge and the uncertainty of dealing with an IJV partner.

This entry mode also made sense from the point of view of the transfer of simple intangible assets to the Japanese partner. At the time of IJV setup, the state was still keeping significant control over the entry modes of foreign companies with technologies that were being promoted, with a strong preference towards IJVs. The state's strategy ranged from tax incentives to the efficient provision of basic utilities to persuade foreign companies to choose local IJV partners. General Manager D (2007) added: "We needed the partner for everything…finding land, negotiating land cost, and negotiating the tax terms for the import of equipment… We also needed them [local partner] to arrange electricity, water, and phone lines."

The quotes show a strong need for a local partner that was mainly due to structural market failure (i.e. government interference). In order to overcome structural market failure, the Japanese partner had to seek the best method of involving the IJV partner relevantly; in other words, the contribution received should enable the IJV to operate efficiently. Contributions ranged from basic utilities to factory space and tax negotiations for imported production equipment.

With regard to actual technological contribution, the GM said that, “We had no expectations of our partner concerning technology… There was a gap of at least 20 years between our companies…”[25] (General Manager D, 2007) Therefore, the Japanese partner had no strategy and no need for using the partner as a potential contributor of components. As such, involving the local partner in the IJV at either an arm’s-length or a non-arm’s length relationship but low ownership that would keep the local partner in a weak position was considered useful. In this case, the local partner retains low ownership but is involved in managerial functions with access to technology as a motivational tool for it to contribute efficiently.

In anticipation of unpredictable future events, the Japanese partner also took precaution in keeping the equity share flexible, so that ownership levels could be changed if the need arose. Accordingly, General Manager D (2007) explained: “We adopted a floating ownership system. Each partner could contribute more capital in the future, and this would change the ownership structure proportionally.”

7.7.6.4 Government influence

Government influence has been high in the setup of this IJV. The city’s investment promotion agency steered the Japanese company towards partnering with its current IJV partner. Although the partner selection process had been steered by the government, it still made sense from a perspective of asset complementariness, with respect to both tangible and intangible assets for both partners. The GM explained:

> *An important reason for the government to allow this IJV was that the SOE could more easily obtain capital, capital-intensive technologies, and secure jobs at the same time. Therefore, it could bypass commercial banks for loans since loans became difficult to obtain for*

[25] This is and exaggerated statement the GM had made in order to highlight what he perceived to be a large technological gap and the strong need to catch up.

(underperforming) SOEs. Owing to its weak financial disposition, the government had simply told the SOE to partner with the Japanese company. As such, both partners were left with little choice. (General Manager D, 2007)

With regard to technology/knowledge-based productivity growth, the intent of the government to save an SOE from bankruptcy, however, did not produce entirely bad results (i.e. negative technology/knowledge-based productivity growth) for the IJV.

Moreover, government interference was not necessarily unwelcome for the Japanese partner, either. In the GM's words: "At the request of our Chinese headquarters in Dalian, we approached the Appliance Measurement Bureau to consult about possible local partners." (General Manager D, 2007)

7.7.7 Interview results: Chinese partner

7.7.7.1 Ownership

The IJV partner wanted its ownership share to reflect the importance of its contributions to the Japanese partner over time. The local partner was dissatisfied with the ownership structure. A large portion of the profits received from the IJV were re-invested in the SOE, and no capital was left to increase the IJV share. However, this was also a problem since the SOE itself was trying to continue to provide employment to its own staff members and therefore needed to ensure survival. When asked about the use of the ownership structure changing in favor of the local partner, the Vice-GM answered:

We want a greater share of the profits. Our contributions have been valuable to the partner. We want to make more contributions, but we presently cannot afford to invest more into the joint venture. Our share is too small to re-invest profits back [into the IJV]. We *currently use all the profits we gain from the joint venture for our own company [SOE]*. (Vice-General Manager D, 2007)

7.7.7.2 Tangible assets

The interviews for the Chinese partner suggest a high reliance on the Japanese partner's tangible assets. These are capital as the most important tangible asset to be acquired by the Chinese partner. This result is somewhat unexpected because the assets such as technologies, machines, and products, although important, are only second to capital. In this case, the interviews have suggested that there is a strong rift between the Chinese partner's short term goals and long term orientation. At the time the SOE entered the IJV with the Japanese partner, it was close to bankruptcy and obtaining capital and saving jobs were priorities, to be achieved partly by re-deploying employees in the IJV. The recruitment process was perfunctory and unsuitable employees frequently transferred to the IJV as a result. Securing social stability and employment therefore implies significant government suasion toward forming this IJV. The results also show that the need for tangible and intangible assets has increased but not always been met by the Japanese partner. The need for new equipment, new products, managerial experience and knowledge necessary to process new technologies has become more important to the Chinese partner over time. For this IJV partner, ensuring financial survival came before technology upgrading. The following quote expresses the situation the Chinese partner faced at the time of IJV setup:

> *Our first priority was to obtain capital. At the time, we (SOE) were short on capital, just like many other SOEs. The second priority was technology… Setting up a JV with a foreign company was the easiest way to obtain capital, it let us bypass commercial banks and loans. Through a foreign partner, we could obtain capital easily…and this ensured our survival and employment for our people… Technology and management skills became important later."* (Vice-General Manager D, 2007)

With regard to technologies that the Japanese partner was transferring, the Vice-GM mentioned:

> *We knew they weren't transferring the latest equipment to us. They were still an attractive partner because they have a long history, so we expected to obtain superior scientific knowledge and managerial knowledge and concepts from them [Japanese partner]… We hoped they would provide our engineers and staff with good training.* (Vice-General Manager D, 2007)

In return, the IJV partner made the following contributions:

> *Our contribution has been great. We obtained the land use rights, we organized the contractors to build the factory, and we organized the utilities (electricity, water, phone lines). Another important contribution we made was recruiting people. We created and ran recruiting advertisements, and we crafted the employment contracts and explained the conditions of the contracts to staff. All HR matters were left up to us… The Japanese did not know how to recruit and manage workers here… They still do not know how to motivate [local] staff… They cannot get their [local staff's] trust...* (Vice-General Manager D, 2007)

7.7.7.3 Intangible assets

This discussion shows that the Chinese partner was disappointed at not being able to receive the knowledge it hoped to gain from the Japanese partner. For the Japanese partner, this could translate into successful technology protection, which would challenge the notion that technology is leaked within IJVs and that IJVs should be avoided for this reason. It can also positively influence technology/knowledge-based productivity growth. As for the transfer of tacit knowledge from the Japanese partner, the Chinese Vice-GM said:

> *There were no systematic training measures in place. We learned everything through daily interaction, we even learned how to speak Japanese. In the managerial sense, there was plenty of opportunity for us to learn from the Japanese just by communicating and observing… Their technological training was not very useful. Their training was centralized and not relevant to our JV. Training for all*

Company D subsidiaries in China took place in three training centers: Beijing, Shanghai, and Guangzhou. We sent our engineers there sometimes, but each training session lasted only about 3 days, so there wasn't much they could learn. They just received knowledge on how to operate certain machines, but no one taught them problem-solving skills. Sometimes, we sent our engineers to subsidiaries in Malaysia or Thailand to learn from their experience. In the end, however, if there was a problem with the production line, or we needed adjustment to custom orders, we had to bring engineers from Japan every time. This was very costly. (Vice-General Manager D, 2007)

As for the minimal incentives to contribute intangible assets arising from the Chinese partner's low ownership share, the Vice-GM stated: "The IJV contract was flexible and did not fix the proportion of the equity. Any partner could contribute additional investment and change the ownership structure; but this still had to be discussed and agreed on with the Japanese partner. We are interested in the JV doing well…" (Vice-General Manager D, 2007).

The quote reveals the motivation of the Chinese partner to contribute to the IJV. Raising financial incentives through higher ownership were still an option for the future, which the Chinese partner did not discount. However, with a large technology and skills gap, the opportunity to learn played a greater role during the initial catching-up (learning) phase. Productivity growth also lends some credibility to the Chinese partner's aforementioned quote.

7.7.7.4 Government influence

The Chinese IJV partner's strategy was strongly influenced by the government. The Vice-GM mentioned that,

The government has had a large influence on company policy. SOE bosses still have a mindset from the times of a planned economy. They have a strong say in selecting which foreign company we partner with. They directly influence upper SOE management. This has an impact on the joint ventures we are involved in with foreign companies. We have to learn their technologies and management skills, and we try *to apply them to our SOE. We want to be a supplying partner in the future.* (Vice-General Manager D, 2007)

In the short-term, however, one needs to realize that the future of many SOEs seemed unstable. "We had to ensure our survival so that there was future employment for our staff…" (Vice-General Manager D, 2007). The SOE had about 25,000 staff, of which more than 1,200 were transferred to this IJV.

The discussion of the Chinese partner's goals raises the issue that many SOEs in the 1980s and 1990s were in difficult financial dispositions. As a result, obtaining capital and assuring employment for a sizeable labor force was a priority for the government, which wanted to ensure financial survival first and upgrade technology and management skills in the process. However, both strategies did not work together, as productivity growth in the IJV suggests. Therefore, a conventional arm's length relationship may still be appropriate with this type of local IJV partner and government policy that is exercised through the local IJV partner.

7.7.7.5 Knowledge uncertainty towards Japanese partner

The example of this case has shown that IJVs in this relationship structure have limitations in the transfer of technology and tacit knowledge but not necessarily in technology protection. As long as the function of the IJV is standard production, however, the benefits for the transferring side (Japanese side) in obtaining intangible assets from the Chinese partner can still outweigh the limitations of technology and knowledge transfer. Therefore, setting up an equity IJV with a local partner will incur low transaction costs.

However, technology protection and little access to training could increase the Japanese partner to split from the current IJV partner since asset specificity is kept low.

The costs of switching to another IJV partner are therefore low, too. In this scenario, it could be argued, the Japanese partner has benefited fro the IJV more than the local partner. However, even if the local partner were to induce instability, technology protection and lower asset specificity between partners than in case A could still mean that dissolving the IJV and switching to another partner or setting up a WOS is more likely. The Japanese partner thus retains control of its own survival, regardless of how the IJV may fare in the future.

7.8 Concluding remarks

The case studies have shown that managers were aware of issues of ownership structure in the long term. General managers may either have assumed duties with this mindset or have learned in the course of managing the IJV that the issue of ownership structure is indeed important to ensure control, stability, and interest alignment between IJV partners. In high-tech industries, it is therefore important to have long-term ownership strategies beyond the immediate IJV setup that take into account the effects of learning and absorption of knowledge, changing partner capabilities as well as changes in external factors that may alter the role of the local IJV partner in the future. Ownership structures are likely to need to reflect such changes over time. In reference to the quantitative analysis, the value of technology/knowledge-based productivity growth is an indicator of the efficiency of processes that result from aligning ownership structures optimally. This is where the qualitative research has been particularly useful. Quantitative research alone could not put issues of ownership structures, interest alignment, IJV stability, and technology/knowledge-based productivity growth into perspective as such. By developing the case studies, I have attempted to address this gap.

The cases have profiled Sino-Japanese IJVs into arm's-length and non-arm's length frameworks based on ownership structure, management participation and the extent of exposure to managerial and technological knowledge implementation processes within IJVs. Government influence could also play a role in choosing an appropriate framework, particularly in case D; which, however, seemed to have confined its performance in technology/knowledge-based productivity growth. Under the circumstances, however, the framework chosen by Company D, however, may still have been appropriate.

The implementation of the processes for exchanging and absorbing complementary assets (tangible and intangible) could compensate for a lack of ownership share for the Chinese partner, particularly in early stages of the IJV, when the Chinese partner was more willing to be compensated through new knowledge gained. What constituted new knowledge to the Chinese partner depended on the Chinese partner's history (e.g. affiliation with Chinese Academy of Sciences), which would determine its initial level of knowledge and technological level and depending on these, its absorptive capacity for new knowledge. This would play a role in determining technology/knowledge-based productivity growth as well as ownership share at the IJV setup stage and equity adjustments in its later lifespan.

In the early stages, technology/knowledge-based productivity growth could usually be influenced to a greater extent through the local partner's exposure to new technology, technological and managerial knowledge, rather than ownership share. Ownership stake became a more important factor in the later stages of IJVs. In cases where ownership structures were fixed or could not be adjusted, IJVs showed a marked tendency towards a decline in technology/knowledge-based productivity growth over time (cases C and D) and in severe instances, even local-partner induced (uncontrolled) instability (case A), provided the local partner already possessed high technological capabilities at the time of IJV setup.

The cases have also discussed the non-alignment of expectations and links to ownership structure. In case A, for example, contributions received from the local partner relative to the local partner's ownership share were subject to the partner's learning and catching-up with new technological knowledge. An IJV would not be successful with regard to both productivity growth and control over the life of the IJV, when small ownership was granted to the local partner in the presence of small technological/knowledge gaps and high product complementariness. Without ownership adjustment in favor of the local partner, the IJV was bound to become unstable as a result of the local partner's new opportunities to cooperate with other firms. This case showed an example of the technology owner (Japanese partner) losing control of the IJV since it was the local partner that induced instability.

Generally, in cases with diffused ownership and/or high management participation, there was more potential for higher growth in technology/knowledge-based productivity and thus technology and knowledge transfer.

Choosing an appropriate strategy at the time of IJV setup that includes ownership share, the degree of flexibility to change such ownership share depended on the local partner's involvement in the IJV, the partner's capabilities and the Japanese partner's strategy for the subsidiary in China.

In cases where the Japanese partner did not intend to use the Chinese partner beyond the procurement of simple tangible and intangible assets or assembly activities, Japanese companies still tended towards modifying ownership strategies in later years, which included either changes in equity structures or termination.

Case B presented the only example in which technology/knowledge-based productivity growth was high, within the framework of a conventional non-arm's IJV length relationship. Despite motivations to protect proprietary knowledge and know-how, such ownership structures were nonetheless most conducive for this subsidiary in the exchange of complementary assets and showed that there was a continuous need for the local partner's complementary assets, whose sophistication evolved over time and could be used to substitute some component imports from Japan. The local partner was motivated by the upgrading of its capabilities and a tangible share in the growth of the joint venture. Protection of vital know-how and R&D could still be controlled by setting up another wholly-owned subsidiary and selectively transferring capabilities developed in the joint venture over time to the new subsidiary.

Qualitative research, particularly case studies, can be open to questions of their ability to generalize results. The four case studies have been chosen for inclusion in this dissertation from interview data of approximately forty possible case studies on Japanese-Chinese IJVs (in China). In fact, when I selected case studies for interviews, I did so by shortlisting subsidiaries from the quantitative sample of 692 subsidiaries based on the extent of their technology/knowledge-based productivity growth. Among the forty possible case studies, I then chose four that best represented subsidiaries typical of the category of technology/knowledge-based productivity growth (low, medium, high) while controlling for factors such as subsidiary age and size of the IJV (e.g. employee numbers, capital) to include in the dissertation. Therefore, my own judgment and perception in selecting case studies for inclusion in the dissertation may have played a role. These limitations should be kept in mind when interpreting case studies and qualitative research in general.

8. Conclusion

The dissertation has highlighted the complexity of entry modes and ownership patterns from the perspective of technology and knowledge transfer. Important to the discussion has been knowledge transfer in particular, which has taken two directions. First, it has been discussed as new technological and managerial knowledge that was transferred from the owner of that knowledge to the recipient, or the local IJV partner in China. Second, the owner of technology – the Japanese partner – was shown to have needed other, often tacit knowledge or intangible assets – from the local IJV partner in China. Entry modes and subsequent ownership structures over the lifetime of equity-based IJV partnerships have been shown to affect knowledge transfer, or more appropriately, mutual knowledge exchange processes. The influence of other factors essential to the process of technology transfer and knowledge exchange has also been discussed. These include the augmentation of the productive lifespan and employee structures that produce higher rates of mutual knowledge transfer within Japanese high-tech companies' equity-based subsidiaries in China, and particularly in joint ventures with Chinese partners.

8.1 Contributions

The dissertation has provided several important contributions to the research on entry mode choice, ownership structures, and quantitative modeling using econometric and qualitative approaches.

With regard to entry mode choice and ownership structures, the dissertation has developed a quantitative framework which measures performance under given ownership structures as the degree of efficiency in technology transfer and knowledge exchange in the form of a residual productivity growth variable. This method has been shown to be a proxy for or an indirect measure of transaction costs, in that ownership structures are validated by the growth in technology/knowledge-based productivity that they caused. In the process, the dissertation has discussed hierarchical entry modes and adjustment of ownership structures with respect to minimizing transaction costs incurred in the transfer and internalization of complementary assets, both tangible and intangible. Previous research has dealt with subsidiary performance mainly in terms of financial measures (e.g. profitability, ROA, ROE, ROI, etc.), instability, and lifespan. By contrast, this dissertation has extended existing research by providing a specific quantitative framework for optimizing technology/knowledge-based productivity growth. The dissertation has also extended an important concept previously developed by Makino and Delios (1996) which discussed the decreasing performance of IJVs after ten years that were formed with local partners. On the other hand, my dissertation provides options to extend the productive lifespan of IJVs with local partners beyond a critical subsidiary age depending on the ownership range as discussed in the quantitative chapter (Chapter 3).

The second important contribution of the dissertation has been the linkage of the quantitative results to their applicability and potential for implementation in Japanese equity-based subsidiaries in China within the framework of a qualitative discussion that has addressed issues of initial entry mode choice and ownership restructuring over the lifetime of the subsidiaries. Additionally, other factors important in the implementation and internalization of new technologies and knowledge, such as employee structures have also been analyzed quantitatively and linked to case studies qualitatively.

By categorizing Japanese majority-owned IJVs into likely types of relationships with their Chinese partners, the case studies have also provided links between types of subsidiary structures and associated quantitative outcomes of productivity growth due to technology transfer and knowledge exchange, and therefore information about the cost of their transaction.

Consequently, linking the concepts of technology/knowledge-based productivity growth, ownership structures and adjustments with transaction cost theory can be considered a third important contribution to the research on entry mode choice.

With regard to quantitative modeling, the dissertation has employed an approach that had previously been developed by economists for documenting macroeconomic progress. However, in most economic literature, the approach has been developed only in theory and actual usage on time-series macroeconomic data has been limited. Felipe (1997), Sala-i-Martin (1997), and Barro (1998) have discussed and extended the theory to a microeconomic context. However, economic literature lacks application or implementation of the theories it develops on actual data. By contrast, business literature widely uses statistical methods with large datasets but lacks approaches in econometric modeling that can be relevant. The dissertation combines the approaches from both disciplines.

Another important contribution of the quantitative model is that given availability of a dataset, it could be considered for application to other countries, subject to limitations. A significant limitation of the quantitative model is that relationships established between dependent and independent variables apply only to this dataset. Therefore, statistical significance may not necessarily occur in other datasets, in which case the model cannot be applied as it is. Moreover, the statistically significant and negative relationship for the overall sample (regressions 1 and 2) and, depending on subsidiary age, subsequent positive and negative relationships (regressions 3 and 4) between ownership change and technology/knowledge-based productivity growth are specific to the case of Japanese companies' high-tech companies' equity-based subsidiaries in China, as are the positive relationships between the logarithmic function of total Japanese ownership and technology/knowledge-based productivity growth for the overall sample in regression 2 and the specific sample of subsidiaries older than seven years in regression 4. In other countries, values for the time it takes to reach peak productivity growth or to experience a decline in productive lifespan may be different, and ownership may not follow an *ln* function in relation to growth in technology/knowledge-based productivity.

8.2 Practical implications

The dissertation has shown that specific ownership structures are important and receive consideration by Japanese managers with long-term capability development strategies in subsidiaries when their parent companies chose entry modes. Companies that did not pay much attention to ownership structures may have become aware of the importance of ownership structures over time as they accumulated experience with their IJV partners and underwent the dynamic process of learning by accumulating and exchanging experience and knowledge while operating in China. Ownership structures are an important motivational tool for both partners to ensure that processes within subsidiaries proceed smoothly.

In addition to academic contributions, the dissertation also provides important implications for policymakers and managers. For Japanese managers, the qualitative findings can help anticipate the type of IJV partner that might be encountered depending on government suasion and the Japanese company's own ability and bargaining power in negotiating a desired ownership structure. Therefore, Japanese managers could better anticipate the behavior of the local IJV partner and choose a framework for an IJV relationship accordingly. The quantitative part can give suggestions about the extent of technology/knowledge-based productivity growth that can be expected from forming an IJV with a particular ownership structure and relationship and thus provide some information about the extent to which the IJV can be re-negotiated or its ownership structures adjusted in the future. Furthermore, the dissertation also highlights advantages and disadvantages of forming IJVs with local partners of different levels of technological sophistication, and accordingly, the degree of managerial and equity involvement to allow the Chinese partner.

With regard to the leakage of technological knowledge, the dissertation does not find strong support that knowledge can simply be leaked unless the local partner has the capabilities to understand, absorb, and misuse such knowledge. However, case studies have addressed methods to calibrate partner motivation and learning through ownership structures and other adjustments.

In cases where the local partner had a high level of technological understanding, cooperation between both partners was efficient (e.g. case C), leading even to R&D. On the other hand, case A has shown that IJV instability could be induced by the local partner. However, the resulting potential for the uncontrolled leakage of proprietary knowledge was mainly caused by the Japanese partner through its neglect of ownership adjustments and managerial involvement that were commensurate with the local partner's increased technological capabilities acquired in the IJV over time.

For policymakers, the dissertation can provide guidance on how to advise Japanese high-tech companies with little experience in China or other foreign markets what to expect and what they should consider before setting up an IJV in China.

Based on the findings, the Japan External Trade Organization (JETRO), for instance, could provide more targeted advice to Japanese companies that are seeking to set up subsidiaries in China with regard to a) choosing equity-based or other structured, b) specific ownership structures within equity-based entry modes c) other structures such as employee structures and d) the likely outcome of entry mode negotiations with the Chinese government and a potential local IJV partner based on the investing Japanese company's unique attributes (e.g. technology to be transferred, size in terms of capital and employees, reputation, bargaining power, history of foreign market entries).

The framework regarding IJV relationships in the qualitative chapter could provide insights for Chinese policymakers to better match SOEs and local companies with Japanese companies based on new technologies and managerial knowledge required from the Japanese partner. It could also help them decide the extent of which they could be involved in an IJV and what to expect with regard to the acquisition of new technologies and upgrading of knowledge from the Japanese partner. Such information could be useful if the Chinese company knew its nascent role within an IJV, such as becoming a supplier or creating higher value-added by taking on certain R&D functions. As a result, more appropriate ownership structures and contract terms could be negotiated prior to IJV setup.

Likewise, a better match could be found between SOEs that merely seek survival and continued employment for large numbers of their workers within Japanese companies that, for example, are more interested in mass production rather than higher value-added activities.

In addition, the dissertation would also help enable Chinese policymakers to understand the motives of Japanese firms better. A more tailored strategy regarding IJV relationship, possible ownership ratios and flexibility for possible future adjustments of entry modes can be incorporated in negotiations.

8.3 Limitations and further research

While the dissertation has employed a large sample, some limitations still need to be acknowledged. As with other econometric models, some assumptions needed to be made in order to accomplish data modeling within the econometric model. For example, a price-output variable was employed without specifying prices or costs. It enabled the data available to be applied to the model, but more research on price data and its incorporation could have made results more accurate. Moreover, constant returns to scale were assumed.

Furthermore, the data employs observations in intervals of three years. Although the time intervals are acceptable for technology transfer and knowledge acquisition, they may become outdated as product life cycles decline, thus necessitating shorter time intervals.

Therefore, the quantitative model can still be refined with regard to these assumptions in the future.

While the dissertation has attempted to provide numerous insights about Japanese high-tech companies' subsidiaries in China qualitatively, there are other limitations to be aware of. The first limitation with respect to qualitative interpretation of the findings is bias. Three significant types of potential bias merit further consideration. First, all local IJV partners were state-owned enterprises and their representatives appointed by the government. Consequently, government policy and involvement, as well as the general state of state-owned enterprises and the specific state-owned enterprises selected for interviews, in particular, may have been portrayed too favorably.

Second, there may have been prior synchronization between Japanese and Chinese managers about what answers to provide before an interview took place. This bias could not be eliminated. In order to minimize the bias, however, interviews with both Japanese and Chinese general and vice-general managers, respectively, had always been conducted separately without the presence of the respective IJV partner.

Third, interviewees may have been mindful of how they wanted to portray their company or subsidiary to an outsider – the interviewer – despite assurances of confidentiality and anonymity. They may also have been careful to maintain a harmonious relationship with the IJV partner, and therefore may have withheld potentially unfavorable information about the IJV partner and/or further information about conflicts within the IJV (Golden-Biddle and Locke, 1993).

Fourth, since China continues to seek to upgrade capabilities through foreign technologies and managerial expertise, experience with R&D is still limited relative to those countries that transfer technologies to China. Therefore, Chinese managers may not have enough experience with negative aspects such as setbacks in R&D to the same extent as the transferor of technology. Their answers were also given against the background of a rapidly expanding Chinese economy. As a result, their answers or attitudes about their companies' capabilities may have occasionally been too optimistic.

In addition, there are limitations with regard to the ability to generalize or extend conclusions drawn from the interviews to other cases or countries. China is still a developing country whose economic development policy is strongly shaped by the government. As previously mentioned, all local IJV partners were also state-owned enterprises. These issues are relevant if applications of theories, models, and conclusions presented in this dissertation are extended to other national backgrounds (companies and countries).

Furthermore, the dissertation is based on four case studies that provide fit to a specific framework of IJV relationships. It is therefore limited by categorization, which could not be expanded upon due to length constraints of the dissertation.

In future research, the focus of case studies could be shifted more specifically to a cause and effect analysis between quantitative and qualitative chapters. In other words, a larger number of case studies could be selected first and thus treated as an independent variable. Their behavior could then be analyzed and conclusions made about the magnitude of technology/knowledge-based productivity growth. In this case, technology/knowledge-based productivity growth would become a dependent variable in such comparative framework. The analysis could then be verified with actual values for technology/knowledge-based productivity growth, which could provide more conclusive answers about the validity of the methodology and its merit for further academic exploration. However, the dissertation has provided an initial foundation from which to extend future research.

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Interviewees:

General Manager A. 2007. Company A
Vice-General Manager A. 2007. Company A

General Manager B. 2007. Company B
Vice-General Manager B. 2007. Company B

General Manager C. 2007. Company C
Vice-General Manager C. 2007. Company C

General Manager D. 2007. Company D
Vice-General Manager D. 2007. Company D

Japanese engineers. 2007. Companies A, C, D
Chinese engineers. 2007. Companies B, C, D