Improving learning effectiveness for international construction joint ventures

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**IMPROVING LEARNING EFFECTIVENESS
FOR INTERNATIONAL CONSTRUCTION
JOINT VENTURES**

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IMPROVING LEARNING EFFECTIVENESS FOR INTERNATIONAL CONSTRUCTION JOINT VENTURES

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SUMMARY

This Research is conducted within the context of international construction joint ventures (ICJVs). As unprecedented and massive economic development all over the world has been accompanied by an enormous expansion of the global construction market, ICJVs have played an important role in the strong growth of the construction industry. However, they are facing a myriad of problems and difficulties that have constrained the performance of ICJV projects. Since learning is regarded as an increasing important source for enhancing the performance of joint ventures (JVs), this research investigates ways to improve the effectiveness of learning in ICJVs. It aims to develop a learning model for an ICJV in order to identify the determinants of learning and assess their impact on learning effectiveness. To realize this, this study addresses two research questions, namely “What factors are conducive to learning effectiveness in ICJVs” and “How do these factors contribute towards learning effectiveness in ICJVs?”

This research integrates JV’s four development stages and learning related factors which emerged in the literature from the international construction area. Based on the literature review, a theoretical framework is developed to investigate the relationship among learning conditions in the environment and partner’s characteristics at the JV’s pre-inception stage, success factors of learning from JV’s characteristics at the JV’s formation and organizing stage, learning actions at the JV’s implementation and adjustment stage and the learning effectiveness at the JV’s completion and evaluation stage. This conceptual framework proposed that the learning effectiveness is positively dependent on three key constructs: conditions of learning in ICJVs (environment and partner’s characteristics), JV’s characteristics, and learning actions.

Based on six cases gathered from ICJVs projects in China and Singapore, the empirical findings of the case studies suggest that the conditions of learning in ICJVs, JV’s characteristics and learning actions impact on learning effectiveness.

The case studies illustrate the link between theories and practice, and the findings support the conceptual model. The case studies, the quantitative study and statistical analysis based on the data gathered through the questionnaire survey found positive relationships among the conditions of learning in ICJVs, JV's characteristics, learning actions and the learning effectiveness in ICJVs. They also identified a partner's development feasibility, absorptive capability, learning intent, a JV's operational characteristics, interactions and relationships, cognitive learning actions and behavioral learning actions as seven critical learning factors, as making a strong contribution to improving learning effectiveness. These findings strengthen the use of the conceptual model for construction companies to improve learning effectiveness and performance when they participate in ICJVs.

Despite the depth of the study, it is worth acknowledging its exploratory nature. It is hoped that its framework will provide the theoretical foundation for more rigorous research in the future.

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LIST OF ABBREVIATIONS

CCDC:	China Construction (South Pacific) Development Co Pte Ltd
CCL:	Circle Line
CSCEC:	China State Construction Engineering Corporation
EHDC:	Ertan Hydroelectric Development Corporation
EMAC:	Environment and Market's Attractive Characteristics
ENR:	Engineering News Record
FIDIC:	International Federation of Consulting Engineers
GDP:	Gross Domestic Product
ICJV:	International Construction Joint Venture
IJV:	International Joint Venture
JV:	Joint Venture
JVBLA:	Joint Venture's behavioral learning actions
JVCEI:	Joint Venture's Collaborative Environment Improvement
JVCLA:	Joint Venture's Cognitive Learning Actions
JVIR:	Joint Venture's Interactions and Relationships
JVKCI:	Joint Venture's Knowledge and Capability Improvement
JVOC:	Joint Venture's Operational Characteristics
LTA:	Land Transport Authority
MNC:	Multinational Company
MNE:	Multinational Enterprise
MOC	Ministry of Construction
MRT:	Mass Rapid Transit
NEL:	North East Line
PAC:	Partner's Absorptive Capability
PDF:	Partner's Development Feasibility
PLI:	Partner's Learning Intent
RTS:	Rapid Transit System
STEC:	Shanghai Tunnel Engineering Co., Ltd
US:	United States
VIF:	Variance-Inflation Factor
YRC:	Yellow River Contractors

List of Abbreviations

Chapter 1 Introduction

1.1 Overview

In this thesis, the author attempted to investigate issues that relate to opportunities and challenges encountered by construction companies when improving the learning effectiveness in international construction joint ventures (ICJVs). Literature has shown that learning in joint ventures (JVs) provides an excellent opportunity for JV participants to acquire and develop new competencies and generally enhance their capabilities and competitiveness.

However, not much study has been devoted to ICJVs, and the performance of ICJV is generally regarded as not very satisfactory in practice. On the other hand, although some companies reckon the importance of learning in JVs, it has not been systematically organized to reap the full benefits of learning effectiveness in their ICJVs and the outcomes of learning are generally not encouraging. These phenomena can be significantly attributed to the lack of systematic guides available due to shortage of research made in this area of study. Therefore, it is conceivable that the research on the subject of improving learning effectiveness in ICJVs is generally very lacking and there are many benefits to be derived from conducting more comprehensive and systematic research in this area.

This study assumes that learning can improve performance. It also assumes that learning effectiveness can be achieved by understanding the learning determinants and their contributions to learning outcomes. Therefore, a model combining learning determinants and learning effectiveness considering the whole JV system and going through four major stages of the JV's process in the international construction sector was proposed to build the basis of this research.

The model includes four constructs during the four stages of JV. Out of the four constructs, three are learning determinants and one is learning effectiveness. The

study identified three learning determinants as learning conditions from the environment and partner's characteristics at the JV's pre-inception stage, success factors of learning from JV's characteristics at the JV's formation and organizing stage, and learning actions at the JV's implementation and adjustment stage. Learning effectiveness is measured by the characteristics of learning organization at the JV's completion and evaluation stage, based on a proposition that the learning organization is the criterion of learning effectiveness,.

With the proposed model, a comprehensive research process was carried out in three stages. Firstly, variables related to the previously mentioned four constructs were identified from relevant historical and contemporary literature; as was some industry management experience sharing, and these variables are systematically integrated into the research mode. Secondly, questionnaire surveys and interviews were prepared according to the research model and variables, and put into practice for data gathering. Finally, various techniques in case studies and statistical analysis were performed based on the information from the interviews and field data surveys.

This study bridged the gap by presenting findings from the literature and relating it to case study and questionnaire survey. Some useful findings were found after the research process. The study has identified key determinants and critical variables for improving learning effectiveness in ICJVs. Also, relationships among the learning determinants and learning effectiveness were found. Furthermore, the results of the case study and statistical analysis indicate that rich inferential values can be elicited from these research findings.

The findings are significant in some theoretical and practical aspects. By revealing the existence of some critical inter-relationships among the learning determinants and the learning effectiveness, the research bridges certain gaps in the literature and contributes towards further understanding ICJVs. In addition, the research findings have generally supported by practice; therefore, it will be useful reference for construction companies in ICJVs.

1.2 Background of Research

The social economy development and construction development are closely linked to each other. Construction is one of the catalysts of economic growth of a country in which the construction industry is a vital part of a nation's economy, contributing from 5% to 15% of the gross domestic product (GDP) (Mawhinney, 2001). In general, a nation's economic activity and development are not sustainable without the support of construction. When construction activity is on the rise, on average, three additional jobs are created in the rest of the economy for every ten new jobs in the construction industry itself.

On the other hand, socio-economic development generates new construction needs. Over the last several decades, unprecedented and massive economic development all over the world has been accompanied by an enormous expansion of the global construction market. The global construction market has expanded heavily especially with very large projects such as transport networks and power plants, which require huge financial support and high technical and managerial skills.

With the continued globalization of the world's economies, JVs have become an important element of many firms' international strategy (Geringer and Hebert, 1989). JV is a legal entity formed between two or more parties to undertake economic activity together. The parties agree to create a new entity by both contributing equity, and they then share in the revenues, expenses, and control of the enterprise.

JVs have proven to be an ideal form of cooperation in a wide variety of settings. JVs have not only offer a way of sharing risks with other companies but also enable companies to benefit from advantages of size and economies of scale and have provided a way of bring together specialists from different companies to work on a clearly defined project.

An international joint venture (IJV) is a subset of JV where the partners, or parents, are from two or more countries. IJV is also an important cooperative business activity,

which is seen as providing benefits to both the host country, through technology transfer and capital inflow and to the companies by bridging knowledge and expertise gaps, sharing risk and exploring opportunities to add value to the JV organizations through collaboration (Sornarajah, 1994; Walker and Johannes, 2003).

The advantages of IJV have been well recognized by many multinational enterprises (MNEs) and their number is increasing. For example, many US MNEs and host-country executives believe that for a MNE, forming an IJV with a private firm as its partner in the host country - the country in which the IJV operates, is optimal compared to other possible methods of foreign direct investment (Raveed and Renforth 1983). Therefore, in recent years, IJV alliances have begun to replace wholly-owned subsidiaries as the most common form of foreign direct investment used by multinational enterprises (Janger, 1980, Geringer and Woodcock 1989). Similarly, Anderson (1990) found that more JVs and other types of collaborative ventures were started between 1981 and 1990 than in all previous years combined. The JV method is likely to remain and grow across the world with the many advantages accruing from this mode.

The international construction JV (ICJV) is an IJV alliance applied in the construction field. Generally, ICJVs are applied in complex project, which is composed of different cultures, different departments, and various functions as elements, as well as the construction industry's special characteristics (Lan and Jackson, 1999; Li and Tiong, 1999).

The nature of ICJVs causes difficulties in practice and in academic research. Many ICJV projects have experienced failure in terms of their intended outcomes. Meanwhile, much research has been carried out, focusing on particular aspects of the issues involved in formulating an appropriate strategy for success from many different standpoints.

One standpoint is to consider the benefits of JVs; to increase benefits and reduce associated risk. Among all the benefits that can be derived from JVs, a particularly

important one is learning: bridging knowledge and expertise gaps. The idea that JVs can be used as an instrument for learning or for acquiring knowledge is relatively new in the academic field. Some international management literature describes JVs as a vehicle for learning (Mariti and Smiley 1983; Killing 1980; Powell 1987; Westney 1988; Kogut 1989; Hamel 1991; Casson 1993). Moreover, Swierczek and Dhakal (2004) also stated learning is an increasing important source for enhancing the performance of JV.

Since learning is important, it's useful to understand what learning means in JVs. Büchel et al (1998) illustrated the meaning of learning in the JV system as: "Learning in the joint venture system means transferring knowledge from the joint venture back into the partner company and integrating it into the knowledge base so that the company can use it later for its own purpose." (Büchel et al 1998, p222) Such an illustration is used in this study specifying the construction area in detail.

It is reported that Japanese contractors freely admit that they have learned a great deal from the U.S construction industry in JVs (Levy, 1993). This example provides evidence of learning in ICJVs in practice and justifies the practical significance and value of researching this topic.

1.3 Problem Statement

Although widely used in many industries, IJV is nevertheless regarded as a complex business and encounters many failures in practices. An increasingly large number of JVs are plagued by time and cost problems, often bringing about dissolution and liquidation (Asia Law and Practice, 1996). There is a body of evidence showing a relatively high failure rate for IJVs and cross-sectional studies, which point to a consistently low level of satisfaction with IJV performance (Beamish and Delios, 1997). Beamish (1993) discovered that in developing countries the number of JVs that failed is significantly high, more than 50%.

The failures encountered by both foreign investors and their local partners in IJVs are the result of many problems. Most are due to a lack of information, poor planning

and poor understanding of each others' situation (Campbell, 1989; Ding, 1993; Dorn and Wang, 1990; Freeman, 1996; Nutwell, 1992; Shenkar, 1990; Sridharan, 1995; Tam, 1994). In addition, Yan and Luo (2001) also claimed that information circulated by the different parties to an IJV is frequently incomplete. Moreover, these problems are compounded by the accelerating changes taking place in the world.

The high failure rate and many problems encountered in IJVs have attracted the attention of the booming number of IJV participants and academic researchers. The success of IJVs has been held back all over the world, which in turn has discouraged many foreign investors who would like to set foot in the market and local partners who wish to establish business relations with overseas companies. Consequently, study of IJVs has become an important subject for both participants and academics.

There is no exception in the construction sector. The fast changing and often confusing investment environment in host countries is caused by differences in culture, infrastructure, technology, competitive dynamics, legal uncertainties, and government restrictions, which also magnify the requirement of study of ICJVs. The issues related to the high-unsatisfied performance rate in ICJVs are mainly the difficulties of understanding market conditions and associated information, the lack of knowledge, and the lack of systematic techniques to help participants make strategic entry and operation decisions in a dynamic environment (Hao, 2002).

Obviously, to solve these problems, knowledge and information availability needs to be furthered. It is argued by some researchers that technology transfer is the key objective of a firm in entering into the JV and that the JV will be regarded as successful if the parent firm learns from its partner about technology and management know-how (Gale and Luo, 2004). Anderson (1990) also argued, if the learning occurs, the JV has achieved something that should contribute to current and future performance, and as a result the participants can solve the knowledge and information problems easily. The company can pay attention to increasing learning effectiveness to gain required knowledge. Externally, an IJV needs to effectively learn to update market preferences, competitors' prices, the information of supply

and the cost of finance. Internally, pressure to maintain the project's profitability and efficiency means that information needs to be managed more effectively in order to promote sound decisions which will optimize the use of resources and contribute to the venture's success (Hao, 2002).

Therefore, the research problem is stated as: *How to achieve learning effectiveness in ICJVs?* A clear answer to the question will solve the knowledge and information problems encountered and increase the performance of ICJVs. It is significant for participants in ICJVs, and will help them to understand better about the nature of learning, the relative important factors and the interplay among these factors and the learning outcomes.

International business scholars have carried out much research in learning topics in JVs, but it has been mainly in manufacturing industries and studies in the construction sector where this specific topic has not been covered. For example, research efforts in the fields of knowledge management, organizational learning, and learning theories in IJVs have been achieving breakthroughs and successes with concepts appropriately applied to many industries, such as the automobile, telecommunications, and other manufacturing industries. Nonetheless, similar research efforts have been lacking in the construction industry, particularly in IJVs, which still seems to focus largely on the motivation, risk, success factors, and performance etc, while learning opportunities in ICJVs are often been neglected.

Furthermore, although IJVs provide a vehicle for learning, and alliances create value (Chan et al. 1997; McConnell and Nantel, 1985), Anand and Khanna (2000) noted that there was widespread recognition of the difficulty inherent in the process of learning and the learning results are not so satisfactory. Therefore some important issues related to better learning in ICJVs arise. The details will be discussed in subsequent chapters, but the story of Japanese contractors' successful learning from the U.S. construction industry about half-century ago created a myth of effective learning in ICJVs, which suggested the significance of studying learning effectiveness in ICJVs.

1.4 Research Questions and Objectives

Based on the background information presented, this doctoral research is linked towards bridging the gap of learning issues in the ICJVs.

The aim of this research is to develop a learning model for ICJVs in order to identify the determinants of learning and assess the impacts of determinants on learning effectiveness. Therefore, this study addresses two research questions:

- (1) What factors are conducive to learning effectiveness in ICJVs?
- (2) How do these factors contribute towards learning effectiveness in ICJVs?

With learning effectiveness improvements in ICJVs, different partners of JVs can reach a better understanding and use of the learning opportunity in the cooperation. To illustrate, partners involved in ICJVs can use the model in order to access technology improvements and the potential for success as well as assisting with better alignment management during the process of the construction project.

Three specific objectives are established to answer the research questions. They are:

- (1) Identify critical determinants to learning effectiveness in ICJVs;
- (2) Incorporate the determinants identified in the first objective into a learning model;
- (3) Test the relationship between the determinants and learning effectiveness in ICJVs.

With these objectives in mind, this research attempts to explore the possible relationships among determinants and their individual relationship with learning effectiveness of ICJVs. It is conceived that this study should shed light on relative importance among these determinants. It is also expected that the findings of this study should provide some useful guidelines for the construction industry to direct and distribute their effort accordingly into more deserving areas of importance. The

study should also provide empirical evidence in support of the findings for enhancing the understanding in the field application of ICJVs.

1.5 Research Methodology

To fulfill the main purpose of increasing the understanding of improving learning effectiveness in ICJVs, this research adopts an integrated approach combining literature reviews, interviews and questionnaire surveys.

Literature reviews were first carried out to find past and current research related to learning in ICJVs. They were used to find out all the possible variables related to learning determinants in ICJVs, which form the foundation of the conceptual research model of improving learning effectiveness in ICJVs. In addition, literature reviews also explore some relevant ICJV cases about learning and its effectiveness.

Interviews will be used to gather some real ICJV project cases that will provide insights and in depth information about the important factors related to learning issues. A qualitative study will be made using all the cases gathered from the literature and interviews.

A questionnaire survey aims to gather empirical data for the quantitative study. It will identify critical variables from the possible variables found in the literature review and case studies and discover the relationships between the critical variables and their impacts on learning effectiveness based on the conceptual model. Furthermore, the hypotheses built on the relationships will also be tested by the multiple regression method using the data gathered in the questionnaire survey after verifying the data through validity and reliability assessment.

1.6 Scope of the Research

This research is limited to investigate and develop a comprehensive learning model for providing and analyzing information that could identify the factors needed to

improve the learning effectiveness for ICJVs in some host countries, mainly in Singapore and China.

The study of learning was embedded into the JV's four main development stages, which comprise pre-inception stage, formation and organizing stage, implementation and adjustment stage, and completion and evaluation stage.

A questionnaire survey and interviews were both conducted within a limited field in this research. Although the model might be used to investigate the relationship between learning determinants and learning effectiveness of different external environments, the findings in this study may just be appropriate in some specific region. As the main data are gathered from China and Singapore, the research results and findings will be derived from a sample pool reflecting the characteristics of this region. It implies that this application of findings is limited to the international construction project in environments similar to China and Singapore. However, it is hoped that the model might be used as a tool for further studying and implementing learning effectiveness in ICJV projects all over the world.

1.7 Significance of the Research

The main contribution of this research derives from filling the gap between theories of general learning in selected applications that are tailored to the ICJV context. Although a great many researchers study and propose various theories on learning, its application to the JV especially to construction context remains limited, and even fewer systematic models are directed to the ICJV. Since ICJVs have special characteristics compared to a general organization, existing research cannot provide specific guidance for improving learning effectiveness in this area. Thus, it is hoped that the research output from the current study will help to fill some of these gaps.

In addition, practical cases or empirical findings related to learning effectiveness improvement in ICJVs are seriously lacking. Indirectly, this becomes one of the factors hindering the reaping of full benefits of learning through the systematical planning and organizing ICJV in practice. To address this issue, the conceptual

model in this research is first supported by the study of 6 ICJV project cases that have improved the learning effectiveness during the JVs. Also, the research model is verified by a questionnaire survey that involves the responses of 96 ICJV projects in Singapore and China.

Finally, one main reason for the high failure of some ICJVs is that the lack of knowledge and capability to complete projects. This research should provide directions to improve knowledge and capability through cultivating collaborative environment after identifying the determinants of improving learning effectiveness. The thesis could eventually serve as useful pointers for company to enhance success in the practice of ICJVs.

1.8 Structure of the Thesis

This thesis is organized into seven chapters. This chapter outlines the overview of this research, introduces the research background and problem statements, research questions and objectives, overview of the research methodology and the limitations of this study, and also provides a structure of how this thesis is organized.

In the second chapter, a literature review of learning as a research topic in general is carried out. Most of the literature is arguably developed with regard to all kinds of industry. The development situation of ICJVs and the current issues are presented. Key relevant thoughts and theories that form the study of learning are summarized to build the fundamentals of research model of the next chapter.

Chapter three focuses on model development. A key part is the construction of a research model that facilitates variables extracted from different areas. Then the detail of four constructs of the model will be elaborated in detail and the hypotheses are made on the relationship of this model.

Chapter four discusses the research design and methodology. Variables in the research model are used for the research design and choosing the methodology for qualitative and quantitative analysis. The next part is developed by the detail of the

research design including the questionnaire content and personal interviews and the scope of the sample. At last, the chapter also discusses the data analysis method chosen.

Chapter five is about the qualitative analysis with case studies. Six cases gathered from China and Singapore are described separately, and then the importance and relationship of some key variables in different JV's development stages related to the learning topic based on this research model are identified and discussed in depth.

Chapter six is about the quantitative study and statistical analysis. Firstly, it is the description of the data gathering, normality of data, and the reliability and the validity analysis. Secondly, factor analysis is undertaken to reduce the variable number. Thirdly, the multiple regression analysis is used to test hypotheses made in chapter four. Finally, it is the discussion of quantitative findings that validates and supports the research model and case study results. From the discussion, findings of study achieved by different methods support each other and also linked to the relevant literatures.

The last chapter summarizes the main conclusions of the thesis and contributions made by this research with some limitations mentioned. The implications of these findings should be observed in construction companies' successful learning experience and help them improve learning effectiveness in ICJVs. This is then followed by a recommendation made on possible future research directions, such as solving the limitations that haven't been fulfilled by this thesis.

1.9 Summary

This chapter is to build the foundations for the proposed research and show its significance. After an overview of the research, research background is introduced, and then the research problem is identified, followed by the research questions and objectives. The research methodology section covers how the study is going to be conducted, which is continued with the scope and significance of this research. Finally the outline of the thesis is stated for the subsequent detailed work.

The next chapter will review the relevant literature about the development and issues of ICJVs as well as learning.

Chapter 2 Literature Review

2.1 Overview

The focus of this review is on ICJVs in the learning aspect in order to provide a thorough understanding of the research domain, and the review embraces the learning aspect in IJVs in other industries. The chapter begins with background information on the introduction and definition of JVs that is adopted for this study. This is followed by a review of the development, problems encountered in ICJVs, and feasible solutions provided by researchers and used in practice. It is continued by a review of the relationship between the development of construction industries and JVs, which presented the opportunities of learning in JVs. Moreover, the importance of learning associated with JVs and current literature on learning approaches, and learning organization are reviewed, it further reviews current research of learning in JVs and integrates learning in international construction ventures. Finally, the chapter reviews those theories and issues that would provide a sound foundation for the conceptual model constructed later in this research. The details of this chapter are depicted in Figure 2.1.

Figure 2.1 Main Flow of Chapter 2

2.2 Introduction to JV

Multinational enterprises are faced with many different options for doing business in a foreign country. These options include license/franchise, indirect export, direct export, sales subsidiary, wholly owned production subsidiary and international joint venture (IJV). In practice, many firms realize that in many situations cooperation through mechanisms such as strategic alliances can help them more than competition (Buckley and Casson 1988). Strategic alliances (JVs, cooperative agreements, etc.) are partnerships between firms that work together to obtain a strategic objective (Killing 1983). Strategic alliances are increasingly becoming an alternative to, or even a replacement for, the role that acquisitions have traditionally played in diversification strategies. For example, Beamish (1988) found that there were four times as many strategic alliances as there were wholly-owned subsidiaries for US-based firms.

Many researchers have defined JV in different ways. Their definitions are similar in the aspect that a JV is a separate legal entity with ownership shared by both partners. For example, Pfeffer and Nowak(1976) defined JVs as legally and economically separate organizational entities created by two or more parent organizations that collectively invest capital and other resources to pursue certain strategic objectives. Lynch (1989) further defined a JV as a cooperative business activity, formed by two or more separate organizations for strategic purposes, which created an independent business entity and allocated ownership, operational responsibilities, and financial risks and rewards to each member, while preserving their separate identity/autonomy. These definitions show that a JV takes the form of a limited liability company with the status of a legal entity, sharing the profits as well as losses and risks. The key difference between JVs and other strategic alliances is that with an IJV, a new independent business entity is formed.

A JV is considered as an IJV if at least one partner is headquartered outside the JV's country of operation, or if the venture has a significant level of operations in more than one country (Geringer and Hebert, 1989).

The ICJV is one sector within an IJV where the partners' business lies with the construction projects. Referring to the definition of JV, this study defined ICJV as: "A cooperative construction business entity formed by two or more separate organizations from different countries, or an entity formed by two or more separate organizations from same country to participate in an overseas construction project located in a different country, which creates an independent construction business entity and allocates ownership, operational responsibilities, and financial risks and rewards to each member, while preserving their separate identity/autonomy".

From the definition, an ICJV has links to at least two separate organizations, one construction project, one independent entity and two different countries. This definition is popular and fits well with the globalization of the world economy that is shown in the following review.

2.3 Development of ICJVs

A JV is one type of strategic alliance partnership between firms that work together to achieve a strategic objective (Killing, 1983). In recent decades, strategic alliances are increasingly becoming an alternative in diversification strategies. Badger and Mulligan (1995) looked upon construction JVs as one of the many forms of strategic alliances, set-up to allow companies from all industrial sectors to compete within the global economy.

Of all of the different cooperative strategies, IJVs have developed quickly to become the most widely used form of doing business in a new market. For example Anderson (1990) found more IJVs and other types of collaborative ventures started between 1981 and 1990 than in all the previous years taken together. Lynch (1989) indeed found the number of JVs increased nearly ten fold between 1980 and 1989.

During the last decade, IJVs have been increasing in relevance and occurrence all over the world. Many experts expect this trend will continue (Anderson, 1990). Many US multinational enterprises (MNEs) and host-country executives believed that, for a

MNE, using an IJV with a private firm in the host country as its partner was the optimal choice as compared to other possible methods of foreign direct investment. Therefore, IJVs have begun to replace wholly owned subsidiaries as the most common form of foreign direct investment by multinational enterprises (Geringer and Woodcock 1989).

In addition to featuring in the manufacturing industry, the IJV mode has also been developed in construction industries since the middle of last century. For example, in Japan, after Kajima introduced the JV concept to team up with Kumagai Gumi to construct a new U.S. Army barrack at Camp Fuji in Japan in 1950-1951, the concept of ICJV was becoming popular in the international construction area in Japan from then on.

Many large Korean contractors such as Hyundai Engineering and Construction Company have a similar development history to those in Japan. Hyundai was founded in 1950, and developed by doing extensive work for the US Army through JV during and after the Korean War as well as the Vietnam War. In 1981, Korean contractors captured eight of the top twenty-five slots for international contractors in the category of “Top 25 International General Building Contractors”.

Learning from the Japanese, Singapore government also recognized the advantage of JVs and supported the JV mode in public contracts since its independence in 1965. The ICJV is especially developed in the MRT project, as Sridharan (1995) pointed out that 21 out of the 36 contractors for the construction of the \$5 billion dollars MRT projects were awarded to JVs.

As in China, it is cautiously opening its construction market to overseas companies, the report from the Ministry of Construction (MOC) shows that the number of foreign contractors who have obtained the business certificate from the Chinese government has rapidly increased (Shen et al., 2001). There was none foreign contractor at the beginning of 1990s; by the end of 1996 there were 118; and by the middle of 1997, the number has increased to 139. Meanwhile, Sino-foreign construction JVs have

grown from 1,200 in 1994, to 1,600 in 1995, and over 2000 by the end of 1996 (Shen et al., 2001).

Recently, JVs are also appearing in the construction industry particularly in forming consortia to undertake a BOT/BOO/BOOT project. A large number of foreign construction investors and contractors have entered into developing economy's construction industry in the formation of JVs with local firms.

Therefore, in the construction development history of many countries such as Japan, Korea, Singapore and China, JVs have been widely used and played important roles. It is supposed that ICJVs will continue to grow and play important roles in the future.

Although IJVs have been developed and will further expand in construction area, ICJVs are still less studied compared to manufacturing industries. In addition, in practice, many ICJV encountered many problems such as weak performance and instability, and poor working relationships. Therefore, it is significant and there is much research in ICJVs still to be done. Some of the problems are identified in the next section.

2.4 Common Problems of IJVs and ICJVs

Although international joint ventures developed well all over the world, many companies in IJVs run into some problems. The first problem is the low level of satisfaction with IJV performance identified by the high failure rate (Beamish and Delios, 1997). Geringer and Hebert (1991) reported that estimates of unsatisfactory IJV performance ranged from 37 percent to more than 70 percent. Similarly, Raffee and Eisele (1994) came to the conclusion that more than 50 percent of cooperative ventures should be classed as failures.

The second problem is the high instability rate. It is widely recognized that IJVs represent an inherently unstable and problematic organizational form (Das and Teng, 1998; Yan and Luo, 2001) with reported instability rates ranging from 25 percent to 75 percent (Geringer and Hebert, 1991; Yan and Luo, 2001).

Significant problems may arise with political and cultural differences stemming from one JV partner not understanding the political and historical pressures influencing their partners. JV partners also risk being implicated in their partner's corruption and/or illegal activity perhaps due to poor definition or interpretation of laws and regulation applying to the project.

Generally, IJVs face the above sets of problems, so the ICJVs may face similar problems plus others that are specific only to the construction industry alone. Although a significant number of studies have identified JV problems across different industries (Cohen, 1982; Campbell, 1989; Shenkar, 1990; Chan and Chu, 1992; Nutwell, 1992; Hu and Chen, 1993; Freeman, 1996; Child, et al., 1997; Lan and Jackson, 1997; Yan and Luo, 2001), only a few of them are related to ICJVs. Some of these are reviewed below.

The construction industry has a long tradition of adversarial relationships between firms in JVs. This has led both to poor quality and productivity in projects due to information and knowledge hiding, and to major barriers to learning lessons for future projects. Hao and Scott (2001) identified the common thread of all the problems associated with construction JVs in China, as being the lack of a dynamic means by which to manage the vast amount of constantly changing quantitative and qualitative information.

Most of the time, the adversarial relationships come from partners' misunderstanding of various differences with other partners. For example, Dalle and Potts (1999) found the majority problems U.K. contractors encountered in ICJVs arose from different culture, different operational methods, management styles and accountancy practices with their partners.

There is high degree of variability and uncertainty associated with construction JVs. Morgan and Henrion (1990) suggested that uncertainty may arise due to incomplete

information, disagreement between information sources, linguistic imprecision, or simplification and approximations.

The above discussion shows one way to solve the problem of how to improve the performance of ICJVs is to improve the understanding of differences and improve overall knowledge. Delors (1996) mentioned “learning to know, learning to do, learning to be and learning to live together” as four pillars of knowledge or fundamental types of learning essential to full personal and social development in the twenty-first century in his report to the United Nations Educational, Scientific and Cultural Organization (UNESCO). What Delors mentioned revealed a way for a better performance, which is learning.

However, in the ICJV practice, learning has not been much attention and study devoted to the sector of ICJVs, particularly so where the performance is generally regarded as not very satisfactory in practice. On the other hand, though some companies reckon the importance of learning in the process of the JV, the learning has not been systematically organized to reap the full benefit of learning effectiveness in their ICJVs and the outcomes of learning are generally not encouraging. These phenomena can be significantly attributed to the lack of systematic guides available due to the shortage of research made in this area of study.

Summarized from the above, considering low performance, a lack of satisfaction and the dynamic instability rate in JV practices, many problems arose from differences in politics, culture, strategy and management styles in an uncertain environment, with insufficient information and knowledge, which affect the issue of learning.

2.5 Different Attitudes of Learning

To be able to fully understand the learning aspect, the following sections will review the importance of learning, the approaches of learning, learning organization theory and the relevant study of learning in JVs.

2.5.1 Importance of Learning

The importance of learning within organizations has long been considered as an important determinant of technological progress and the raising of efficiency and productivity. Theorists have suggested that the most important asset for the organizations is knowledge, and the most important capability is how to learn (Grant and Baden-Fuller, 1995). Garratt (1987) and Degeus (1988) have suggested that the only competitive advantage for organizations is their ability to learn faster than their competitors. It means learning faster than their competitors is important for success in business. Recent research on IJVs showed that the learning process was an important determinant for the formation of strategic alliances (Hamel, 1991; Kogut and Zander, 1992; Inkpen and Beamish, 1997). That means the ability to learn is probably the most important intangible asset that a company can possess.

Practitioners and scholars alike have focused attention on the concept of learning because organizational learning is a key prerequisite of innovation in an effort to achieve success in uncertain, dynamic environments (Hurley and Hult, 1998).

Parkhe (1991) identified five dimensions of inter-firm diversity in global strategic alliances, namely societal culture, national context, corporate culture, and strategic direction, as well as management practices and organization. Parkhe (1991) argued that the diversity had negative effects on the longevity and effective functioning of an alliance, but organizational learning and adaptation could mitigate the impact of diversity, i.e. the partnership can be strengthened when the partners learned to analyze their diversity and to devise solutions to accommodate the differences. This implies that in modern business, the knowledge of managing international strategic alliances has become an essential resource of most firms, and learning is the means to acquire and accumulate the resource.

Joint learning in alliances contributes to the sustained performance of the alliance and the transfer of knowledge which results in the perceived success by the partners of these firms (Morrison and Mezentseff, 1997). Fiol and Lyles (1985) suggested that

irrespective of the underlying interpretations of organization learning, “in all instances the assumption that learning will improve future performance exists.” Evidence to the contrary suggested that although learning affected the performance of the organization, this performance adjustment might not necessarily be positive. Levitt and March (1988) comment “Learning does not always lead to intelligent behaviors” implying that not only can the input to learning be negative, and often ignored, but the outcome of learning could also be unexpected.

Bolisani and Scarso (1999) suggested that there should be a continuous exchange of knowledge with external sources to facilitate learning. JVs can act as vehicles for learning or the means for technology transfer diffusion (Jones and Lall, 1998; Carayannis et. al., 2000). According to Inkpen (1998), when organizations with different skills and knowledge decide to forge an alliance, it provides each partner with an opportunity to learn. This learning enables the firms to facilitate their action plans and also to provide capacity for adapting to changes through an improvement in their performance.

Although learning is important to the performance improvement of business, many companies recognize the process of value creation through learning is difficult (Anand and Khanna, 2000). It needs to build a systemic learning model to improve the behaviors of learning to achieve better learning effectiveness. In the following section, approaches of learning are reviewed.

2.5.2 Learning Approaches

This section reviews the learning approaches including learning from experience and learning from partners in JVs.

It has been generally accepted that experience is the ultimate teacher. Therefore, when a business carries out a project, there is a moment of truth where capability is tested, and there is an opportunity to learn. Learning from experience comes extremely naturally to individuals, so people do it subconsciously. However, organizational learning from projects requires focused and well-coordinated effort

especially the business of building construction projects in which learning effort is driven by out-sourcing and decreasing product life cycles. Learning from project experience is now an imperative for all business.

Unfortunately, learning from projects can be difficult. Organizations can easily observe a poor outcome from a project, declare a lesson learnt, and then repeat the outcome in the next project. Organizational learning from experience is more than observing "lessons learned". The opportunity to learn from failure is part of what some experts call "incidental learning". Learning has not occurred until better decisions are made - and more appropriate behaviors exhibited - in future projects. The firms use their JV experiences as a credential, which makes it easier for them to form new JVs. They are viewed as better partners and they have experienced people.

Anand and Khanna's (2000) empirical analysis identifies two important factors that drive value creation in alliances: a firm's experience in managing alliances, and the existence of persistent firm-specific differences in the ability (or inability) to create value through alliances. They find strong evidence that firms learn to create more value as they accumulate experience in joint venturing.

Like other business, experience is one of the key approaches in JVs. The complexity, uncertainty, and ambiguity of JVs are still uncomfortable for firms, but more accurate knowledge of the future probability of certain events has come with experience (Lyles, 1988). Lyles (1988) found unanimous agreement among managers and staff of two US and two European firms, with a successful history of operating IJVs, that there was a valuable transference of experience from previous ventures. This transference took place largely through the sharing of experiences, the continuity of top-management oversight, and the development of management systems.

With the growth of their experience base, the firms have begun to identify certain events that may occur during a JV's life. It was expected that as firms gained JV experience, they would become less risk-averse as they grew comfortable with the joint venture model. The companies were also able to use their experience as a

credential that made it easier for them to form new IJVs. In related empirical work Gulati (1995) shows that pairs of firms appear to learn over time to manage their collaborative activities more efficiently.

As a vehicle of learning, JVs provide another approach of learning. That is learning from other partners. When operating in a transitional economy characterized by a weak market structure, poorly specified property rights, and institutional uncertainty, an IJV seeking efficiency and growth needs an adaptive orientation, a solid supply relationship, comprehensive buyer networks, and a good organizational image (Luo, 1997). The local partner's market experience and accumulated industrial knowledge are of great value to the realization of these goals.

Inkpen (2000) elaborated on this distinction and noted two forms of learning from partners. Firstly, firms may seek access to partners' knowledge and skills but not with the aim of integrating the knowledge in their own operations. This type of partner learning is necessary when firms seek to combine their skills successfully in an alliance. Secondly, a firm may acquire knowledge from its partner that can be used to enhance strategy and operations in areas unrelated to the alliance activities. Learning from partners occurs largely through the transfer of tacit knowledge, in order to enhance competencies and the competitive position of the parent firm — a view given prominence by the resource-based theory (Glaister, 1996; Hamel, 1991).

These firms have learned that partners may acquire their partners' skills, which partner firms may be merger targets and may change hands, and that technology can be a valuable asset in joint venturing. With this increased knowledge, these JV-experienced firms are better able to anticipate major issues and how to handle them.

Learning from strategic alliance is like learning from the JV experience, as it requires an experiential learning process, distinct from learning the other partner's skills (Tsang, 1999). Tsang (1999) noted this did not imply that the partners must have intent to learn. Individual and organizational learning may be an unconscious

activity. However, intent to learn may spur an organization on to higher levels of learning. Hamel (1991) argued that a partner's intent to internalize the other's skills was a key determinant of learning; the stronger the intent, the higher the chance that the partner would win the learning race. Tsang (1999) argued that although learning intent was not a necessary condition for learning, especially experiential learning, to take place, the presence of learning intent in a company was the first step towards learning effectiveness.

Learning involves interaction among partner firms, and the JV, by definition, is a legally separate entity created and managed by two or more different firms by a way of a mutual agreement to share a part of their resources in order to achieve similar objectives and/or interests (Inkpen and Beamish, 1997). The resources involved may be land, labor, capital and knowledge, or any combination of these. This research will study learning from the whole ICJV system.

2.5.3 Learning organization

The literature on learning organizations sees research partnerships as mechanisms enabling firms to learn and enter new technological areas and to function more effectively given technological and market uncertainties. As this statement suggests learning and knowledge are closely linked; where knowledge is a critical output of learning. From an organizational learning perspective, it requires a high degree of mutual involvement in problem recognition and problem solving processes. With suitable conditions, an ICJV organization can be well built as a learning organization. In this section, several definitions of a learning organization are reviewed.

Many definitions or descriptions of a learning organization have been proposed (Senge, 1990, Garvin 1993). Differences in these authors' conceptualizations are captured in their models. The most widely known model is that of Senge (1990), who approaches the learning organization from a systems perspective. Senge (1990) described a learning organization as "a place where people continually expand their capacity to create results they truly desire, where new and expansive patterns of

thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn." He suggested that building a learning organization requires five disciplines: systems thinking, personal mastery, mental models, building shared vision, and team learning. System thinking is the ability to view the world and its problems holistically, as a set of inter-related elements, rather than decomposing phenomena into isolated components and then attempting to reformulate the whole. Personal mastery refers to continually refining and channeling energy toward one's personal vision. The discipline of refining mental models is a process of surfacing, examining, and adjusting one's own and others' worldviews. The fourth discipline, building shared vision, refers to creating a common picture of the future state of the organization which is connected to the personal visions of the individual members and focuses the collective energy of the group. Team learning refers to developing frameworks, processes, and behaviors to learn collectively. Senge (1990) suggests that both individuals and organizations have a role in practicing the five disciplines in order to enhance their capacity for learning and innovation.

Garvin (1993) defines a learning organization as "an organization skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights". He suggested learning organizations as skilled at five main activities: systematic problem solving, experimentation with new approaches, learning from past experience, learning from the best practices of others, and transferring knowledge quickly and efficiently throughout the organization. Systematic problem solving is thinking with systems theory, insisting on data rather than assumptions and using statistical tools. Experimentation with new approaches aims to ensure a steady flow of new ideas, and provide incentives for risk taking and demonstration projects. Learning from experiences and past history is recognition of the value of productive failure instead of unproductive success. Learning from the experiences and best practices of others is enthusiastic borrowing. Transferring knowledge quickly and efficiently throughout the organization is including reports, tours, personnel rotation programs and training programs.

Another perspective on learning organizations is provided by Watkins and Marsick (1993), who are interested in learning and organizational change. They emphasized the connection among individuals, teams, organizations, and society and suggested four action imperatives for “sculpting” a learning organization. The first imperative is for individuals to have continuous learning opportunities embedded in their work such that personal problem-solving and development occur as a natural, integrated part of work. Like Senge (1990), they advocate sharing, dialogue, and partnering with internal and external customers to expand and distribute knowledge across teams. The third imperative resides at the organizational level and requires that leaders create a corporate culture and structure that empowers employees and teams toward a collective vision. The fourth element, which is unique to this model, calls for recognition of the complex interdependencies between the organization and its internal and external environment. These researchers suggest that organizations need to be responsive to the work-life needs of their internal members. Externally, organizations need to contemplate the extent of which their actions enhance their community and are impinged upon by competitors and legislators. Watkins and Marsick (1993) argued that managers must understand and address the nested nature of the four elements in order to maximize their capability for adaptation and transformation.

A fourth model, Marquardt (1996) offers a framework that he terms the systems-linked learning organization model, which is comprised of five interrelated subsystems. The core subsystem of the learning organization is learning. This subsystem encompasses levels of learning (individual, team, and organizational), types of learning (adaptive learning, anticipatory learning, deuterio learning, and active learning), and skills for learning (Senge’s five disciplines and dialogue). The organization subsystem refers to the context in which the learning occurs and includes the organization’s culture, vision, strategy, and structure. The people subsystem includes the various people and entities within and outside the organization, which may participate in and contribute to the learning. The remaining two subsystems, knowledge and technology, that are unique to this model and address the management of knowledge and the tools for doing so. For example, the

knowledge subsystem includes acquisition, creation, storage, and transfer and utilization of knowledge. The technology subsystem encompasses the processes and systems (information technology, technology-based learning, and electronic performance support systems) for coordinating and distributing knowledge.

In general, one can think of a learning organization as an organization in which learning is continuous and transformative at individual, team, and company levels. Summarizing all the above definitions, in this study, a learning organization is described as an organization that has the ability to share ideas, to learn from any source, collectively, continuously and effectively to learn with a free collective aspiration and collaborative climate, the knowledge is continuously created, acquired, transferred and transformed, and the organization can modify its behavior to innovate and develop itself after knowledge change. Later, the learning effectiveness in the JVs will be measured from the learning organization perspective in this study.

2.5.4 Current Research of Learning in JVs

Some studies focused on learning in JVs. In a successful JV, the exchange of knowledge as well as individual and collective learning together creates organizational learning (Francis, 1997). Supporting this view, Senge et al. (1994) argued, while individual learning did not guarantee organizational learning, the latter could not occur without the former. The collective insights of these individuals, working together, will facilitate organizational learning. This suggests that group dynamics and sharing of ideas will be important for learning in JVs.

Child and Faulkner (1998) noted that collaboration could enhance organizational learning through the accumulation of experience and knowledge about how to manage alliances. Moreover, this benefit is becoming increasingly significant at a time when more business activity is being organized through strategic alliances. Clearly, collaborative know-how might be used later in the design and management of other collaborations.

According to Senge (1990), teamwork is becoming the key learning unit in organizations, because almost all important decisions are now made in teams, either directly or through the need for teams to translate individual decisions into action.

Cohen and Levinthal (1990) related each firm's learning ability to its 'absorptive capacity'. Absorptive capacity refers to the ability of a firm to understand and exploit knowledge in various knowledge domains, and may be used as a measure of a firm's ability to acquire knowledge from an alliance relationship. The greater the absorptive capacity of a firm, the more knowledge it can appropriate from a given volume of alliance-generated knowledge.

They also argued that this ability was relative to the organization's level of prior existing knowledge - which included factors such as basic skills possessed by employees, the common language they shared and also including knowledge of the most recent scientific or technological developments in a given field.

Hence it is important to recognize that a firm's absorptive capacity is not simply the sum of individual's absorptive capacity, rather it depends on the ongoing exchanges of individuals embedded in organizations who continually share their knowledge and expertise, building upon the notion that information sharing is critical to organizational knowledge since intellectual assets, unlike physical assets, increase in value with use (Quinn et al., 1996).

Organizational culture will determine absorptive capacity in inter-organizational learning. Differences in national culture have received a great deal of attention in studies of cross-border alliances and acquisitions, and the consensus is that national differences do exist and that these affect both the intent and ability to learn. In general, British and American firms focus more on the legal and financial aspects of alliances, but rarely have either the intent or ability to learn through alliances. In contrast, German and Japanese firms are more likely to exploit opportunities for learning (Sasaki, 1993).

Some other relevant studies focused on what kinds of knowledge can be learned from JVs and how to learn. In asking how exactly might firms learn to manage alliances, or acquire an alliance capability, Anand and Khanna (2000) break the question into two parts: first, how individuals within the firm learn and, second, how firms harness the learning experiences of such individuals.

Inkpen (2000) presented concepts on how to form and manage IJVs which involve the acquisition of knowledge useful in the design and management of other alliances which may be applied to the management of future alliances.

The object of learning from a partner is usually a certain technology, or other types of knowledge. This learning motive is strong in alliances where the firms desire to discover new opportunities or to acquire new capabilities (Dussauge, et al., 2000; Khanna, et al., 1998; Koza and Lewin, 1998; Lane, et al., 2001; Nit and Kumar, 2000). Hence increasing numbers of IJVs are being created because both partner companies hope to acquire new competencies by combining their resources in a process of inter-organizational learning (Büchel et al., 1998).

Büchel et al. (1998) argued that the important thing was to learn how a JV worked, the problems that arose and the possibilities that existed for organizing, guiding and developing in different areas. This concept of learning emphasizes that managing an alliance with a partner is itself a great learning experience, especially if the partner is a foreign company.

Kramlinger (1990) focused learning on increasing collaboration within and between workers and work units; improvement learning, which concentrates on improving products and processes relative to customer requirements; and alignment learning to gain agreement on and commitment to a common vision.

More recently, firms from the US and Europe have used alliances and JVs with Japanese firms to learn new operations skills, for example, production management, and supplier chain management (Dale and Tidd, 1991).

Some important factors mentioned here will be further studied in this research. Some similar kinds of knowledge in ICJVs will also be considered in the future study.

2.5.5 Integrating of IJVs and Learning

Büchel et al. (1998) identified two different kinds of learning in JV, they are 'learning the other partner's skills', i.e. co-operating to learn, and 'learning from strategic alliance experience', i.e. learning to co-operate. Both of them significantly contribute to the performance and development of JV and the parent companies.

JVs need to learn to become more effective (Cahill, 1997). In the construction industries, the effectiveness is measured by the ability of JVs to ascertain the needs of the clients and also to create new products and services to satisfy their needs. The unbounded markets characterized by intense competition and diverging clients' tastes demand JVs learn to innovate continuously and adapt to these changes so they are able to compete successfully (Drew and Smith, 1995; Kay and Bawden, 1996; Kumar, 1997; Buckler, 1998). This accelerated rate, and the extent of change, implies that for ICJVs, success will be more dependent on the learning that they achieve and how they use it (Rifken and Fulop, 1997). For developing countries, in the absence of adequate opportunities to innovate, learning in JVs will be concentrated in the area of efficiency in productivity, and leading to improved performance.

Knowledge and experience are important factors contributing towards business success in the modern information era and the JV offers a vehicle of learning which provides opportunity to access relevant information, knowledge and experience. Lyles and Salk (1996) advanced the IJV literature by testing the common assumption that the more knowledge learned from foreign parents, the better the IJV's performance. They found support for this across several different measures of IJV performance in Hungarian IJVs. However, Berdrow and Beamish (1999) showed there was a relationship between learning activities and knowledge gained in IJV and used a large survey data of IJV learning activities to indicate a marginalization of learning opportunities and tangential relationship between learning and IJV

performance in the manufacturing industries of Canada and the US. Therefore, the relationship between learning and IJV performance may be differ in between countries or within different industries.

Swierczek and Dhakal (2004) mentioned, in response to dynamic operating environments and rapidly changing technologies, that manufacturing JVs are required to learn to innovate swiftly and to adapt to new technologies. They presented some example JVs in developing countries like Thailand and Nepal. They found that learning made efficient use of man-hours, machines and materials thereby enhancing performance. Since the operations of JVs in Thailand were longer than those in Nepal, Thailand's JVs were able to gain a significantly higher level of improvement compared to those in Nepal with more chance and more time to learn during the JVs' cooperation.

Büchel et al. (1998) presented the case of how a parent company learned management knowledge from its IJV to improve itself: As Xerox in the US realized that its position in the copier industry was declining in the 1980s, the importance of the Fuji Xerox JV began to increase. The CEO of Xerox started to take a closer look at the internal management activities of Xerox Fuji since the manufacturing costs and the reject rates were substantially lower than in the American operation. Soon, Xerox executives visited the Fuji Xerox operations and started to employ similar management practices like the benchmarking and qualifying programs implemented within the JV. In the late 1980s and early 1990s, these efforts started to bear fruits and Xerox increased its competitiveness in the American market.

However, Büchel et al. (1998) also mentioned that cooperation of learning would only be possible if the partners tried to create a win-win situation for all the companies in the JV system and the most important preconditions for the transfer of knowledge from the JV to the partners was the existence of a learning intention.

Büchel et al. (1998) gave the case of Ericsson and HP. When these two companies created a JV EHPT, the partners were already planning to acquire knowledge through

the JV. After the JV had been operating for a year, the partners were satisfied with its economic performance, but their learning objectives had not been met. Ericsson gained very little by the way of HP's skills through the JV, and HP increased its knowledge of the telecommunications market only to a very small extent though both companies had expected to gain accesses to the core skills of the partner.

Although the partners shared these learning objectives, neither did much to realize them. The interfaces that were needed to increase the exchange of information between the organizations were not created and there was no transfer of personnel, which would have permitted employees to transfer skills between the companies. The partners therefore had to rely on their own employees returning from the JV to bring them knowledge.

The above examples studied the significance of knowledge and learning to improve the JV's performance in some industries. Although ICJVs are very different from other industries, learning is also significant in the construction area. The ICJV combines the effects of the complexity of construction projects and the uniqueness of international business that includes many differences in culture, management styles, trade barriers, and unpredictable political and economic environments (Han, 1999). Also, construction JVs are typically larger in size and more complex technologically and organizationally than their counterparts in other industries. Due to the distribution of projects in different locations, construction JVs tend to be more project oriented, more mobile and subject to more environment influences (Demacopoulos, 1989). The complexity and many problems encountered in JVs and the construction industry required a knowledge improvement which would contribute to the JV's and the parent companies' performance as well, and the JV itself provides the opportunity to learn from the partner company which will improve companies' competitive ability.

Although it's generally accepted that IJVs also provide a learning opportunity in construction areas, some studies show that learning and technology transfer were not effectively reached in practice. For example, Chai (1997) found that although

Singapore contractors have opportunities to imitate in the area of technological transfer through a JV with the Japanese, it has unfortunately not been practiced. This suggests that whether the company can effectively find a way to get the technology transfer is uncertain, and there have been many problems related to effective learning from ICJV which need to be explored.

However, there is no specific study on how to improve the learning effectiveness or how to make use of this learning opportunity in ICJVs, which reveals that there is a need for further exploration in the field of learning in IJVs.

2.6 Relevant Issues of learning in ICJVs

This section reviews the four main relevant issues of learning in ICJVs: conditions of learning, success factors in learning aspects, learning actions in ICJVs and measurements of learning effectiveness.

2.6.1 Conditions of Learning in ICJVs

For learning to be a conscious activity of the participants in IJVs, several conditions in the pre-inception stage of JV need to be presented. Beamish and Berdrow (2003) identified three key conditions that could facilitate or inhibit learning within IJVs as: motivation, intent and choice of partner. Among these three conditions, many researchers have identified the associated variables from the characteristics of external environment and partners.

Numerous studies have examined the motivations of IJVs. Beamish and Berdrow (2003) noted that among other motivations, an IJV must have been formed for the purpose of learning. Some of the motivations, which are found related to the purpose of learning, can be identified from the external environment. These include the government support, complexity and the potential of the host market.

On the aspect of government support, some governments provide preferential treatment as support to forming JVs. For example, Levy (1993) reported that the

Japanese government provided subsidy to encourage JVs to bid on public projects. Similarly, Chai (1997) stated that the Singapore government had encouraged foreign construction companies to team up with suitable local companies by providing preferential margins of up to \$5 million dollars over other contractors. The main reason behind a government's support is found to relate to learning focusing on technology transfer during the implementation of the projects. Apparently, the expectation and support of local government forms a significant part of the motivations for some of the contractors in their participation in a JV endeavor.

Motivations of IJVs from the external environment also include the conditions of a host market. Beamish and Berdrow (2003) found the strongest motivation for engaging in an IJV was to gain access into new geographic markets. The new geographic market is generally complex to foreign participant due to the lack of knowledge about it. The complexity of a market would naturally increase the need for knowledge. For example, to survive in the complex market like Asia, Gale and Luo (2004) found that foreign companies have to learn and obtain know-how on handling projects in the process of JVs in a specific host market. On the other hand, new geographic markets would also provide higher potential, which in turn enhances the willingness of both the foreign contractors and the local contractors to explore their business jointly and share knowledge with each other. As a matter of fact, the strong economic growth in Asia during the past few decades has boosted market potential in construction and encouraged large numbers of multinational companies (MNCs), largely American and European, to form JVs with local companies bringing advanced technology and management skill into these booming markets. The above examples illustrate that a market's complexity and its potential relating to the acquiring of knowledge, would form the motivations of ICJVs.

While the motivation describes the reasons for engaging in IJVs, the intent, on the other hand, guides the behaviors concerned by establishing desired outcomes. Hamel (1991) and Inkpen (1998) have identified intent as an important determinant of efforts a firm would put into learning in a JV. Howes and Tah (2003) further

indicated that the intent to transfer existing knowledge, acquire knowledge, develop new knowledge through JVs and apply new knowledge later, have strong relationships with the actual engaging in learning. In this context, the intent is deemed to determine on learning efforts and relate to the actual engaging in learning; and thus would affect a partner's learning effectiveness in a JV.

Beamish (1988) found that partner choice is important to IJV success. Among many factors in partner choice, only development feasibility and absorptive capability are considered and discussed here as two important factors in terms of learning. A partner's development feasibility could be reflected by a company's management structure and its development strategy. To a large extent, decentralization and the organic degree of a company reflect flexibility in a company's organizational structure. In general, a more decentralized and organic company would exercise more flexibility in its operation, which will provide more opportunities for learning in JVs. Similarly, Anderson (1990) found that the development strategy of a company provides a company with development feasibility in diversification and engaging future business which in turn, require more knowledge and spurs a company to learn more actively.

Absorptive capability, which signifies a partner's learning ability to recognize the value of new knowledge and subsequently assimilate them, forms part of the learning conditions. In this respect, Hamel (1991) identified receptivity and adaptability as a partner's ability to adopt skills; Inkpen (1998) identified that a company's experience increases the probability of recognizing useful incoming knowledge.

From the above discussion, three key learning conditions could be summarized. Firstly, motivation such as government support, market potential and market complexity could be identified from the environment specific area. Secondly, learning intent could be identified from the partner specific area including intent to transfer, acquire, develop and apply knowledge. Thirdly, partner choice could be identified from the partner specific area including a partner's development feasibility and absorptive capability. The above literature review also suggests that these three

conditions of learning in IJVs are embedded in the characteristics about the environment and the partner companies that are identifiable during the pre-inception stage of a JV.

2.6.2 Success factors of ICJVs in learning aspect

From an organizational point of view, Lei and Slocum (1991) found in essence, the success of any JVs is derived from the ability to learn from another partner's strength while preserving one's own sources of competitive advantage. Although few studies placed their focus on the success factors of learning in IJVs, Lei and Slocum (1991) and Inkpen (1998) have many studies on the success factors of IJVs. This paper discusses the most relevant success factors in the learning aspect from JV's operational characteristics such as the JV's structure and management competency, to the relationships and interactions among JVs.

Egbu (2000) indicated proper organizational structure as a success factor for promoting knowledge sharing. Gido and Clements (1999) believed that the structure of JV's integration affects the success of learning. These findings explain that the integration of JVs provide collaboration as well as learning opportunities for partners.

Inkpen (1998) discussed the importance of management competency to the success of IJVs in the study of organizational learning in JVs. This study considers management competency from the authority of running JV independently to the power of making major decisions.

Mutual trust, cultural understanding and business relatedness can identify the relationship among JVs. Lei and Slocum (1991) and Inkpen (1998) found that trust is one of the primary variables for partnership success. Anderson (1990) considered trust as an important feature of relationship quality, in addition to power, communications, and compatibility. Thus, trust forms an essential element for cooperation, which in turn will influence its organizational learning effectiveness. This study assumes that partners need to build mutual trust to better learn and cooperate in the JV.

Good relationships must also build on the cultural understanding between partners. Lorange and Roos (1993) suggested that an IJV's success was linked to firm's ability to understand and adapt to cultural differences. Cultural compatibility is also found significant to accept the foreign partner's knowledge. Hence, cultural understanding is important to the IJV's success and significant to access other's knowledge. Thus, it is proposed that cultural understanding would affect learning effectiveness in this study.

The other relationship is the business relatedness among partners and JV. Inkpen (1998) suggested that if the IJV is involved in an unrelated business, it is unlikely for collaboration on knowledge creation. Conversely, this study suggested that the business relatedness of IJV and partner would affect collaboration for learning and knowledge creation.

Inkpen (1998) found that management support and training by the partner provide a vehicle and solution for learning and knowledge transfer. Hence, this study considers management support and training provided by partners as two variables of interactions among JVs.

The above discussion on success factors suggests that some of the success factors of IJVs are actually embedded within the determinants of learning in an IJV. These determinants can be organized into a construct that displays the characteristics of IJVs during the JV's formation and organizing stage. Variables such as JV's structure, management competency, mutual trust, culture, business relatedness, management support and training would be grouped under the construct of JV's characteristics in this study.

2.6.3 Learning actions in ICJVs

Robbins (1997) said, intention and capability are only parts of the equation for success, a major part of success is action and action produces results. Thus, the most direct impact on learning effectiveness is created by learning actions, which

are the daily learning activities that take place in the JV. This thinking is also in line with the concept of “learning by doing” which is popular in the construction practice. Richter and Vettel (1995) thought companies must undergo a learning sequence consisting of the perception, internalization and abstraction of the partner firm’s knowledge resources to expand their own corporate knowledge base. For example, Levy (1993) found that Japanese have learned a great deal from the U.S. construction industry when they form cooperative JVs with overseas companies by not only with learning in mind but also in taking corresponding learning actions all the time.

Many researchers have identified some important factors about the learning actions in cognitive and behavioral aspects. Hoff et al (2004), Bryan (2003) and Senge (1990) argued that achieving learning success entails cognitive actions of self-examination, sharing visions, experience and providing supportive attitudes in the IJVs. On the other hand, relevant works of Hoff et al (2004), Senge (1990), Jashapara (1993) and Watkins and Marsick (1993) show that behavioral actions such as engaging problems actively, listening to others, accepting staff’s best suggestions, and knowledge management actions such as developing and creating new knowledge in work, gathering and recording knowledge, and applying new knowledge are also significant to learning.

As discussed above, learning actions which includes both cognitive and behavioral aspects can be collectively investigated during the implementation and adjustment stage of IJVs, will form a construct of the conceptual model in this study.

2.6.4 Measurement of Learning Effectiveness in ICJVs

To better measure the learning effectiveness, it is needed to consider the definition of learning. Learning can be defined in various ways as proposed by researchers in the prior literature review. This study adopts the definition of learning in JV as stated by Büchel et al. (1998) who stressed that: “Learning in the JV system means transferring knowledge from the JV back into the partner company and integrating it into the knowledge base so that the company can use it later for its own purpose”. Büchel et al.

(1998) has further identified two types of learning in JV consisting of (1) learning to cooperate and (2) cooperating to learn. It is noted both types of learning are in fact interdependent and each could significantly contribute to the learning effectiveness and performance of the JV as well as the partner companies. Thus, this concept would be employed as the way of measuring learning effectiveness in this study.

In Büchel et al. (1998)'s definition, learning to cooperate means and striving towards a growing understanding of the processes and specific problems encountered in JVs, and continuing to develop one's own practices and competencies in JV management. It emphasizes the importance of the technology or know-how of the other partner so the result of learning to cooperate is basically focused on knowledge and capability improvement. Similarly, Beamish and Berdrow (2003) also recognized knowledge and capability improvement as a direct learning outcome. A knowledge and capability improvement could thus be regarded as the main part of learning effectiveness that could improve technology, management, knowledge and working capability for individuals, the JV team and the organization.

On the other hand, in Büchel et al. (1998)'s definition, cooperating to learn means using JVs as a medium for organizational and inter-organizational learning, and the aim of cooperating to learn is to enable the partner companies to learn in JVs. It emphasizes the learning environment improvement. At the same time, Dodgson (1993) also contended that learning effectiveness improvement between partners depends on the construction of a 'climate' of trust engrained in organizational modes of behavior, and supported by the belief in the mutual benefits of collaboration throughout the organization. Therefore, the result of cooperating to learn should improve the collaborative environment in JVs. As collaboration provides a medium for cooperating to learn, collaborative environment improvement could be regarded as the second main part of learning effectiveness.

As discussed above, knowledge and capability improvement and collaborative environment improvement form the two main parts of learning effectiveness. Through the study of learning organization, it is found that learning

effectiveness could be satisfied in a learning organization. Firstly, Ellinger et al. (2002) summarized many definitions of learning organization focusing on the first part of learning effectiveness, namely knowledge and capability improvement such as acquiring, improving, transferring knowledge, facilitating individual and collective learning, as well as integrating and modifying behaviors of the organization with its members. On the other hand, Senge (1990) described a learning organization as a place where people continually expand their capacity to create results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people can continually learn how to learn. It is noted that Senge (1990)'s description of learning organization placed focus on collaboration throughout the organization, which concurs strongly with the second part of learning effectiveness.

Noticeably, both Ellinger et al. (2002) and Senge (1990) defined a learning organization as an organization that provides a collaborative environment where people can effectively improve knowledge and capability continuously and successfully. As this description of a learning organization encompasses both parts of learning effectiveness as discussed earlier, its characteristics will be used in this study to measure the learning effectiveness at the completion stage of a JV.

2.7 Summary

JVs, learning and construction industries were reviewed in order to establish a need for the study and to identify problematic areas and shortcomings. It is the shortcomings, common to most of the models, which clearly show the necessity of producing a learning model capable of dealing with the complexities and inter relationships of factors involved in learning from ICJVs. From the literature review, it is found that although learning can solve some of the problems in the development of ICJVs, there is lack of systematic study in the research of learning in ICJV sectors. There is a gap between the general learning and the context of ICJV, and there is also a gap between academic and empirical study. The systematic literature reviewed in this chapter provided a solid foundation for development of such a model.

The next chapter will establish a research model for improving learning effectiveness based on the rationale identified in the literature review.

Chapter 3 Research Model for Improving Learning Effectiveness in ICJVs

3.1 Overview

As explained in Chapter 1, the objectives of this study include identifying determinants critical to learning effectiveness in ICJVs and incorporating them into a learning model. In pursuit of these objectives, as shown in the following Figure 3.1, this chapter firstly introduces the learning system in the ICJV scope, which includes the JV organization, the partner companies and the environment, where learning is considered in the JV's four development stages. Within the scope, this chapter builds up a learning model and reviews some more detail of all the variables. After that, six hypotheses were built on the proposed model. Finally, it is summarized of this chapter.

Figure 3.1 Main Flow of Chapter 3

3.2 Learning Systems of JV

Learning in the JVs system means transferring knowledge from the JV back into the parent company and integrating it into the knowledge base for future use. Generally, assuming there are only two partners, a simple ICJV system is showed in Figure 3.2. Partner A and Partner B form a new entry JV company or contractual JV companies specifically for a construction project together. The environment creates an ICJV system. Based on this, learning in an ICJV system includes three important parts. They are learning within the JVs, learning between the JV and the partner company and learning within the partner company. Some important aspects need to be considered in these three parts and will be further explained and discussed in the following sections.

Figure 3.2 ICJV System

A dynamic approach to JVs can describe and explain changes in the JV system over time. Therefore, the learning model should accommodate the different development stages of JV.

The literature contains numerous models that show the different developmental stages of JVs. Kogut (1988) proposed that development of a JV is a sequence consisting of creation, institutionalization and termination. Dwyer et al (1987) distinguished five stages that they called awareness, exploration, expansion, commitment and dissolution. Zajac and Olsen (1993) described stages that they

called initializing, processing and reconfiguration, and drew attention to the cyclic relationships amongst them. During the initial stage the preliminary conditions are set. In the processing stage, learning processes take place and the first behavior patterns develop. In the reconfiguration stage, the JV is evaluated and this may lead back to the first two stages. Büchel (2003) investigated the development of JV by proposing a model built on three stages including formation, adjustment and evaluation.

Wong (2002) identified JV's four development stages as the pre-inception stage, formation and organizing stage, implementation and adjustment stage, and the completion and evaluation stage. This study was based on these four stages.

3.3 Model Development

This study is an attempt to build a model for improving learning effectiveness in ICJVs which can solve some of the knowledge and information gap problems in ICJV practice and provide instructive guidelines for construction companies in steering their planning for improving learning effectiveness particularly in a relatively new host nation. Firstly, integrated the previous studies on organizational learning into JV's specific sector, variables which have relationships with learning were identified, they were arranged into four categories based on the characteristics they represented: environment and partner's characteristics, JV's characteristics, learning actions and characteristics of learning organization as shown in Table 3.1 with their supporting research. Secondly, regarded the four categories as a preliminary model, it was pretest through questionnaire survey and repeated pretest through face to face interview to experienced ICJV experts. After pretest and repeated pretest from the practice and further review from relevant academic research, the revised research learning model with JV's development stages was achieved for the further validating throughout this study.

Table 3.1 Supporting Research of Learning Related Variables

Category	Variables	Supporting Research
Conditions of Learning (Environment and partner's Characteristics)	Government support	Levy (1993), Chai (1997)
	Market complexity	Beamish & Berdrow (2003)
	Market potential	Gale & Luo (2004)
	Organizational strategy	Anderson (1990), Naoum (2001)
	Organizational structure	Foil & Lyles (1985), Guth & MacMillan (1986), Anderson (1990), Barclay (1991)
	Prior knowledge	Si and Bruton (1999)
	Openness	Salk (1997), Si and Bruton (1999)
	Learning capability	Cohen and Levinthal (1990), Hamel (1991), Nonaka (1994), Lyle and Salk (1996), Madhukar (1997)
	Learning intent	Hamel (1991), Inkpen (1997, 1998), Tsang (1999), Berdrow(1999), Howes & Tah (2003)
JV's Characteristics	Integration	Egbu (2000)
	Management Capability	Lorange & Roos (1993), Inkpen (1998)
	Culture	Parkhe (1991, 1993), Lorange & Roos (1993), Tsang (1999)
	Trust	Hrebiniak (1974), Anderson & Narus (1984), Anderson et al (1987), Morgan & Hunt (1994)
	Management Support & Training	Nonaka (1994), Lyles & Salk (1996), Inkpen (1997,1998),
	Business Relatedness	Kogut (1989), Mjoen & Tallman (1997), Inkpen (1997, 1998)
Learning Actions	Self-examination	Hoff et al (2004)
	Share personal vision	Senge (1990), Thompson (2003)
	Share experience	Marquardt & Reynolds(1994), Hoff et al (2004)
	Explain common vision	Senge (1990), Bryan (2003)
	Support over blame	Redding (1997), Hoff et al (2004)
	Ask questions	Hoff et al (2004)
	Listen to others	Senge (1990), Argyris (1991),Jashapara(1993),
	Solve problem together	Watkins & Marsick (1993)
	Develop & create knowledge	Senge (1990), Hoff et al (2004)
	Record knowledge	Walsh & Ungson (1991), Büchel et al.(1998)
	Apply new knowledge	Senge (1990), Hoff et al (2004)
Characteristics of Learning Organization	Collaborative environment	Tobin (1993),Kovach (1997), Abbey (1997)
	Continuous learning climate	Tobin (1993), Bennett and O'Brien (1994), Kovach (1997)
	Consistent vision	Senge (1990), Tobin (1993), Bennett and O'Brien (1994), Kovach (1997), Byran (2003)
	Competent leaders	Senge (1990), Marquardt & Reynolds(1994), Byran (2003)
	Open communication & dialogue	Tobin (1993),Kovach (1997), Byran (2003)
	System thinking	Senge (1990), Senge (1990), Marquardt & Reynolds (1994), Abbey (1997)
	Team learning	Senge (1990), Bennett and O'Brien (1994), Redding (1997)
	Individual development	Senge (1990), Garvin(1993), Bennett and O'Brien (1994)
	Efficient & effective working	Garvin(1993), Bennett and O'Brien (1994)
	Knowledge improvement	Garvin(1993), Bennett and O'Brien (1994), Byran (2003)
	Skill improvement	Bennett and O'Brien (1994), Marquardt & Reynolds(1994), Byran (2003)

In the pretest, 30 respondents who have experiences in ICJVs were asked to give their opinions on the preliminary model in ICJVs. The answers of them show that:

1. Environment and partner's characteristics are some of the reasons of forming a JV, they can reflect the condition of learning;
2. JV's characteristics are derived from the forming of the JV and are important to the success of JV;
3. Learning actions are participants' daily activities in their operation of JVs; and
4. Because learning is an ongoing process, it is not easy to measure the result during the JV. However, the characteristics of learning organization can reflect some of the learning results in the end of the JV.

After the pretest, 18 experienced managers or company directors from Singaporean, Chinese, Japanese, South Korean and Swedish construction companies which have ICJV projects in Singapore were interviewed to repeat the pretest result. The interviewees were asked to refer to some of their ICJV projects to justify the preliminary model. Most of the variables are observed at different stages of those successful learning ICJV projects. Some of these projects are further studied as cases to justify the research model in Chapter 5 Cases Studies.

The results of pretest and repeated pretest show the rationale of the preliminary model and suggest JV's development stages in the model. Although different literature employed different numbers of stages, tracking the four categories discussed in the literature review and justified in the pretest and repeated pretest, JV's four stages was applied in this study (Wong, 2002). One can note that the characteristics of the four categories could be identified from JV's four stages: pre-inception stage, formation and organizing stage, implementation and adjustment stage, and completion and evaluation stage respectively. Therefore, a revised model, which considers the four categories discussed previously as the four constructs of the model and embed them into JV's four stages, is developed

In summary, at the pre-inception stage, construction companies were encouraged to learn by a diverse range of conditions from the environment characteristics to the partner's own characteristics. At the formation and organizing stage, a separate entity of ICJV is formed and partners now begin to build the JV organizational structure, working on the management and developing working relationships. During the implementation and adjustment stage, members of JVs focus learning from working through a series of learning actions. And finally, when the project is nearing the completion stage, the learning effectiveness is assessed based on the characteristics of a learning organization, which can be used to measure the effectiveness of achieving both parts of learning on learning to cooperate and cooperating to learn.

As shown in Figure 3.3, the revised research model proposed that the conditions of learning have a direct impact on the characteristics of ICJVs and learning actions, which in turn contribute to the success of JV and thus the learning effectiveness. The model also proposed that characteristics of ICJVs have direct impact on learning actions as in turn contribute to the effective learning outcomes. It is finally proposed that learning actions have direct impact on the learning effectiveness.

Based on the above discussion, this research proposed that study of learning in ICJVs can be carried out based on a research model comprising four constructs in the four main stages of JV as shown in Figure 3.3.

Figure 3.3 The Revised Research Model for Learning in ICJVs

3.4 Model Descriptions

The research model comprises four constructs: conditions of learning (environment and partner's characteristics), JV's characteristics as the learning success factor,

learning actions in JV, and the characteristics of learning organization as the measurements of learning effectiveness, which will be further discussed in the following sections.

3.4.1 Conditions of Learning in ICJVs

3.4.1.1 Characteristics of market environment

Over the past 50 years there has been a steady increase in the number of construction businesses operating on a global basis and these have typically included design consultancies, contractors, property managers, material suppliers, equipment manufacturers and other specialists who provided services and products (Howes and Tah, 2003). Meanwhile, the external environment may include many kinds of characteristics, but this study will only focus on those characteristics which may affect learning in ICJVs, such as government support, the market's complexity and potential.

Government Support

Badger and Mulligan (1995) mentioned "The 21st century will most likely usher in a whole new era of cooperation through alliances within the construction industry as it moves from domestic to foreign ventures". Occasionally, the government will encourage the submission of JV proposals in an attempt to give smaller contractors an opportunity to work on more complex projects with larger, more experienced general contractors. For example, from 1984 to 1987, Singapore government encouraged the foreign constructors to form construction JVs with local contractors by setting up incentives like preferential margins up to 5% over other contractors who bid alone on for government projects under the Preferential Margin Scheme as a means to encourage technology transfer (Singapore Government Press Release, 1990). This extension was instrumental in promoting many of the partnerships between Singapore and foreign contractors. Such incentives provided local contractors with the chance to work with foreign companies on equal ground for the first time and enable them to learn new technologies and management styles. Therefore, it's

assumed that the government support will provide more chances and encourage contractor learning to improve their competitiveness capability.

Actually, if the government encourages companies to learn, the knowledge gained could be well applied in the development of the county, so both the government and the companies can benefit, forming a good cycle. Therefore, government support can be one of the determinants to facilitate companies to learn from ICJVs.

Market Complexity

A complex market is a competitive and changing market, which may require the contractors to master more knowledge to fulfill a project successfully. In an increasingly competitive market, construction firms, consultants and clients recognize that the reuse of their know-how is now essential to grow business and increase their operational potential (Preece, et al 2003). The international construction market is in a constant state of change and it is important that those companies already operating in other foreign countries should keep their corporate strategy under periodic review (Howes and Tah, 2003).

Although foreign companies have considerable knowledge and experience of operating in a domestic market, this may not transfer in its entirety to foreign markets, and to the local company, with advanced companies entering, the market is also becoming more complex, so constructors need more specialist knowledge of the global construction market and prior knowledge of national, regional and global economic prospects to suit the complex market. As a result of increasing complexity in the market, partners may need to access more knowledge and skills, which may affect the learning effectiveness in ICJV.

Market Potential

Attempting to anticipate future markets is a key aspect in the development of the international construction industry. Often the developing world is seen as a potential market; these countries are seen to be stratified. However, there are occasions when its contractors do not have the necessary expertise and finance to undertake more

complex, on-off construction projects single-handedly. The main reason for this is their lack of technical and managerial skills. JVs between contractors from developed and developing countries are a recognized mechanism for technology transfers therefore one way of improving skills that are lacking (Sreenivasan, 1998).

Therefore, in the potential market, either the foreign contractors or the local contractors are willing to explore their business there, the foreign contractors are likely to learn to understand and fit the local markets, while the local contractors are likely to learn the technology needed to do more work in their own market. At the same time, to get the share of those potential markets, the contractors from developed countries will agree to share some of their knowledge to local partners in developing countries. Based on these considerations, it is assumed that in the potential market, learning is more possible to take place and the contractors have more motivation to learn more effectively.

From the above review and discussions, government support, the complexity and potential of the market are considered as three main external environmental characteristics which are related to learning in ICJVs.

3.4.1.2 Characteristics of partners

Partner companies have different kinds of characteristics, but this study will mainly consider those characteristics which may be related to learning in ICJVs into the general characteristics such as the organizational strategy, the flexible structure, the prior knowledge, the openness, the capacities of employees and the company's specific characteristics as a learning intent.

Organizational Strategy

Organizational strategy was acknowledged in the construction industry in the 1960s following increasing pressures from the environment (such as technological advances and government legislation) that demanded a change in the way organizations had to run their business (Naoum, 2001). For development, the company can either explore their existing market or explore their working arrange,

namely the market strategy or product strategy. To perform either of these strategies, the company needs to learn more knowledge and to train more capable people to fulfill the development; therefore, these strategies may have impact on the learning effectiveness in ICJV.

Organizational Structure

Each company has its own organizational structure. Structure can be regarded as the backbone of the organization and its effectiveness depending on how strong or weak the skeleton is. The design principles of organizational structure can affect the organization technically and socially, therefore, if the organization forming a JV, its structure will affect its learning issues as well. There are many different characteristics of a company's structure. The most significant related to learning are the flexibility of the structure, which is the decentralization and organic form of a company.

Decentralization refers to the extent of decision-making involvement of individuals in organizations (Hage and Aiken, 1967). The hierarchy of authority decreases from top management to lower level managers as organizations move from centralization to decentralization. As parent organizations become more decentralized, involvement, communication, and interaction of partners in the shared management of the IJV increase (Guth and MacMillan, 1986; Wooldridge and Floyd, 1989), which may impact the learning issues. Since organizations are made up of individuals, they learn something when their organizational members learn it and share it (Argyris and Schön, 1996). Centralization creates a barrier between parents for creating behavioral orientations (e.g., team orientation, systems orientation, learning orientation, and memory orientation), and then restricts learning. Overall, decentralization decreases the level of alienation and stimulates the exchange of ideas, which leads to collaboration and cooperation between parent organization(s) within the IJV (Barclay, 1991; John and Martin, 1984; Ruekert and Walker, 1987). Therefore, decentralization may facilitate learning effectiveness improvement.

In Burns and Stalker's classic study, *The Management of Innovation* (1961), they identified two types of organizational forms – organic and mechanistic – and found that organizations with an organic form were more effective in dealing with rapidly changing markets and technologies, while those with a mechanistic form were more effective in stable markets. As learning is a way of dealing with rapidly changing markets and technologies, therefore, organic form should impact the learning effectiveness as well.

In similar vein, Fiol and Lyles (1985) argue that a “centralized mechanistic structure tends to reinforce past behaviors, whereas an organic, more decentralized structure tends to allow shifts of beliefs and actions”. Therefore, a more decentralized and organic company is more flexible in operation. It is assumed the more flexible the structure the better learning, that is to say the higher decentralization and the more organic the company is, the greater learning effectiveness will be in ICJVs.

Prior Knowledge

To better perform in a market, the contractor must better understand the market and have sufficient prior knowledge to do the job. In different construction markets, the legal system for construction is often different, for example, a legal system in China is radically different from those in most Western countries. Si and Bruton (1999) found company's prior knowledge affected its knowledge learning goals after they studied knowledge transfer in IJVs in China. Construction is a kind of business implementing in local, so the degree of company's prior market knowledge should be an important influence on the learning effectiveness of the partner company in ICJV.

Openness

Openness is the degree to which the parent company encourages information sharing with their partners. Therefore, openness provides access to a greater number of information sources, forces the development of mechanisms that facilitate the information sharing and offers alternative interpretations of information (Slater and Narver, 1995). To achieve higher levels of team orientation, system orientation, learning orientation, and memory orientation, the role of openness is critical in the

shared-management of IJVs. Because openness increases cooperation and communication between parent companies, it reduces the boundaries to national differences. Hence, parent companies in an open climate will be more likely to develop capabilities to overcome crisis and conflicts, and negotiate a set of understandings and norms with potential for learning synergy in the IJV (Salk, 1997). Thus, it is argued that an open climate will facilitate the formation of behavioral orientations that are embedded in the IJV's organizational learning. Therefore, the openness to receive new knowledge is one of the partner company's characteristics, which may affect the learning effectiveness in ICJVs.

Absorptive capability

Employees are the main resources of a construction company. Their capabilities are important for company's development. These capabilities related to the learning may include the receptivity, experience and adaptability.

Receptivity refers to a partner's capacity to learn. In building learning organizations, one of the processes is to create receptivity in the organization, so that it can consciously interpret and codify this information into business-relevant knowledge (Madhukar, 1997). Hamel (1991) argued that enhancing the organization's receptivity to learning was a function of the exposure position of the firm relative to its partner. Exposure position involves access to people and facilities. Inkpen (1997), in studying North American-Japanese IJVs, similarly found that receptivity to learn was important. This is thought to be especially important for creating openness to new knowledge in the IJV, for creating emergent skills and knowledge building on what the foreign parent can provide an IJV, and tailoring foreign parent knowledge to fit the specific needs of the IJV (Cohen and Levinthal, 1990; Lyles and Salk, 1996; Nonaka, 1994). Employees build the organization and so the employees' receptivity will affect learning effectiveness in ICJVs.

The availability of experience will be very influential in determining the mix of products and services that can be exploited in the international market (Howes and Tah, 2003). Employees with previous JV experience will more easily look for the

opportunity to learn from the ICJVs, they have experience of sharing their knowledge with others and accepting knowledge from others; therefore, they can learn more effectively.

Adaptability is another characteristic of employees, employees with higher adaptability can easier to adapt the changing environment and the management style, and it may also affect the learning in the ICJVs.

Learning Intent

Although the JV provides a platform for learning, whether the partner company learns or not is related to their initial learning intent. Learning intent of an organization is an organization's general learning attitude, and the way in which the people of the company think about learning and make decisions to learn.

Intent was found to be an important determinant of the efforts a firm puts into learning from a JV partner and the evolution of learning. Intent will arguably affect the resources that the partner contributes to the IJV, and the degree to which the partner learns from the IJV (Inkpen, 1997).

In this study, the learning intent of the partner company includes the intent to transfer, acquire, develop and apply new knowledge from the ICJVs. Berdrow (1999) unfolded the myth of IJV learning and indicated that these four kinds of learning intents are significantly related to the actual outcome of that kind of learning. Berdrow (1999) further explained that willingness to transfer knowledge to and acquire knowledge from the partner is correlated, indicating an exchange relationship and correlation between learning intent and outcomes also found to support the exchange relationship. Furthermore, both learning intent and outcomes of developing and harvesting knowledge are significantly correlated with the partner's transfer of knowledge to the IJV and the responding company.

The prior literature shows that learning intents are very important factors in learning in IJVs, therefore, this study considers learning intent as a kind of specific company characteristic in building the model for improving learning effectiveness in ICJVs.

3.4.2 JV' Characteristics

The learning in this study is based on the JV platform; many characteristics of JVs may be directly related to the learning effect. In this study, the JV operational characteristics, the characteristics among the partner companies and the JV and the daily activities related to learning will be discussed as the variables for improving learning effectiveness.

Integration

It is convenient for the purpose of this discussion to consider the two extreme categories that the operational structures of a construction JV could take: firstly as an integrated JV and secondly as a non-integrated JV. Under an integrated JV, the parties agree on a prescribed profit or loss sharing basis and participate completely at every level in the execution of a given construction project. On the completion of the contract, the profits or losses are then apportioned in accordance with a pre-determined formula. It's assumed that within a highly integrated JV, there will be more collaboration as well as more learning chances. An integrated JV will favor those situations where the work is of such a nature that it is not possible to divide a project into neat 'packages' or where a project is so complex that it demands a highly structured and authoritative central management. Therefore, the undivided degree of the work may also provide more collaboration as well as more learning chances for members from different partner companies.

Management Competency

In regard to other operational characteristics of the JV management, excepting its direction, a useful distinction has been drawn between a coalition type management made up of nominees of the parties and an autonomous management which runs the JV as an independent enterprise and only has to turn to its board, representing the participants, on major decisions. Sometimes one of the participants is appointed as

managing partner for the enterprise under a separate management agreement. In this situation, the other parties will wish to ensure that the managing party is required to refer back to them for major decisions. In practical terms in the early stages a coalition type of management may be unavoidable even where greater autonomy is the ultimate goal. The jurisdiction of the Board is particularly important since excessive jurisdiction may mean the Board be inundated with inconsequential details while a very limited jurisdiction will compromise control by the Board over the operations of the JV. In this study, the management's capability about the independence of the management board and the authority of decision-making is considered as an important determinant for the learning in the ICJVs.

Culture

Companies operating in the global market are increasingly faced with 'cultural' problems. The cultural environment is a crucial factor influencing the management and performance of JVs. Previous literature has frequently mentioned that different managerial style, business and corporate culture between developing and developed countries can lead to serious conflicts, instability and failure of JVs (Parkhe, 1991; Tsang, 1999). Partners should understand the values of different cultures first or they can't learn.

In addition, Parkhe (1991, 1993) found evidence that differences in partner nationality and culture would negatively influence the success of an alliance, particularly the ability to benefit from knowledge spillovers. Lorange and Roos (1993) suggested that an IJV's success was linked to the firm's ability to adapt to cultural differences. Mowery et al (1996) found that there were higher patterns of knowledge transfer in alliances of culturally similar parents than in alliances with cross-national parents. Conversely, cultural conflicts and misunderstandings can limit the sharing of information and learning (Fiol and Lyles, 1985; Lane and Beamish, 1990; Lyles and Salk, 1996; Parkhe, 1993; Salk, 1997). Consequently, the parents' cultures need to be compatible in order for the IJV's managers to understand the norms and values implicit in acquired know-how. Lane et al (2001) found cultural

compatibility is significant when tested with the ability to understand the foreign partner's knowledge.

Trust

Moorman et al (1992) define trust as a willingness to rely on an exchange partner in who has confidence. According to their view, belief and behavioral intention are necessary components of trust, because if one believes that a partner is trustworthy without willing to rely on that partner, trust is limited. At the same time, Morgan and Hunt (1994) argued that one could not label a trading partner as trustworthy if one were not willing to take actions, and therefore willingness to act is implicit in the conceptualization of trust. Therefore, Morgan and Hunt (1994) argued that inter organizational trust exists when a parent organization has a confidence in its exchange partner's reliability and integrity. That means willingness to rely is redundant or unnecessary, because just as behavioral intention is viewed as an outcome of attitude (Fishbein and Ajzen, 1975), commitment to learning can be viewed as an outcome of trust (Hrebiniak, 1974).

The role of trust has been conceptualized in two distinct ways. First, trust has been seen as an important feature of relationship quality, in addition to power, communications, and compatibility (Anderson et al 1987). Second, trust has been viewed as a determinant of the amount of cooperation (Anderson and Narus, 1984) and communication (Mohr and Nevin, 1990) between exchange partners. As such, the role of trust is significant for learning.

Management Support and Training

This element of management support is even more important in the case of ICJVs where a new organization is formed from a few partner companies with diverse backgrounds and origins.

The studies of Lyles and Salk (1996) and Inkpen (1997) support the belief that active management involvement and training by the foreign partner not only provide a vehicle for transferring explicit or codified knowledge, but also can be a vehicle for

learning and knowledge transfer of tacit knowledge via socialization by the foreign partner management (Nonaka, 1994).

In conclusion, characteristics among partner companies and the JV including culture, trust, management support and training are considered as three variables of relationship between partners in this study. They have important relationship to the learning issues in some other researcher's study. For example, Dodgson (1991) found that it was the different abilities of the organizations to learn quickly about technological opportunities, which was responsible for changes in the pattern of competitive relationships among the companies. Si and Bruton (1999) studied the China experience of knowledge transfer in IJVs and found the better the relationship between the JV partners, the greater the extent of knowledge the MNC partner contributes to the JV, allowing local partners to learn more from the JV. Some managers believe organizational learning in IJVs is only possible with long-term partnering relationships. For one-off JVs, the effect can be the opposite - partners may break off after one project. Also there must be complementary learning, not one-way as partners like to "trade-off" their contributions in knowledge transfers. One-way learning seldom takes place, as the "teaching" party finds no necessity to do so. Therefore, good relationships and long term relationships may determine the company's effectiveness and possibility to learn from JVs.

Business Relatedness

Another variable is the business relatedness of the partner firm and the IJV. Mjoen and Tallman (1997) found that the higher the relatedness of the IJV with the partner, the stronger the positive effect on control over specific activities and the higher the perceived IJV performance. Kogut (1989) found a positive relationship between relatedness and IJV survival. Furthermore, Inkpen suggests that if the IJV was involved in an unrelated business, it was unlikely that the primary rationale for collaboration will be knowledge creation (Inkpen, 1997).

From the above review, it is assumed that with a better relationship, more compatible culture, more trust, more management support and training from the partner

company to the JV, and more business relatedness, the more learning effectiveness can be improved in ICJVs.

3.4.3 Learning Actions in ICJVs

Another direct impact on learning outcomes is learning action, which is the daily learning activities occurring in the JV. This thinking is from the concept of “learning by doing” which is popular in construction practice. Richter and Vettel (1995) thought companies must undergo a learning sequence consisting of the perception, internalization and abstraction of the partner’s knowledge resources to expand their own corporate knowledge base. Beamish and Berdrow (2003) considered transfer, transformation and harvesting as the processes of learning in IJVs. Hoff et al (2004) divided many best learning activities into individual-level and organization level. Many researchers (Senge, 1990; Garvin, 1993; Kovach, 1997) presented many activities to achieve a learning organization.

This study has identified eleven basic variables to measure learning actions occurring in the ICJV which will affect the organization learning as the following: self-examination, sharing personal vision, sharing experiences and lessons, explain the common vision, support over blame, ask questions, listen to others, solve problems together, Develop existing knowledge and create new knowledge, record knowledge and applying new knowledge. These are further examined as follows.

Self-examination

Self-examination can be looked upon as a kind of reflective openness, e.g., being honest with oneself about a situation, critiquing existing mindsets and behaviors. It is a staff activity in the ICJVs, carrying out self-examination of near misses and mistakes, in particular around how the near miss or mistake is being conceptualized by the individual and the larger lessons to be learned from it (Hoff et al , 2004).

Share Personal Vision

Senge (1990) suggested sharing personal vision as a practice to build shared vision – one of the principles of a learning organization. He states “Shared visions emerge

from personal visions. This is how they derive their energy and how they foster commitment.” Only after personal visions have been broadly cultivated should the work of developing a shared vision commence (Thompson, 2003).

Share Experience

Sharing experience can be also looked upon as a kind of participative openness. It is an activity that staff in the ICJVs communicate to other via personal stories and experiences about near misses and mistakes committed (Hoff et al , 2004).

Explain Common Vision

The common vision is vision of the ICJVs, a corporate goal of different partner. Bryan (2003) suggested leaders must continually be mindful that the vision is understood and shared at all levels and removes obstacle where necessary. Therefore, one of the activities of leaders is to clearly explain the common vision of all employees.

Support over Blame

Support over blame means within the ICJVs, leaders place emphasis on dealing with mistakes through a supportive rather than blaming approach, the latter defined primarily by putting the onus for a mistake or near miss either completely on the individual or completely on one or more system aspects surrounding the individual (Hoff et al , 2004).

Asking Questions

Asking questions is to inquire in the ICJVs, it is an approach to uncovering, examining, and resolving a mistake or near miss problem and gaining and assessing information around the problem (Hoff et al, 2004). It is a tendency to ask “why” in addition to “how” around the processes for identifying, investigating and resolving mistakes.

Listen to Others

Senge (1990) suggested listening to others as a learning practice. Listening is an active process that can be practiced and improved. In dialogue, employees learn to listen to others and to themselves. It might be possible however to learn what is real and important to another within the group. It's an activity to gain better opinions from others. Jashapara (1993) explained that the effectiveness of the communication process can be improved through promoting active listening skills. Active listening involves being non-evaluative, paraphrasing thoughts or feelings, reflecting implications and underlying feelings and inviting further contribution. Barriers to communication can result if an unequal standing is adopted between the speaker and listener similar to the defensive routines suggested by Argyris (1991).

Solving the Problem Together

In the working process, most problems can not be solved by the individual; therefore, employees need to work together. Watkins and Marsick (1993) said, "People learn best when they tackle real problems together in small teams of peers, none of whom is the expert. They take action and think about results, using others in the group to see the situation in new ways." People worked together to develop innovative and creative solutions to problems.

Develop and Create Knowledge

As every construction project has specific characteristics, the cooperation in joint project may encounter new problems, so the organization needs to take the activity to develop the existing knowledge or even create new knowledge. It's an important activity to solve problems and improve knowledge.

Record Knowledge

In the working process, with employees experience sharing and problem solving, abundant knowledge emerges. The ICJVs should take an activity and record using different media, so that the organization can keep it for a longer period. In order to be of long-term use, knowledge needs to be stored in some sort of memory such as a

document or computer records which others can use (Walsh and Ungson, 1991, Büchel et al., 1998).

Applying New Knowledge

In an IJV construction project, to solve new problems or to solve problems more effectively and efficiently, organizations may apply new knowledge and adapt to new technology and business practices. This activity is to make working more effective and efficient, and changes the organization's behavior and develops the organization itself.

It's assumed that to achieve certain results, some action must be taken. Namely, the eleven learning activities are conducive to improve learning effectiveness in ICJVs.

3.4.4 Learning Effectiveness in ICJVs

Learning effectiveness should be improved continually. However, it's not easy to assess the changing outcomes. Therefore, the learning organization concept is introduced here because a learning organization can be regarded as a successful organization, which can learn and improve continually. As a result, the characteristics of a learning organization will be used to assess learning effectiveness.

The concept of the "learning organization" has received much attention in practitioner literature since Senge (1990) coined the term. With the absence of research-based evaluation of learning organizations and the lack of a clear definition, the concept is in danger of becoming yet another management fad. Organizational learning has begun to formulate reasoned and sound theories but the gap between practices and empirical knowledge has not been filled (Kuchinke, 1995). Theoretically, in a learning organization, employees embrace change. People in learning organizations react more quickly when their environment changes due to the anticipatory rather than reactive nature of the learning organization. The members of the organization know how to create the kinds of changes they want. Change and learning may not be synonymous but they are linked together (Senge et al., 1994).

Many definitions or descriptions of a learning organization have been reviewed in Chapter 2. In this section, their characteristics described by different researchers are reviewed first.

Senge (1990) wrote that building a learning organization requires five disciplines: systems thinking, personal mastery, mental models, building shared vision, and team learning. They become the five characteristics of a learning organization.

Pedler et al (1991) considered four characteristics of a learning organization, they are climate to encourage individuals learning and develop their all potentials, extending the learning culture to customers, suppliers and other related organizations, developing human resources as the center of organizational strategy and, continuing the process of organizational innovation.

Garvin (1993) suggested presented five main characteristics namely: systematic problem solving, experimentation with new approaches, learning from past experience, learning from the best practices of others, and transferring knowledge quickly and efficiently throughout the organization.

Tobin (1993) and Kovach (1997) pointed out that learning organizations share three important characteristics: they are open to new ideas; the organizational culture encourages and provides opportunities for learning and innovations and, employees understand how their work contributes to overall goals and objectives. By using the cumulative knowledge of the corporate network, including vendors and customers, they solve problems, create value and gain a competitive advantage.

A long list of the characteristics of a learning organization is shown in the study of Marquardt and Reynolds (1994). It includes: embracing change; encouraging managers to be coaches, mentors, and facilitators of learning; having a culture of feedback and disclosure; having a holistic, systematic view of the organization and its systems, processes, and relationships; having shared organization wide vision, purpose, and values; having systems for sharing learning and applying them in the

business; providing frequent opportunities to learn from experience; spreading trust throughout the organization; striving for continuous improvement; viewing the unexpected as an opportunity to learn.

Abbey (1997) found six specific learning organization characteristics to represent the learning environment including a shared vision for the organization, open communication and dialogue within the organization, connection to the external environment, a corporate culture that encourages experimentation and risk-taking, employee involvement and empowerment, and systems and practices that support learning.

As the characteristics of learning organization explained above, a trait common to all learning organizations is their concern with organizational transformation. This concern is something that clearly needs to be led and supported by top management. There are a number of organizational factors which top managers will need to be both able and willing to appraise, if they wish to create a true learning organization.

Bennett and O'Brien (1994) have identified a list of twelve key factors that support organizational learning. These elements will affect the capability of learning and innovation in the organization. They are: strategy/vision, executive practices, managerial practices, Climate and values, organization/job structure, information flow, individual and team practices, work processes, performance goals and feedback, training and education, individual and team development and rewards and recognition.

Marquardt and Reynolds (1994) summarized that a learning organization required eleven factors, they are structure, learning culture, authority, environment search, knowledge creation and transfer, learning skill, quality, strategy, supportive climate, team and networking ability, and vision.

Redding (1997) summarized many organizational learning and learning organizational assessment tables and found learning organization can be measured

from twelve aspects, they are individual learning, team learning, organizational learning, vision and strategy, leadership and management, culture, structure, system procedure, communication and information system, performance management and supporting system, technology, innovation management.

Byran (2003) provided a vehicle for assessing a learning organization from ten aspects: will, leadership, strategic thinking and vision, communication, learning and development, innovation and decision making, change management, intellectual capital and knowledge, measurement and assessment, reward and recognition.

Summarizing all the above characteristics and descriptions of a learning organization and combined the characteristics of an ICJV, in this study, eleven characteristics are considered. These characteristics include a collaborative environment, continuous and creative learning climate, consistent vision, competent leaders, an open communication and dialogue, system thinking, effective learning, individual development, efficient and effective working, knowledge improvement, and organizational development.

In this study, the characteristics of learning organization are regarded as learning effectiveness for the members of ICJV to share ideas, learn from any source, collectively, continuously and effectively learn with a free collective aspiration and collaborative climate. The knowledge is continuously created, acquired, transferred and transformed, and the organization can modify its behavior to innovate and develop itself after the knowledge change. The eleven characteristics selected from above characteristic descriptions of many researchers form the variables for the assessment of effective learning outcomes. They were further described as follows.

Collaborative Environment

Collaborative environment means that staff from different partners don't regard each other as adversary, but help the partner to create success in the JV organization. This characteristic was recognized and stated by Watkins and Marsick (1993) and Marquardt and Reynolds (1994). Watkins and Marsick (1993) described that all

employees of a learning organization must be involved in a process of a collaboratively conducted environment. Additionally Marquardt and Reynolds (1994) said the organizational success is from creative employees working happily together.

Continuous Learning Climate

The continuous learning climate was identified as one of the characteristics by many researchers. These researchers (Tobin, 1993; Bennett and O'Brien, 1994; Marquardt and Reynolds, 1994; Redding, 1997; Kovach, 1997) identified the continuous and creative learning climate as a basic element of a learning organization. This kind of climate encourages creative learning and provides sufficient opportunity and resources to achieve creation.

Consistent Vision

Consistent vision means the vision between the JV and the individuals is well aligned. Senge (1990) said building shared visions refers to creating a common picture of the future state of the organization, which is connected to the personal visions of the individual members and focuses on the collective energy of the group. Marquardt and Reynolds (1994) explained that only when the employees work what they want to work, then they can effectively and creatively learn for the purposes of better working.

Several authors (Senge, 1990; Kofman and Senge, 1993; Greenwood et al., 1993; Watkin and Marsick, 1993) suggest that collective commitment to a shared vision is an important aspect of learning organization. Therefore, to measure whether staff from different company had consistent vision can assess its degree of being a learning organization.

Competent Leaders

The competent leaders of the learning organization are facilitative, coaching and supportive of personal development and highly respected by the employees. Marquardt and Reynolds (1994) identified encouraging managers to be coaches,

mentors, and facilitators of learning as learning organization characteristics. Several authors (Bennett and O'Brien, 1994; Redding, 1997; Byran, 2003) suggested leadership as an important aspect to assess a learning organization. Therefore, competent leaders should be an important characteristic of a learning organization.

Open Communication and Dialogue

Open communication and dialogue have been suggested as a means of surfacing individual meaning structures so that they can be questioned and refined toward a collective vision (Senge, 1990; McGill and Slocum, 1993; Kofman and Senge, 1993; Greenwood et al., 1993; Watkin and Marsick, 1993). Abbey (1997) identified it as the characteristic of a learning organization. It basic for an organization to learn, therefore, it becomes an important factor to measure a learning organization. Free and open communication pervades the entire ICJV organization and barriers are removed that threaten to impede it.

System Thinking

System thinking means staff of the JV have been able to solve the problem from a system perspective. It is the ability to view the world and its problems holistically, as a set of inter-related elements, rather than decomposing phenomena into isolated components and then attempting to reformulate the whole (Senge, 1990). Jashapara (1993) suggested system thinking could help individuals to develop an understanding of the processes of change and how they affect the organization.

Team Learning

Team learning means staff of JVs are able to work and learn very effectively as a team. It refers to developing frameworks, processes, and behaviors to learn collectively (Senge, 1990). The discipline of team learning starts with "dialogue," the capacity of members of a team to suspend assumptions and enter into a genuine "thinking alliance." Team learning is vital because teams, not individuals, are the fundamental learning unit in modern organizations. Therefore, unless teams can learn, the organization cannot learn.

Individual Development

Individual development means that the individual's capability as well as developing in the process of JV. Bennett and O'Brien (1994) suggested individual development, is a basic factor for organizational continuous learning, as without individual development, the organization cannot develop continuously. Jashapara (1993) further explained with the other characteristics, individual capacity is continuously improving.

Efficient and Effective Working

Efficient and effective working means the staff of JVs are able to work efficiently and effectively. Bennett and O'Brien (1994) suggested the learning result could be shown in the working process. In a learning organization, individual capacity is developing with team learning and system thinking and so knowledge is improving. With suitable knowledge being applied, therefore, the work can be solved efficiently and effectively.

Continuing Knowledge Improvement

Continuing knowledge improvement means the overall knowledge is increasing continuously. In the definition of Garvin (1993), a learning organization is good at improving knowledge by creating, acquiring and transfer. In the definition of Marquardt (1996), a learning organization is making progress from acquiring, managing and applying knowledge. Karash (1995) suggested a learning organization is about marshaling energy and human spirit to create new works and new capacities.

Continuing Organization Development

Continuing organization development means the engineering technology and management skills of the JV are being developed continuously. Galraith and Lawler (1993) suggested a learning organization is changeable with the organization strategy and environment change. This characteristic is also shown in the learning organization definition of several authors (Pedler et al., 1991; Jashapara, 1993; Wick

andleon, 1995). The development can be shown in the engineering technology or management skill aspects.

3.5 Research Hypotheses

As described above, there are three levels comprising external environment. Partners' company in the JV and JV organization are considered to relate to building a learning organization as improving learning effectiveness. As Figure 3.4 show, six main hypotheses among the four constructs of the research model are described as follows.

Figure 3.4 The Proposed Research Model for Learning in ICJVs

H1: Conditions of learning in ICJVs have a positive influence on learning effectiveness in ICJVs.

Although the external environment may include many kinds of characteristics, this study only focuses on those characteristics which may affect learning in ICJVs, such as government support, the market's complexity and the development potential of the market.

A partner company has different kinds of characteristics, but this study mainly considers those characteristics which may be related to learning in ICJVs, into general characteristics such as the organizational strategy, flexible structure, prior knowledge, openness, capabilities of employees and the company's learning intents.

These selected characteristics of environment and partners are regarded as the conditions of learning in ICJVs, and it is proposed that the above-mentioned conditions of learning in ICJVs may positively improve learning effectiveness in ICJVs.

H2: JV's characteristics have a positive influence on learning effectiveness in ICJVs.

Learning in this study is based on the JV platform; many characteristics of JVs may be directly related to learning effectiveness. In this study, the JVs operational characteristics and the relationships among the partner companies and the JV related to learning have been discussed as the variables, which may support learning effectiveness. The operational characteristics include the degree of JV integration and the management competency of the JV board. The relationships among the partner companies and the JV include the cultural compatibility and inter-organizational trust between different partners in the JV, the management support from the partner company to the JV and the business relatedness between the partner company and the JV. These JV characteristics may have a positive impact on the learning effectiveness in ICJVs.

H3: Learning actions in ICJVs have a positive influence on the learning effectiveness in ICJVs.

Learning actions are those learning related activities during the JV procedure which drive the development of the project, improvement of the collaborative environment and exchanging the knowledge of different participants, therefore, it should directly influence learning effectiveness.

H4: Conditions of learning in ICJVs have a positive influence on JV's characteristics.

As the prior study mentioned, the selected JV's characteristics in this study are the success factors of learning which could be identified during the formation and organizing stage of a JV, while the selected characteristics of market environment and partners are the conditions of learning which could be identified in the pre-inception stage. Since these two kinds of characteristics are suggested to have a positive influence on learning effectiveness in ICJVs, based on the procedure of JV development, the characteristics identified in the first stage should also have a positive influence on the characteristics identified in the second stage, which proposed that conditions of learning in ICJVs have a positive influence on the JV's characteristics.

H5: Conditions of learning in ICJVs have a positive influence on the learning actions in ICJVs.

As the learning actions which could be identified in the implementation and adjustment stage of the JV have a positive influence on the learning effectiveness in ICJVs, the conditions of learning in ICJVs selected from the characteristics of market environment and partners which could be identified in the pre-inception stage of JV which also have positive influence on the learning effectiveness would have positive influence on the learning actions in ICJVs.

H6: JV's characteristics have a positive influence on the learning actions in ICJVs.

Similar to H4 and H5, there is positive interrelationship between the characteristics of JV and the learning actions in ICJVs that could be identified in different stage of JV, it is suggested that JV's characteristics have positive influence on the learning actions in ICJVs.

The above six hypotheses will be justified and tested through the methodology which will be described in the next chapter.

3.6 Summary

This chapter firstly provides an overview of the overall learning system in ICJVs, learning within the JV organization, between JV organizations and JV partners, and within the partner companies during the four JV's development stages. Secondly, an implemented deduced from organizational learning is revised through a pretest for further review on the JV study. Finally, the revised model including three constructs of learning determinants and the learning effectiveness with their variables of the research are described in more detail.

This chapter has presented the development of a proposed conceptual learning framework into a more practicable learning model for the ICJVs. The developed model and its relevant issues are discussed in detail as well as how to further justify it through a methodology to test the validity of this model.

The discussion of issues concerning learning in IJVs in the literature and the learning practices in the ICJV reality help provide learning model building. It is concluded from this discussion that learning in IJV should be taken seriously and strategically incorporated from the external environment to the internal JV organization.

Based on the proposed conceptual model, six hypotheses were built up to test the relationships among the conditions of learning selected from the environment and

partner's characteristics of ICJVs, JVs' characteristics, learning actions and learning effectiveness in ICJVs.

In the next chapter, the research methodology will be described to provide the data and methods to justify the proposed conceptual model.

Chapter 4 Research Methodology

4.1 Overview

In Chapter 3, the research model was proposed and the research hypotheses were presented. This chapter aims to describe the methodology to provide data to investigate relationships among the four constructs of the proposed conceptual model. As shown in Figure 4.1, the chapter starts with a discussion of using research design for this study (section 3.2). Following that, the qualitative stage and quantitative stage are discussed respectively in section 3.3 and section 3.4. Finally conclusion is given (section 3.5).

Figure 4.1 Main Flow of Chapter 4

This chapter outlines the overall methodology adopted for this research. Figure 4.2 illustrates the major components, which include literature review, a series of case studies and a questionnaire survey.

Figure 4.2 The Overall Research Methodology

4.2 Research Design

Research is viewed as a process that contains five stages: problem formulation, data collection or literature search, data evaluation, analysis and interpretation, and presentation of results. Research design is primarily driven by the nature of the problem of proposed research as well as theoretical and methodological limitations. This study will adopt a non-experimental, fixed effect, one-industry research design.

This research owes its birth from the increasing social demand of knowledge in this new era. Little literature did specific study on the question of how to improve learning effectiveness in ICJVs. This study is not only focusing on the theory building of a learning model to answer this question, but also testing the solution in practice. To achieve the other aims of further developing this model in ICJV system, questionnaire surveys and case study are selected.

The study can be seen as an equivalent status design as both qualitative and quantitative methods are used to understand the different learning conditions in ICJVs. The alternative designs for mixed method studies between qualitative and

quantitative methods include equivalent status designs, dominant-less dominant designs and designs with multilevel use of approaches (Tashakkori and Teddie, 1998). According to Tashakkori and Teddie (1998), in equivalent status designs, both the qualitative and quantitative approaches are equally important in understanding the phenomenon under study, while dominant-less dominant designs mean that an approach is dominant with small component of the overall study drawn from an alternative design. Studies with multilevel approach use data from more than one level of organizations or groups to reach better understanding of behaviors and/or events, where both qualitative and quantitative methods can be used at different levels of studies. Taking the above methodological, theoretical, and contextual considerations, the current study can be seen as an equivalent status design as both qualitative and quantitative methods are used with equal importance in understanding the different learning conditions in ICJVs.

The qualitative stage of the research includes a case study to ensure a good degree of concurrence and lend validity towards the proposed conceptual model. It involves the use and gathering of a variety of empirical materials such as interviews, personal experience, life story and visual texts (Denzin and Lincoln, 2000). The qualitative stage in this study involves the patterns among the background of the JV, the characteristics of the JV, learning actions and learning outcomes in ICJVs. It is used mainly to address the research concerning the relationships of the situations of JVs and learning effectiveness.

The quantitative stage explores mainly the development of instruments and the testing of the hypotheses using questionnaire surveys. The questionnaire contains questions relating to the environment and partner characteristics of the ICJVs, the ICJV's characteristics, learning actions and learning effectiveness in ICJVs. The questionnaire was pre-tested in a pilot study to identify any deficiencies. Following the pilot study, a large sample questionnaire survey is conducted in selected ICJVs in Singapore and China. The data gathered are then analyzed statistically, where multiple regression analyses are used in the hypothesis testing of the relationships within the variables of the proposed conceptual model in this study.

4.3 Qualitative Stage

The qualitative stage involves the case study analysis conducted to provide field evidence to illustrate the findings from the literature and the proposed conceptual model using for this study. This section presents a detailed description of the activities involved in this stage, which includes the justification of the case study methodology and the selection of multiple-case studies.

4.3.1 Justification of the Case Study

Yan and Gray (1994) mentioned that the choice of any research design is influenced by three conditions: the type of research question proposed, the extent of control that the researcher has over actual behavioral events, and the degree of focus on contemporary, or historical events. Each condition lends itself to a particular research design. The use of case study is justified on the following criteria.

First, according to Easterby-Smith et al. (1991), the main purpose of case study is to obtain information from, or about, a defined set of people, or ‘population’. Since there is a lack of official data on the study of learning in ICJVs, a case study is an effective and useful approach to obtain an accurate picture of the status of learning in ICJVs from the people involved.

Second, as suggested by Yin and Gray (1994), a case study is commonly used to answer questions like “how” and “why”, focusing on contemporary events. Through the research suggestion of Yan and Gray (1994), the research questions in this study are “What factors are conducive to learning effectiveness in ICJVs?” and “How do these factors contribute towards learning effectiveness in ICJVs?”, as the researcher has no control over behavioral events that occur in the chosen setting, the case study is appropriate for the present study.

Finally, this research investigates contemporary phenomena as the researcher focuses on the conditions of the ICJVs and the learning attitude and actions of the participants in the particular environment. Combined with the earlier criteria, the

case study methodology is seen as a suitable approach for this research (Chew, 2001).

4.3.2 Selecting Multiple Case Studies

A primary distinction in designing case studies is between single- and multiple-case designs (Yin, 1994). Although either the culture-sharing group or specific individuals within it might be considered a “case”, the case study approach to qualitative inquiry is focused less on discerning patterns of the group and more on an in-depth description of a process, a program, an event, or an activity (Miller and Salkind, 2002).

A multiple-case studies approach instead of a single case will be used for this research as the multiple-case design has many advantages as follows (Chew, 2001):

- Provide a full variety of evidence
- Involve a methodologically rigorous approach on replication logic
- Provide triangulation of evidence, data sources and research methods for more rigorous research
- Handle complex phenomena under study
- Use for theory testing and generalization

Perry (1998) advises several case studies should usually be used because they allow cross-case analysis to be conducted for richer theory building. The evidence from multiple cases is often more compelling and the overall study is therefore more robust (Yin, 1994).

The cases for case study approach are collected through face-to-face interview and relevant news reports. The interview is a one-on-one question and answer process, which has more freedom to further explore interviewees’ opinions to every question relevant to learning in ICJVs. It helps to further improve the learning effectiveness in practice, to seek more significant issues in each level and identify more common variables that impact the learning effectiveness.

4.4 Quantitative Stage

The quantitative stage involves the development of a survey instrument to measure the environment and partner's characteristics of ICJVs, the JVs' Characteristics, learning actions and learning effectiveness in ICJVs applicable to the research context. Based on the conceptual model, this section provides assurance and appropriate procedures as followed. The quantitative stage is organized into three major topics: (1) survey target, (2) data gathering methods, and (3) data analysis methods.

4.4.1 Survey Target

Based on the results of the literature review and interviews with experts, the questionnaire and interview questions are designed to further evaluate the effect of the presented model including the learning determinants and the learning effectiveness in ICJV.

The questionnaire is designed on the basis of the characteristics of the environment, partner company and JV organization and the measurement of learning effectiveness. The questionnaire has considered the clarity of the questions, the appropriateness of the questions, the ease of completion, and the length of time to complete the survey taken by the respondents.

The target population of this survey includes Grade 1 and Grade 2 construction company of China and Grade A and Grade B contractors registered in Singapore in 2004. Based on the data of the China Ministry of Construction, there are 809 Grade 1 and Grade 2 construction companies in China. And based on the data of Singapore Building & Construction Authority, there are 268 Grade A and Grade B contractors registered in Singapore in 2004. Some of these construction companies are listed in the top 225 international contractors (ENR 2004). As practically it is difficult to survey all these totally 977 companies due to the size, inconvenience and survey cost, therefore, in this study, 30% of them, that is 293 construction companies are random selected as a random sample for this survey.

The target population is the Singaporean or Chinese companies. These two countries were chosen for several reasons.

First, Singapore's construction industry was successfully developed after local construction companies' JV projects with a large number of western and Japanese's constructors. Second, China is the currently one of the most active areas for international construction projects. Finally, China is the home country of the author, therefore, the author can convenient return to China to collect the vast majority of the data, to mail and doing pilot testing; meanwhile, Singapore is the country where the author is studying. Rather, they were selected because that findings obtained here may be comparable to other host countries. The reason behind is that although the target population is the Singaporean or Chinese companies that have ICJVs, their partners are from all over the world, and the projects are operated all over the world.

The survey target focused on general managers in the sample companies as they are deemed to be directly responsible for the managing and learning activities and know what the significant factors that impact on the learning effectiveness are.

4.4.2 Rationale of the Questionnaire

This section presents the rationale of the questionnaire. The questionnaire is written both in English (Appendix A) and Chinese (Appendix B). The first part includes questions that provide background information about the respondent. The second part includes six sections to measure the environment and partner's characteristics, learning intent, operational characteristics in JV, relationships among partners, learning actions x and learning effectiveness in JV, some of the general information of the JV project which the respondent referred to are also asked before the measurement.

The first part of the questionnaire extracts some background information in order to identify whether the respondents are suitable targets. As stated before, the target

population is the Singaporean or Chinese companies that have ICJVs, therefore, Question 1) “Name of company” was designed to determine whether the company of respondent’s belong to the survey target. Question 2) “Name of respondent” and Question 4) “Contact No.” were asked for reference and following up use if there are any clarification required for the answering of the questionnaire. Also, since the questionnaire was more expected to be completed by experienced executives such as middle or higher level managers, therefore Question 3) “Designation” of the respondent in that company was asked.

For the best reference of the answer in the second part of the questionnaire, the respondent was asked to answer some detail of the JV project he herein referred to including Question 1) Project duration, 2) Project value (S\$ millions): 3) Each partner with equity share (Yes/No).

The second part of the questionnaire use the five-point Likert scale (1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree) for the respondent to indicate his best assessment on the description of each question on the learning perspectives of ICJVs. Six sections of this part are described individually below.

Section 1 is designed to identify the characteristics of the environment of the JV project the respondent referred to and the characteristics of each partner in the JV. It includes twelve statements as follows:

- 1) The host government is generally supportive in the aspect of forming a JV.
- 2) The host market is very complex for the entry of a single company.
- 3) The host market provides good potential for company’s development.
- 4) Each partner of the JV has planned to widen its construction business range.
- 5) Each partner of the JV has planned to widen its own existing market exposure.
- 6) The power of control in each partner of the JV is decentralized and well dispersed to departments.
- 7) Each partner of the JV is flexible and adaptable toward work and procedure.
- 8) Each partner of the JV doesn’t have full understanding of the host market and not in the possession of required technology.

- 9) Each partner of the JV is very open in terms of accepting new knowledge.
- 10) In general, staff in each partner of the JV is receptive towards new knowledge/techniques.
- 11) In general, staff in each partner of the JV has good experience in working with other companies.
- 12) In general, staff in each partner of the JV has strong adaptability to the changing environment.

Question 1) to 3) were asked to assess the degree of the host government's support, the complexity of the host market for the entry of a single company and the potential of the host market for the company's development of the referred project. These three questions were asked as they can measure the reasons of company engaging in IJV, and they can facilitate or inhibit learning within IJVs (Beamish and Berdrow (2003). Question 4) to 12) test partner's characteristics, including partner's business range widening plan, market exposure plan, the decentralization of power control, flexibility, prior knowledge, openness, staff's receptivity, experience and adaptability. These characteristics are important for the partner choice in IJVs, while Beamish (1988), Anderson (1990), Hamel (1991), and Inkpen (1998) found they have relationships to learning issues, the detail was mentioned in the literature review of Chapter 2 in this thesis.

Section 2 aims to identify various aspects of learning intent of each partner at the time of forming a JV. It includes the following four statements.

- 1) Each partner of the JV has planned and willing to transfer its existing knowledge to the JV.
- 2) Each partner of the JV has planned to develop new knowledge through joint activity.
- 3) Each partner of the JV has planned to learn its partner's exiting knowledge via the JV.
- 4) Each partner of the JV has planned to apply new knowledge/technique learned from the JV into its other business operation.

Question 1) to 4) measure partner's willing to transfer its existing knowledge to JV, plan to develop new knowledge through joint activity, plan to learn its partner's

existing knowledge via the JV and plan to apply knowledge/technique learned from the JV into its other business operation. They are asked as they are the four important aspect of learning and they have strong relationships with the actual engaging in learning (Howes and Tah, 2003).

Section 3 is designed to identify JV's operational characteristics. The following four statements are assessed.

- 1) The JV project was managed in a fully integrated manner.
- 2) The project cannot be divided into a few neat work packages to be handled separately by different partners.
- 3) The management of JV is very independent in managing the JV.
- 4) The management of JV has very strong authority in decision making.

The above statements are used to measure the JV's integration, project's impartibility, management independence and management authority. They were asked because the structure of JV's integration and project's impartibility affects the success of learning (Gido and Clements, 1996), management independence and authority as management competency are important to the success of IJVs (Inkpen, 1998).

Section 4 evaluates the relationships among partners and the JV. It includes the following six statements.

- 1) There is good mutual trust among partners in the JV.
- 2) Partners seem to have their cultures quite close to each other in the JV.
- 3) Partners can understand the cultural differences that exist among themselves in the JV.
- 4) Each partner of the JV has a major business area which is very much related to the JV project.
- 5) All the parent companies are seen to provide good management support to the JV.
- 6) All the parent companies provide good training for their staff in the JV.

The above six questions are asked to assess the mutual trust, cultural similarity, understanding of the cultural differences, business relatedness, management support

and training in the JV. These questions can reflect different aspect of the relationships. Researchers such as Lei and Slocum (1991), Inkpen (1998) and Anderson (1990) have found trust, culture are essential elements for cooperation in JVs, while Inkpen (1998) also found that business relatedness is important to collaboration on knowledge creation, management support and training provided a vehicle and solution for learning and knowledge transfer in JVs. Thus, this section is designed to test the learning model for this research.

Section 5 attempts to identify various efforts of the learning actions which were implemented during the JV. The following eleven statements were assessed.

- 1) Staff of JV has shown effort in conducting self-examination on mistakes and negligence.
- 2) Staff from different companies in the JV has shown to put in effort to share vision to each other.
- 3) Staff from different companies in the JV has shown to put in effort to share experience and lesson learned.
- 4) Effort has been made by management of JV to help all the staff to understand the common vision.
- 5) When faced with problem, management has shown to be supportive towards their staff.
- 6) Staff has shown effort to engage question/problem actively in search of better solution.
- 7) Staff of JV has seen to make effort in listening and accepting better opinion from others.
- 8) The management of JV always makes an effort to consider opinion/suggestion of staff for better problem solution.
- 9) Staff of JV has shown effort to acquire and develop new knowledge/technique in the work.
- 10) The management of JV was seen to make effort in gathering and documenting useful knowledge of all staff.
- 11) There is a clear effort shown in the JV in applying new knowledge/techniques widely into the project.

Based on the study of Hoff et al (2004), Bryan (2003), Senge (1990), Jashapara (1993) and Watkins and Marsick (1993), the above eleven statements measured eleven learning actions including self-examination, sharing personal vision, sharing experience, common vision explaining, support over blame from the management, questions asking, listening to others, solving problems together, developing and creating knowledge, knowledge recording and applying new knowledge. As discussed in the Chapter 2 literature review, these actions have great impact on the learning effectiveness, therefore they are asked in the questionnaire.

Section 6 is to identify the status of the learning effectiveness based on the characteristics of learning organization. It includes eleven statements as follows.

- 1) Staff from different partners has regarded each other as someone whom they can share success.
- 2) The JV has developed a conducive and creative learning climate.
- 3) Vision between the JV and the individuals are discussed and well aligned.
- 4) The management of JV was very competent in facilitating, coaching and supporting individual's learning.
- 5) Free and open communication and dialogue pervades the entire JV, barriers that threaten to impede it were removed.
- 6) Staff of JV has been able to solve the problem from system perspective.
- 7) Staff of JV has shown to be able to work and learn very effectively as a team.
- 8) Individual's capability seems to be able to develop in the JV.
- 9) Staff of JV has been able to work efficiently and effectively.
- 10) The overall knowledge/technique of the JV has generally improved.
- 11) The engineering technology and management skill of the JV have been developed.

The above eleven statements are based on the characteristics of learning organization from the studies of Ellinger et al (2002) and Senge (1990). They are applied to evaluate the learning effectiveness, including collaborative environment, continuous learning climate, consistent vision, competent leaders, open communication and dialogue, system thinking, team learning, individual development, efficient and effective working, knowledge improvement and skill

improvement. They are regarded as the examination of the learning result in this study.

Follow the sequence of the questionnaire, the above rationale of the questionnaire answered “Why the question asked?” and “How does it link to the specific statistic test. The following section will further describe how to gather data from the practice based on questionnaire designed.

4.4.3 Data Gathering Methods

The questionnaire survey is chosen for data gathering to explore the complex nature of the research problem, which is central to the research presented here. This may also be valuable when used in conjunction with other methods, for example, to provide an initial screening to see which particular informant would offer the most beneficial interview (Easterby-Smith et al., 1994). Survey research is useful when a study seeks to answer questions about the distribution and relationships among characteristics of the members of a population. Burns and Bush (1998) point out that surveys allow a researcher to obtain information about motives, circumstances and a sequence of events or mental deliberations. It also facilitates the division of respondents into subgroups for comparisons. Furthermore, much of the information needed for the study is unobserved and involved the perceptions of key personnel familiar with operation activities of their firms. Hence, direct questioning of managers who participated in their firm’s decision making is the way to secure this kind of information.

The questionnaire survey will be sent to the target companies accompanied by a brief covering letter explaining the importance of the research options for response (i.e., either by fax, mail or email), and suggestions for alternative respondent. Respondents had the option of receiving summary copies of the results. Surveys have been scanned for completeness and coded initially in spreadsheet format prior to statistical analysis.

4.4.4 Data Analysis Methodology

4.4.4.1 Theoretical Basis of Analysis

In general, there are two types of statistics: descriptive and inferential. Descriptive statistics are the numbers that describe the target phenomenon. Typically, they are simply measurements or counts. Descriptive statistics are the basic data. Inferential statistics are more complex, because they are calculated using the descriptive statistics so that some conclusion can be inferred from the data. In this study, both of these two types of statistics will be used.

Statistics are created out of data (evidence). To create some statistics, some data must be gathered. The interested phenomenon is usually found in a large number of individuals. These individuals as a group are referred to as the population. Usually data cannot be gathered from the entire population; because of time or money limitations. Thus, typically data can be gathered from only a part of the population. That part is called the sample.

A sample should be (i) representative of the entire population, (ii) randomly chosen, so that each member of the population has an equal opportunity to participate in the study, and (iii) large, as results from larger samples are more easily interpreted and presumably reflect the population better.

The Central Limit Theorem is a statement about the characteristics of the sampling distribution of means of random samples from a given population. That is, it describes the characteristics of the distribution of values we would obtain if we were able to draw an infinite number of random samples of a given size from a given population and we calculated the mean of each sample.

(<http://www.animatedsoftware.com/statglos/sgcltheo.htm>)

The central limit theorem consists of three statements to show that a sample can be representative of the population:

- The mean of the sampling distribution of means is equal to the mean of the population from which the samples were drawn.
- The variance of the sampling distribution of means is equal to the variance of the population from which the samples were drawn divided by the size of the samples.
- If the original population is distributed normally (i.e. it is bell-shaped), the sampling distribution of means will also be normal. If the original population is not normally distributed, the sampling distribution of means will increasingly approximate a normal distribution as sample size increases (i.e. when increasingly large samples are drawn)

So there is a very important link between sample statistics and the normal distribution. In practice, many researchers state that when the sample size is equal or above 30, even when the population is not normally distributed, the sample means will have an approximately normal distribution (Ronald et al., 2002). Based on the central limit theorem, if more than 30 completed survey results can be gathered, the standard normal distribution will be useful. But if the number of results is less than 30, t-distribution is a mix of a gamma distribution for the variance and a normal distribution for the mean, can be used.

After gathering enough data by questionnaire, statistical techniques will be applied for statistical analysis. In this study, descriptive statistics will be used to test the simple relationship between different responses to the addressed issues and the effectiveness of every stage.

Many researchers believed a technique that truly measures what it purports to, had to be valid and reliable (Peter, 1979, Kerlinger, 1986, Venkatraman, 1989). In the following two sections both validity assessment and reliability assessment that will be tested before analysis are described separately.

4.4.4.2 Theory of Validity Assessment

The degree to which a construct achieves theoretical and empirical meaning is referred to as construct validity (Hughes et al, 1986). Construct validity requires convergent validity and discriminant validity of a measure (Kerlinger, 1986). Convergent validity is the extent to which the evidence from different sources about the construct indicates the same or similar meaning of the construct. Discriminant validity is the extent to which a construct can be empirically differentiated from other similar constructs (Kerlinger, 1986).

Factor analysis is considered to be an indispensable method for determining convergent validity. It is a method for reducing a large number of measures to a smaller number called factors by discovering which measures go together, as well as the relationships between the clusters of measures. Discriminant validity is measured via pairwise correlation among constructs. In this research, both tests of convergent and discriminant validity will be employed and they are described further as follows.

Theory of Convergent Validity Analysis

The factor model used in this analysis was a principal component analysis with varimax factor rotation on every observable construct. Factors extracted from factor analysis with loading more than 0.45 were considered adequate for establishing convergent validity (Kim and Muellar, 1978).

Following the advice of Hair et al. (1992), multiple criteria for the numbers of factors extracted will be used: (a) latent root (eigenvalue) criterion should equal to one; (b) percentage of variance criterion required that factoring procedure should not be stopped until extracted factors account for at least 60 percent of variance; and (c) the scree test suggests that the point at which the curve of the latent root first begin to straighten out is considered to indicate the maximum number of factors to extract.

Theory of Discriminant Validity Analysis

The measures should not only have convergent validity, but also discriminant validity. Discriminant validity is the extent to which the measure is novel and not simply a reflection of some other construct or variable (Churchill, 1979). Discriminant validity is measured by pairwise correlations as suggested by Venkatraman (1989). High correlations among the constructs might invalidate the test, because high correlations might indicate that the scales measure the same rather than different constructs (Campbell and Fiske, 1959). Discriminant validity is indicated by low correlation between the measures of interest and other measures that are supposed to measure different constructs (Heeler and Ray, 1972; Venkatraman and Grant, 1986).

Specifically, discriminant validity is attained when the correlation of a variable with another variable does not exceed 0.55 and is significant at $p < 0.05$ (Schwab, 1980). Additional evidence of construct validity is provided when the pairwise correlations between the variables of interest have the direction assumed by the theory (Venkatraman, 1989).

4.4.4.3 Theory of Reliability Assessment

The exploratory nature of this study, and the fact that the questionnaire on learning used in this study has not been used in any relevant previous studies, required an assessment of the extracted variables from factor analysis (Venkatraman and Grant, 1986).

Reliability is defined as the degree to which measures are free from error and therefore yield consistent results (Peter, 1979). Out of three basic methods for assessing reliability (test-retest, internal consistency, and alternative forms), the internal consistency method has the fewest limitations and is most often used in assessing reliability (Carmines and Zeller, 1979; Venkatraman, 1989).

Following the recommendations of Churchill (1979) and Nunnally (1967 and 1978), Cronbach's alpha (α) will be computed for all factors that will be used as variables in hypothesis testing. Researchers usually use a cut-off value of $\alpha = 0.70$ (α_1) for studies

in advanced phases (Nunnally, 1978), while for exploratory studies alphas ranging from 0.50 to 0.60 (α_2) are considered to be sufficient (Nunnally, 1967; Van de Ven and Ferry, 1979).

Measures have to meet validity and reliability conditions in order to be considered good measures and to be used in hypothesis testing. The hypothesis testing techniques will be discussed in the following section.

4.4.4.4 Discussion of Hypotheses Testing Technique

The variables of main effects in this research are metric and nominal for learning determinants and ratio for learning effectiveness measures and some controlling variables. The theoretical model presented in chapter 3 clearly suggests numerous dependent variables. Such a model suggests the use of three possible techniques: Structural equation modeling, canonical analysis, and multiple regressions (Emory and Cooper, 1991). Each of these techniques requires particular assumptions that have to be met in order for the technique to be valid.

The structural equation modeling technique needs at least 100 observations (Hair et al., 1992), while the recommended sample size has to have 200 observations (Miner, 1982). Canonical analysis is a technique for exploring the relationship's amount of multiple criterion and multiple predictor variables. The technique is more general than any other multivariate techniques, but it has several limitations that discourages researchers from using it: (a) the technique is mostly descriptive and as such has limited predictive validity of assumed relationships; (b) it reflects the variance shared by the linear composites of the variables; (c) canonical weights derived in computing from canonical functions are subject to a great deal of instability; (d) canonical weights are derived to maximize the correlation between linear composites, and not the variance extracted; and finally, (e) it is difficult to identify meaningful relationships between the subsets of dependent and independent variables because precise statistics have not been developed yet (Hair et al., 1992), and no researcher mentioned the development of precise statistics after 1992.

In this study, only 96 valid answers of questionnaire were gathered. Thus, the sample size has only 96 observations which is smaller than 100 observations, the minimum requirement of the structural equation modeling technology. Therefore, structural equation modeling cannot be used in this study. This study tests hypotheses which reflect the cause and effect relationships between learning determinants and learning effectiveness. However, Hair et al., (1992) pointed out that Canonical analysis is difficult to identify the meaningful relationships between the subsets of dependent and independent variables. Thus Canonical analysis cannot be applied in this study.

The limitations of the previous mentioned techniques imply the use of multivariate regression analysis in this study. This technique requires the use of one single criterion variable and one or several independent variables. The objective of this technique is to use independent variable. This technique requires three crucial assumptions to be met in order for this technique to be valid: (a) normality of variables, (b) homoscedasticity, and (c) non-existence of multicollinearity among independent variables. The methodologists have developed numerous techniques for assessing the character of assumptions and techniques in cases when assumptions are not met (Dimovski, 1994).

Before applying regression techniques to the data, several diagnostics will be performed. First, the relationship between each dependent variable that represents learning process and each independent variable will be performed via partial regression plots in order to determine the type of relationship (linearity test). Second, the identification of possible outliers will be performed in order to identify possible influential observation via residual analysis. Third, the normality of the variables will be inspected via analysis of distribution shapes of variables and Shapiro-Wilk's test. All regression equations will also be tested for multicollinearity via tests of tolerance value and variance inflation factor. The possible existence of heteroscedasticity will be tested by a test of first and second moment specification (White, 1980).

As there are four constructs, a multiple regression model is considered for the quantitative analysis for the questionnaire received. For clarifying the relative weight of each level affects the learning effectiveness, it is simply supposed that if the model is linear then the model will become a multiple linear regression model. The linear test of the relationships between dependent variable and each independent are tested via partial regression plots firstly. All regression equations have been tested through multicollinearity tests before using this analysis method.

4.5 Summary

This chapter has described the research design and methodology that was used in this study. The purpose of this chapter was to describe the tools that were implemented in this study to support the objective of this research. Firstly, this chapter has outlined the overall research and the methods taken to gather the qualitative and quantitative data necessary to justify the conceptual model and to test hypotheses that drive the research. Then, the case study methodology was justified, and the multiple-case studies approach is selected to gather data and do the qualitative study. Finally, the survey target and the rationale of questionnaire were presented to gather the quantitative data, later the methodology of analyzing these data was discussed, and the multiple regression technique is chosen to test the hypotheses which were presented in chapter 3. The Next chapter will apply case studies to support the research model in practice.

Chapter 5 Qualitative Study

5.1 Overview

This chapter presents the real cases about learning in the ICJV. The ICJV provides a good opportunity for construction development in many countries. Six ICJV projects gathered from China and Singapore are presented. The sources of the first three cases were gathered from the company's report, and some of the background information of the project and the company found in the newspaper are regarded as references for the case study; the other three cases were gathered in Singapore through face-to-face interview.

5.2 Case 1 Ertan Hydropower Plant Lot I

5.2.1 Background

Table 5.1 Case 1 Ertan Hydropower Plant Lot 1

Project	Ertan Hydropower Plant Lot I (Main construction)
Contract Sum	US\$776M
Project Location	Southwestern Sichuan Province China
Project Duration	Sep 14th ,1991 to Apr 15th,1999
Contractors	Ertan JV
JV Partnerships	Impregilo(32%), Dumez (21.25%), GTM(21.25%), Torno (10.05), SinoHydro Bureau 8 (15%)
Material from	Mainly from company report, Newspaper as references

The profile of Case 1 is shown in Table 5.1 and the detail background of this case is shown in the Appendix D-1. This project was undertaken by the Ertan JV, it included Torno, Dumez , GTM and SinoHydro Bureau 8. The implementing agency is the Ertan Hydroelectric Development Corporation (EHDC) and Impregilo was the lead company.

5.2.2 Experience and Findings from Sino-hydro Bureau 8

Ertan was the first project to bring China's construction in line with international practice. There were many large Hydro-electric power stations emerging all over the world, and there was a lack of electric power in China at that time.

Before the Ertan JV was built, Mr. Liu Jin, the director who prepared the Ertan JV from Bureau 8 said, "Cooperate with foreign companies in the domestic market is better than going abroad just looking at the way they work. By cooperating with foreign companies and constructing together in our domestic market, our contractors can learn foreign managerial know-how and technology", he added "there is abundant water resources in the big south-western area, which can reach 71.35 billion kilowatts, so the enrichment of the water resource potential here is among the highest in world. If Bureau 8 can take part in the construction of Ertan project, in the near future, we can not only build large hydro power stations by ourselves in the domestic market, we can also bid in the international construction market".

The JV was under linear function management, the project management structure had seven levels consisting of project manager, site manager, department manager, director, section chief, foreman and worker. The headquarters gave the project manager very large authority, except for some issues like whole budget auditing and middle management human resource changes, other dispositions of human, finance and materials were all under the jurisdiction of the project manager. There was clear authority in longitudinal orientation and clear responsibility division in transverse orientation. Therefore, the management was very efficient. For saving the construction costs, the contractors used a very capable and vigorous management structure and tried to make use of cheap local human resources, where foreign management was only 4% of the workforce

Based on the contract, the foreign contractors held all the important positions, and the second men were the elites from Bureau 8. The consciousness of landlord was

challenged to the staff from Bureau 8. They couldn't understand why they had to accept the command of foreigners in their own country at the beginning.

The cooperation situation was very bad at the early stages. One engineer with monicker "Donald Duck" was full of energy when he first came to Ertan. The foreign senior gave him a drawing but he found there were several mistakes in the drawing after the recalculation of some data. When he pointed out the mistake to the foreign senior, the foreign senior was very unhappy. They disputed the mistake and finally the angry foreign senior fired the engineers. This kind of conflict happened frequently and the contradictions between the staff of Bureau 8 and the foreign contractors became acute. During the first half year, there were big strikes and a small conflict happened almost every day.

The staff at Bureau 8 said "The development of Chinese hydropower plants is not slow, why invite foreigners to China? Why we have to accept the command of foreigners." Some engineering teams even considered stopping cooperation with foreign contractors.

From 1992 to 1994, there were many conflicts and strikes. It is not only the conflict process of different cultures and values, but also the process of continuing adaptation and adjustment. Finally the foreign partners recognized that China had Chinese characteristics, and made some adjustments. After several strikes, one of the foreign site managers fired an Italian foreman who was arrogant and disrespectful of Chinese. He also told his employees "Don't look down on Chinese. They don't lack the capability to build the hydropower plants. Chinese have built many more hydropower plants than any other country. International cooperation means that Chinese contractors want to know how foreign contractors cope in the intensely competitive international hydropower construction market".

On the other side, the Chinese partner told their staff to be strong and confident to improve working spirit, work technology ability and the market competitive capability. As the leader of the Ertan project construction team of Bureau 8, Mr Liu

dealt with the construction business in the day, listened and comforted the staff at night. At that time, 1992, then Chinese leader Deng Xiao Ping held a talk which encouraged continuing reform and opening. The talk steadied Bureau 8 and gave them the confidence with the open and cooperative policies. And the top management of Bureau 8 sent higher and middle level managers to establish the Bureau 8 Ertan Construction Sub-Bureau to deal with the affairs of Ertan. The Bureau 8 Ertan Construction Sub-Bureau confirmed their working guild idea as “doing well in cooperation with foreign partners, with the sincere desire of making the JV a happy cooperating team to ensure the Ertan project is successfully finished, while in the process, training a group of persons with ability and learning a set of management method”.

For the company’s long-term development and to learn unknown knowledge, Bureau 8 abandoned the idea of retreat but chose to continue cooperation with foreigners, enduring humiliation in order to carry out an important task. This strategy of concession in order to advance was the reflection of Bureau 8’s previous learning mindset. The idea of cooperation and learning was delivered to every level of the staff who were involved in the JV, and later on, the staff and the workers had fewer complaints and a better cooperating climate was built. At the same time, the Ertan Hydroelectric Development Corporation (EHDC) also provided material support and helped Bureau 8 to solve some difficulties. After that, Bureau 8 maintained the passive stage, and gradually got used to the difference with foreign contractors. Therefore, the conflict was declined gradually and the staff and the foreign contractors finally built a good partnership.

One manager said “Through the Ertan project, all the staff especially those managers have a great change in the thinking opinions, we endured the storm of market economy, and we understood the importance of product quality to the company’s survival. We began the exploration of management and did a mass of well-knit work and got a great substantial achievement”.

The Ertan project was called “Ertan Universtiy”. Ertan was regarded as the domestic international market, international school of hydro power construction and the median of participating international competition by Bureau 8. The leader of Bureau 8 left no stone unturned to let more staff training in Ertan. There are about 6000 people came to study in Ertan, two-third of them were young. Some of these young staff had no traditional limitations in their mind; they grew much faster in on-site training. Bureau 8 notices this and used it to train a modern construction team through the EJY.

Young engineer Li Jianning was a good example. At the beginning, he was the vice-director of technology department. He learned new knowledge after using some foreign equipment. But he also recognized the most significant differences between the foreign contractors and the domestic contractors were the system and management. He always compared the Ertan project with other domestic projects he worked on before, and acquired the experience and knowledge from Ertan. Because he knew English and Italian as well as Chinese, in the conflict, he could directly communicate with foreigners, and solved the misunderstanding and developed a bridge to allow greater communication and harmony between different, lowering distrust between mutual partners. After doing well of his own tasks, he paid much attention to the management of the JV. He was very good at finding problems and summarized the experience and he often put forward the method or suggestions to solve the problems to the management. In practice, he found that the foreigners were better in the macro-management and less in micro-management because of fewer staff and language problems, therefore, the higher level management duties were often entrusted to Chinese staff. However, different Chinese staff were intermingled, some were full of responsibility and some just muddled along; some were professional and with high management skill but others were very low quality. In this situation, he suggested providing training to the Chinese staff, especially those recruited from social markets. Training a group of excellent Chinese management staff was an urgent affair for the project management. The JV adopted his suggestions to great benefit.

Another good example is Zhang Huaping, who worked in the repair department. His senior was French, who was working very hard, about 14-16 hours every day. Zhang Huaping was moved by the foreigners' working spirit, and then he made the decision to learn from them. With this learning mindset, he worked with the foreigners actively, and asked questions whenever he didn't know. He felt that the foreigners were generally open, and if he wanted to learn, they were willing to talk and teach. They also liked people who were willing to learn and ask. Zhang Huaping was very diligent and accepted new knowledge very fast, and his ability and working efficiency improved very fast. He was promoted as Chinese engineer and put in charge of one department of the JV. After that, he learned more about management knowledge and cut back on the repair costs. He noted that foreign partners had some leaks in their management process. He corrected some of their wastefulness such as throwing out useful fittings. He also provided more than twenty improvement suggestions to modify the design of a car. Working efficiency was improved. He also studied the new car retropack with the Italian technical staff as a team. His study was successfully used in the experiment to very good effect and he also applied for a patent. Zhang Huaping made use of the JV as a learning opportunity and learning very successfully, his improvement also helped better performance of the JV which was recognized by his manager.

It's true that Ertan was a good school. The vice-manager Yang Minghai went from being a second grade welder to an advanced level of management staff through the Ertan project. In the August of 1992, he passed a JV exam to become a welder. He had just graduated from junior high school then began to work on the site. His knowledge was much lower than the foreigners in Ertan. He knew the only way to catch up was through learning. Therefore he worked harder in Ertan, and was encouraged by his family. He persisted in learning and endured all the difficulties. He had a very flexible mind and was very good at language learning. Soon after he could understand what his foreign colleagues said and did as they instructed. Soon he was promoted to middle management. In 1995, he was promoted to vice-manager of Department of Electronic Engineering, in charge of transportation. In this position, he worked with other staff and solved the problem of transporting 52 long boards, of 48

tons, from Aba Zhou to Ertan, where the road was potholed. Yang's was supervised by the minister of Ministry of Machinery and Electronics, who gave him independence in his work. In this environment, Yang tried his best to work creatively. He dealt with every task in an orderly way and his responsibilities slowly increased leading him to progress in the company after several years as vice manager, he won recognition from foreign colleagues and the support and respect of staff under his supervision, being seen as a great example of good leader by both Chinese and foreign builders.

The fourth example was the vice manager of the Ertan project main dam, Wu Jinshu. Wu graduated from Zhengzhou electric school in 1991, majoring in corporation management. He was traffic staff in 1992. A year later a foreign colleague asked him to manage a warehouse. Young people have strong adaptability and receptivity, and foreign colleagues noticed sharp-witted and surefooted working attitude. Therefore, in 1995, he was promoted as vice manager of the main dam construction department. After adapting to different work in the first few years, he became familiar with and accumulated with construction direct experience stage by stage. At the end of 1996, a foreign colleague put Wu in charge of the concrete placement work of the main dam which Wu was unsuccessful at. At the end of 1997, under his management, the concrete placement record was 1,500,000 Cube Metres each year, a new record in the concrete placement history of Ertan, and not only the best in the history of Bureau 8 but also better than any other concrete placement output all over the country and a world record. The concrete placement output volume continually set new records in the last years of the Ertan project under the management of Wu. The quality of concrete placement was raised to a new level in the construction of the super hydropower plant main dam.

There are many examples of individual improvement in Ertan, the foreign colleagues commented on the growth of these young people "from them, we not only see the strong future of Bureau 8, but also see the mightiness of the China hydropower construction business clearly and hear the footsteps of China enter the international hydropower construction market as well".

The growth of Bureau 8 was very significant. In 1996, Bureau 8 defeated Impregilo and won a construction contract for a power plant in Pakistan. In 1997, by thanks to the experience of cooperating with foreign contractors in Ertan, Bureau 8 triumphed over all the domestic competitors and won the task of manufacturing left side of Sanxia - the largest Hydropower plant in the world.

Through construction with foreign partners, Bureau 8 trained a new generation of hydropower talents, and their later performance shows that they created more and more achievement after Ertan. This is the great success of Bureau 8.

5.2.3 Discussion

Ertan Hydroelectric Development Corporation (EHDC) was under the authority of the Government in this case. It provided much support for the JV, meeting with the contractors weekly to solve construction problems. When the local contractor was dissatisfied with foreign behavior and went on strike, EHDC also appeared to negotiate with both partners to solve the conflict and promote the mutual understanding of different culture. With the help of EHDC, the partners understood each other gradually and a better working and cooperating environment was built.

The site is located near Panzhihua on the Yalong River, which is situated (a tributary of the Yangtze) in Sichuan Province. Its development is a top priority for the government, since the region is poor and attracting foreign investment has proved difficult compared to the successes of the booming coastal provinces. And there were also some other difficulties, such as communication and transportation in that area. The law for large project construction was not mature; the hydro power reform was not completed at that time. Therefore, the market was regarded as complex and underdeveloped.

China has the largest untapped hydro power potential in the world. Less than 10% of potential hydro resources are currently being exploited. Large and medium sized

hydro power projects will help China satisfy the requirements for the national development. Both the foreign and China contractors recognized the market potential. Therefore, Ertan was touchstone for partners to further explore the market later.

Bureau 8 regarded Ertan as a university, many young people were sent to train-on-job. Those young people had no restrictions of old tradition, just as the four examples mentioned; they were open to learn new knowledge. Many of them had years' of construction experience like Zhang and Yang, and many of them had strong adaptability and receptivity like Li and Wu. These people improved quickly during the project.

In this case, the director Liu said they wanted to explore the market elsewhere in China and also go abroad to compete in the international hydro power construction market.

The promotion in the four examples shows that the organization of the JV was very flexible and they promoted capable people without other considerations. The management of the JV was organic and decentralized, and different level managers had strong authority to make the corresponding decisions. The Ertan project was managed systematically. This gave more opportunity for the people involved in the JV to learn and to improve faster.

From the beginning, EJVB was regarded as the learning platform by Bureau 8. Bureau 8 wanted to learn managerial know-how and advanced construction technology from the foreign partners. The company and the staff have the willingness to learn and improve. They are willing to accept new knowledge from the partners, and they also have the intent to develop and apply it to the special circumstances of the project.

The project was fully integrated under different shares. Different staff and workers cooperated together to finish the same task, for example the foreign managers entrusted Chinese staff to manage the bottle management affairs, or the Chinese engineers calculated the shop drawing for the senior foreigner and then to guild the local workers etc. These connected works gave more opportunity for the staff to know each other and learn from each other easily.

The management structure of the JV was outlined, and the headquarters gave great authority to the project manager to charge the JV's affairs, and the other level managers had corresponding authority to manage the people under them. The management of the JV was recognized as independent and they could make most decisions. In this kind of situation, the managers have more power to manage in their ways, it inspired their creativity to improve the working capability and help them to learn and grow faster.

In the first two years, there were many conflicts between staff from different partners because of the difference of culture. After the conflicts and learning the difference from each other, they understood each other well about culture differences like living habit, beliefs, values etc, and they also built mutual trust with good communication and understanding. This improved the relationships between partners. And it also provided the basis for the avoidance of conflicts or how to achieve their resolution and for ongoing peaceful coexistence during the JV.

When the conflicts emerged, the management gave great support to solving the problems. They adjusted and comforted different partners, and educated their staff to recognize their partners and develop the correct approach to the cooperation. A better learning climate was forming gradually in the JV. The manager also provided some training to improve the general capability of managers and trained an excellent management team for the hydro power construction. The main business of Bureau 8 was hydropower construction, similar to the Ertan project.

In the four examples, the four persons all liked to engage to problems actively. Zhang liked to ask questions and listen to foreign colleagues. They also liked to share their opinions and experiences, for example, Li suggested providing training for the Chinese management staff, and Zhang pointed out the waste problem and also provided suggestions for the development of a new car retropack, Yang solved the difficult transportation and unloading of big materials. Wu developed the concrete placement technology and applied it to the Ertan project, which created the world record. And senior managers gave great authority to these people, supporting their development. The management also educated all staff involved in the project to

understand their basic vision. Peng Qiyong, the director general of Bureau 8 said “Chinese and foreign partners have consistent vision under project construction, which is to complete the Ertan Hydropower plan successfully according to the contract. To reach this vision, different partners must achieve harmonization and must build good partnership.”

Gradually, the JV environment changed. With the help of management, the staff from different partners had built consistent visions to complete the largest hydropower plan in the 20th century. Some capable staff improved their foreign language to help different partners communicate without obstacles. With the understanding, a collaborative environment was formed in the JV. And the managers could solve the problem with the system thinking concept, which would consider the Chinese characteristics and the benefit to all partners. Beyond that, it implied recognizing difference and diversity as opportunity rather than danger and as a valuable resource to be used for the common good of better performance. Therefore, a continuous learning climate was formed step by step. The case also shows that after learning and improvement from the JV, some construction technology such as the concrete placement technology was improved. Also managers gain knowledge for international construction management. Many individuals made use of the opportunities and grew up faster. The managers knew how to coach the people under them and won the respect from these people, such as Yang in the examples above. With these developed personnel, working became more effective, for example, Wu increased concrete placement output with great quality. And the participants also learned to work as a team, for example, Yang solved the transportation difficulty together with the staff under him, and Zhang worked with technical staff from Italy to improve the new car retropack etc. A learning environment was gradually built and the capability of the individual and company improved in the progress of the JV.

5.2.4 Conclusions

This case provided evidence of sincere learning by Bureau 8 in the Ertan JV. There is the evidence of government support undertaken by the EHDC. And the project was

under the potential Sino-hydropower construction market, but there are some complexities under that construction and policy environment at that moment.

Most of the company characteristics, which may help learning, were found in Bureau 8. The staff from Bureau 8 generally had strong capability; Bureau 8 had the market development strategy and strong learning intent to improve from the JV.

The characteristics of the JV which help learning were also identified: the project was fully integrated, the project couldn't be divided clearly, the staff from different countries had to finish the same task together, the organization of the JV was organic and decentralized, the management had strong independence and had great authority to make decisions. After conflict solving and understanding the process, different culture was understood and respected, and mutual trust was reached. The parent company provided significant support to the continually cooperation and also provided training for the management staff. Since the main business of Bureau 8 was similar in this project, the staff could accept the relevant knowledge easily.

Many learning activities were observed in the cases, such as engaging work actively, asking and listening to others, sharing the personal vision and experience. The management provided education to help the staff understand the common vision and had a supportive attitude toward the improvement of individuals. The individuals were observed developing and applying new knowledge with their creativity.

Finally, a good collaborative environment was formed gradually, the staff could communicate without obstacles with consistent vision, and solved problems with system thinking and a continuous learning climate was formed. Other than that, the individual and the organization were improving. More technology and knowledge were gained by the organization. The individual improved their capability and the leader got the respect from staff. The staff brought their intelligence to work as a team and work effectively in the JV in that situation. A learning organization was formed gradually in the JV progress.

The director of EHDC commended that “during the construction of the Ertan project, the achievements of Bureau 8 are the largest”. When Bureau 8 was asked why they

had this achievement in the short-term, they answered “in the practice of Ertan, we learned how to be an international contractor, and go around the world from Ertan”. Bureau was a great learner in the Ertan JV; the important characteristics, which were discovered in the case, are significant for their success.

5.3 Case 2 Xiaolangdi Project Lot I

5.3.1 Background

Table 5.2 Case 2 Xiaolangdi Project Lot I

Project	Xiaolangdi Project Lot I(Main Dam)
Contract Sum	US\$2160M
Project Location	Exit of last gorge of the middle reach of Yellow River, China
Project Duration	Jul 16th,1994 to Nov 30th,2000
Contractors	YRC (Yellow River Contractors)
JV Partnerships	Impregilo (36.5%), Hochtief (36.5), Italstrada (14%) Bureau 14 (13%)
Material from	Mainly from company report, Newspaper as references

The profile of Case 2 is shown in Table 5.2 and the detail background of this case is shown in the Appendix D-2. This project was undertaken by Yellow River Contractors (YRC), a JV formed by Impregilo, Hochtief, Italstrade and SinoHydro Bureau 14.

5.3.2 Experience and Findings from Bureau 14

Xiaolangdi is the largest World Bank-financed hydroelectric project in China. Dividing up the work among three different groups of international and Chinese contractors worked well. A number of subcontractors were hired, increasing participation of local companies in the project. At the peak of construction, more than 700 expatriates were employed from 51 foreign countries. Different partners cooperated based on the international regulation and International Federation of Consulting Engineers (FIDIC) contract clauses.

Faced with the new characteristics and new trends emerged in the water and hydroelectric market, Bureau 14 considered the macro-environment, aiming to fulfill the market requirement, adjust its management strategy, according to the basic principles such as linking to a strong company, complementation strength, and participating different kinds of JV in Xiaolangdi project.

From the beginning, Bureau 14 was willing to understand FIDIC through the project. Inevitably, many problems were encountered and provided both chances and challenges. Logistical problems, for example, handling of materials by one contractor, and placed in temporary stock piles by another contractor; coordination of the distribution of the designated local materials; and planning of the diversion between Lot 2 Contractor (underground works including diversion tunnels, plunge pool and temporary cofferdams) and Lot 1 Contractor. Bureau learned how the foreign contractors solve it based on the FIDIC.

Furthermore, Bureau 14 was willing to learn foreign advanced technology from the collaboration. The management of the JV from Bureau 14 had the independence and authority to make a decision for technology innovation. A number of technical innovations, including the use of fully corrosion-protected tendons and testing and the use of improved grouting methods should be noted. In China, cementitious grout is considered as adequate protection against corrosion for tendon wires. Fully protected tendons were first used at the Ertan project and then very extensively at Xiaolangdi. The roof of the fourth highest underground powerhouse cavern in the world is supported with rock bolts and corrosion protected tendon rock anchors (Wang and Solymár, 1997). Also extensive use of corrosion protected tendon rock anchors was made in the support of the 120m high intake and plunge pool slopes.

Different corporations have different cultures, management style and value opinions, but each corporation has its own advantages. Therefore, the partners of JVs can strengthen its advantage and reduce its disadvantage through JVs. For example, each level of managers who have been involved in the JV learns to know the

contract-centered management opinion of Impregilo. The impression of a complete and particular management system, accurate, strict, detailed and substantial operation of site and cost management, and the standardized equipment management has a positive effect on the staff of Bureau 14 through system learning.

Bureau 14 also provided some training for the staff working in the JV. For example, there are some special technical requirements in the construction, Bureau 14 put great human and resource efforts and used different methods to train the construction staff to guarantee the construction quality. Bureau 14 also considered the international characteristics and opened an “English Corner” learning area, computer classes, a special type of work classes, and promoted a zealous learning environment to learn computers, foreign language, and computer drawing. These activities not only guided the staff study and encouraged working actively, but also improve the staff’s comprehensive capabilities.

After the completion of the construction of the main dam, Bureau 14 JV with other engineering companies involved in the project benefited from the management skills that were passed onto the company. The Director of Bureau 14 Mr Li said, “our construction operations basically stayed in the product managing stage, capital input and output was not considered. When the cost was larger than the budget, we just complained to the owner. For example, when we found it is not enough to excavate one m³ at RMB28, after a complaint, RMB28 could be changed to RMB30; later we found RMB30 also not enough, we could complain again and asked for RMB35 etc. But now, we couldn’t do like this again after signing the FIDIC contract, if the contract says excavate one m³ at RMB28, it can’t be changed, we will lose money if we have to make it. Therefore, we have to learn how to save the cost and how to manage the capital”. He also added “After participating in the construction of the Xiaolangdi Project, we recognized that management is the eternal subject for the company, management is the determinant for the success of the company; In the Xiaolangdi project, the viewpoint of the managers of the companies and all the staff has been updated, which is very meaningful for the

reformation and development of the company, this reward is much larger than construction itself”.

As the partner of foreign contractors, Bureau 14 can construct based solely on the construction scheme of the sponsor contractor. However, Bureau 14 is the only Chinese main contractor in this JV, it considered the success of this important Chinese project as its responsibility, and tried to make some innovations to improve the technology to guarantee the quality of the project and finish it faster. For example, the pressures double-wire without bond anchor technology were first applied in the construction of the three scouring tunnels, no experience could be referred to. Based on the original scheme established by the foreign contractor, Bureau 14 designed and manufactured a series of special tools to suit the construction requirement, these innovations not only guaranteed the quality and scheduled requirement of the project, but also the convenience for the use of the workers. Later, when the foreign colleagues had some difficulties, they would discuss with Bureau 14 actively to find the solutions.

At one point the work fell one year behind schedule, partly due to a large number of rock falls and collapses recorded in the orifice tunnels at the start of the project, and partly due to other events and disputes. Three collapses occurred and the delay associated with the reconstruction of the failed sections appeared to be almost insurmountable at the time of the events. Excavation was nearly at a standstill for two months while the situation was assessed. A repair programme was suggested and prepared by the contractor and later modified/approved by the engineer. Acceleration measures, including assigning Bureau 14 for the underground works, some reorganization and better cooperation between the engineer and contractor, helped to reach the target date for river diversion. Concrete production rates reached more than 115000 cubic meters per month from the planned 90,000. This alone is a remarkable achievement.

5.3.3 Discussion

Under the direct leadership of the Ministry of Water Resources, the government supported the project, and encouraged local contractors to learn from foreign contractors and expand into foreign market. The solicitude of the leaders of the Party and the State had greatly encouraged all the workers of the Xiaolangdi Project.

The Government of the potential Chinese Hydroelectric market supports the Xiaolangdi project. Developing countries are regarded as a higher potential market in the construction industry. China as a developing country is regarded as a very potential construction market in the world. The market is a battlefield. Therefore, the company has to suit the market to win in the competition.

In the construction management experience report's introduction to the Xiaolangdi project of Bureau 14, the director mentioned, “About eight years of experience in Xiaolangdi, through connection and collaboration with foreign contractors, based on the learning and using of advanced construction technology and management experience of foreign contractors, continually accumulating, bravely exploring, bringing more in line with international practice, SinoHydro Bureau 14 formed a better construction project management experience and construction capability, management level, duty completing ability and synergic spirit are improved”.

SinoHydro Bureau 14 regarded this JV as a magnificent learning opportunity and tried to apply the project construction management principle in the project. They had intent to acquire and apply the international knowledge in contract management. They also had intent to develop the technology or management skill according to the environment and the Chinese characteristics. And they successfully made the improvement.

Bureau 14 recognized the importance of employee's capabilities. Many employees with good adaptability and receptivity were sent to the JV to learn to improve their knowledge and experience. Bureau 14 provided training to improve the project

quality, and also provided environment for computer training, and foreign language training to increase the employees' capability. The communication problem between the staff from different countries was reduced because of the foreign language training. Therefore, the JV performance was guaranteed and the company itself was developed. The director said "modern company management must recognize human beings as the basic unit of development. The capability of human beings determines the management level and production capability of an enterprise. A JV as an independent economy entity must obey this basic discipline". These people have been trained as the key mainstay for parent companies' development later.

Bureau 14 engaged the problem actively and developed specialized tools for the construction, and also improved the foreign contractors' schemes several times. To better learn the international management skill, it listened and accepted the contract management of the experienced foreign contractors to increase its contract management level. The contract management concept was practiced throughout the JV management.

Bureau 14 developed new technology such as designing more suitable tools for construction and improved its international contract management knowledge and skill. Individual capability was also improved, and many leaders with coaching and respectable capability who could manage were also trained, so working effectiveness was improved, and they learned to work with foreign contractors more efficiently as a team in the program of the JV project.

Bureau 14 continually perfected its management system to make sure all levels of staff knew their responsibilities, to the benefit of the JV; therefore the staff could understand the common vision of the JV, which formed the basics for Bureau's good management reward in the construction and management process in the JV. Combining the international project characteristics of Xiaolangdi, the characteristics of Bureau 14 and the project construction management requirement, Bureau 14 built the regulation and system from many aspects such as station responsibility, administration logistics, management contracts, distribution, construction production,

material and equipment, labors and staff basic behavior rules. This Improved these management system and methods from the practice, and increasing the system's managing power of human resources.

With the above conditions, a continuously learning climate was developed, the bureau 14 and the foreign contractors communicated and made innovations and solve problems together. Bureau 14 learned the international advanced construction and management experience, with the concept of develop the useful and discard the useless and always keep international standards in project management. International tradition was connected with Chinese characteristics and a new creative international project management mode with Chinese characteristics was explored. The management concept and skill of Bureau 14 were improved.

5.3.4 Conclusions

With government support, in the complex and potential Chinese hydroelectric construction market, the SinoHydro Bureau 14 had intent to acquire and apply international knowledge in contract management and develop the technology or management skill according to the environment and the Chinese characteristics.

Under the above conditions, with relevant learning capability, in daily activities, Bureau 14 put great effort into learning the new concept and real construction technology and management skill from the partners and from the JV. In the procedures of the JV, the Bureau's international concept was increased. The learning effectiveness to the foreign advanced management experience changed from learning spontaneity to consciousness in the learning organization of the JV. The JV was formed as a very good learning platform as a learning organization, and Bureau 14 learned and was improved continually in the construction process.

5.4 Case 3 Xiaolangdi Project Lot II

5.4.1 Background

Table 5.3 Case 3 Xiaolangdi Project Lot II

Project	Xiaolangdi Project Lot II(Intake, Tunnels and Spillway)
Contract Sum	US\$4200M
Project Location	Exit of last gorge of the middle reach of Yellow River,China
Project Duration	July 16,1994 to June 30,2001
Contractors	CGIC JV
JV Partnerships	Züblin (Germany) (26%), Strabag(18%), Wayss and Freytag (15%), Del Favero(15%), Salini(14%), Bureaux 7 (6%) and 11 (6%)
Material from	Mainly from company report, Newspaper as references

The profile of Case 3 is shown in Table 5.3 and the detail background of this case is shown in the Appendix D-3. This project was taken by CGIC JV, formed by Züblin, Strabag, Wayss and Freytag, Del Favero, Salini, SinyHydro Bureaux 7 and 11

5.4.2 Experience and Findings from of Bureau 11

This case is also under the macro-environment of the Chinese hydroelectric market same as the previous case, and with the special characteristics of Xiaolangdi are under government support.

The project is the first time for SinoHydro Bureau 11 to collaborate with engineers and workers from more than 50 countries, different situations of different countries, different languages and different thinking styles, so misunderstandings are unavoidable. However, with the support of the owner, supervision and the CGIC JV, all the employees of SinoHydro Bureau No.11 tried their best to finish the 27 months' task in 13 months, and achieved the river diverting goal in 1997, at a miraculous construction speed. SinoHydro Bureau No.11 put across the intake tower concrete placement task on June 20, 1999, and it made the whole construction project four months earlier than the contract.

From the bidding, the Bureau 11 used Xiaolangdi as a little union and big school to train and develop different talents who could adapt the international project. To improve the enterprise's whole competitiveness, they concentrated on changing mentalities, absorbing the most advanced international enterprise management ideas, and innovating the enterprise's management model totally.

The Bureau 11 sent about 100 young engineers to all departments of the CGIC JV, including more than ten bachelors with international project management double degrees. Through the practicing training, the construction teams have been well brought up and exercised, the whole capability of all the staff were greatly improved, and it also trained a group of persons to adapt the international project, especially the persons with the technology, contract and foreign language capability. It's a great treasure for the bureau, and it forms a very good foundation for their participation in the international competition.

On the other hand, at the beginning, Züblin recruited management from its own country but recruited the workers without experience, at lower price, but they could not work with the management, and many difficulties like collapses happened which made the work of Lot 2 fall behind schedule. Finally the best management and construction team were transferred to the JV to solve the problem and get back on schedule.

In the construction process of the Xiaolangdi intake project, they actively explored the project management mode. They built a SinoHydro Bureau 11 Xiaolangdi construction bureau, as the representative to organize the construction of the Xiaolangdi project for SinoHydro Bureau 11. There they pushed the project construction and strengthened the project management. The practice proved this system guaranteed united control and corresponding operation for the intake main construction, and played an important role for each tower's successful capping.

In the construction of the Xiaolangdi project, they felt that to protect the enterprise benefits they must use the contract clauses: firstly, the directors and project managers must pay attention and strengthen the contract management work from the beginning to the end, and the staff who undertake the work must be the right-hand, with contract management experience, capable to deal with emergencies and with a strong sense of responsibility. Secondly, the contract management staff must have enough time to seriously study every clause of the contract and master the key points. Thirdly, all the project management staff should participate and cooperate with each other.

In the Xiaolangdi project the foreign partners took a somewhat disciplinarian approach: when an accident happened, admitting responsibility only lead to the wrong-doing company being looked down upon, so there would be much buck-passing resulting in accidents and mishaps taking longer to deal with than necessary. Therefore, in the initial stages, there was conflict between the staff of Bureau 11 and the foreign partners every day because not enough time had elapsed for trust to be built. A year later, cultural differences were understood and the partners began to work much better together, built on mutual goals - quality, speed, safety and reputation.

The Bureau 11 also referred to the experience of the Euro contractors to strengthen the headquarters' management of the project. They made use of advanced communication technology, each overseas project reported to the headquarters each month. They also actively built an internet office system for international project management; devised a complete overseas payment system separate from the administration layer and a series of practicable management systems. The management of headquarters strode forward to systematization.

5.4.3 Discussion

This case was under the same external environment of the previous case, under the government support and potential market. SinoHydro Bureau 11 also had intent to improve itself from learning in the CGIC JV. These characteristics impacted on the learning actions in the process of JV.

After ten years of Xiaolangdi cooperation, the Director of SinoHydro Bureau 11 said “The SinoHydro Bureau 11 summarized experiences continually, actively explored the advanced project management mode, and strengthened the international project management of the company. We experienced the impact on an omnidirectional connection with an international management mode, with each separate layer having its own complications. We now profoundly understand what an international project is. Our thinking and opinions are changing, the capability of the group have been exercised, the technology level has been improved, and most important is that we have accumulated abundant experiences in aspects such as the international project management mode, project management, and contract management. And these construction management experiences have been quite well applied in practice”.

Furthermore, the Director of Bureau 11 added “With the international department of Bureau 11 acting as the main unit in the project, the management can organize each operation with the system thinking opinion and make it easier to accept all the operation tests, which is of great benefit to the professionalism of the organization and the cooperation inside the JV organization, and most important is that it can actively explore and accumulate international project management experiences”.

The above conditions and activities helped Bureau 11 learn from the JV. Now the bureau has marshaled a group of young technological staff and international project management elites that have been trained by the Xiaolangdi in all the positions of the international project. These persons have become a very important force to take the bureau into international water and hydroelectric project markets such as in Nepal Zambia.

5.4.4 Conclusions

This case also provided evidence of the importance of government support and market potential and the subsequent effect of company’s learning intent. With these conditions, Bureau 11 was actively involved in the JV, bringing their learning intent

to the line with international practice, exploring and accumulating international project management experiences, with collaboration instead of conflict and forming a better environment in the JV which not only helped the company really learn but also complete the project successfully. This JV environment is similar to the learning organization, and finally Bureau 11 not only learned to increase their technology level, but also accumulated enough experience for an international construction management mode, and opened its oversea market smoothly and successfully later.

5.5 Case 4 NEL Project C709

5.5.1 Background

Table 5.4 Case 4 NEL Project C709

Project Title	Design, Construction and Completion of Chinatown Station including Tunnels (C709)	
Contract Sum	S\$142M	
Project Location	Eu Tong Sen Street and New Bridge Road, Singapore	
Project Duration	June, 1997 to June, 2002	
JV Partnerships	Gammon Construction (70%)	Econ Piling (30%)
Date of interview	Aug 3 rd , 2005	Jul 28 th , 2005
Interviewee	Mr. Chiang	Mr. Sin
Destination	Senior Project Manager	President

The profile of Case 4 is shown in Table 5.4 and the detail background of this case is shown in the Appendix D-4. This project was taken by a JV formed by Gammon Construction and Econ Piling.

5.5.2 Experience and Findings from Econ

Before the construction, in about 1995, Land Transport Authority (LTA) representing Singapore government, invited all the local contractors who were involved in the NEL project, including Econ, to an interior meeting. LTA told local contractors that they were getting the job and working with foreign partners in a JV, and LTA wanted them to learn.

With expectation and support from the Government, and also seeing the opportunity of the long-term development of the MRT project in Singapore and all over the world, Econ had planned to expand in the MRT market, just as its president said “We want to learn, because we target the MRT project as one of our main areas. And we didn’t want to only do it in the local market; in fact we used Singapore as a base to go overseas”. Therefore, from this, Econ had paid much attention on learning in the JV. Mr Sin, the President of Econ mentioned, “Definitely the JV can be a learning platform”. When the staff were sent to a JV, they were told, “you are sent to JV, you must learn, because next time, we will do similar work alone without foreign partners”.

With the learning intent, Econ sent suitable staff to the JV. For example, to learn about the technology of tunnels, two foremen who have tunnel experience for 3 years were sent to the tunneling site to operate the machine together with the workers from Gammon. And the president of Econ added that “Other than similar experience, the people you send must be suitable and know how to merge and how to work with other people, can be going, and can work with others as a team”.

The JV was fully integrated because of the contract requirement, which provided a better environment for learning. The president of Econ said, “The better environment is the permanent JV. In the general situation, there are conflicts, in order to learn you can create a system so that everybody involved can learn. We are more interested in the integrated kind of JV. In these situations, people can work together to solve the same problem. It’s a key for learning”.

In the JV agreement, Gammon took a 70% share and Econ took 30%, Gammon has more members in supervision board, but all must agree on decisions. Therefore, the management of Econ also had some capabilities to make decisions in the JV. For example, Econ had the authority to arrange the position of the staff to guarantee that their foremen were put in the right place, to operate the tunneling machine on the site. The president of Econ mentioned, “When we sent our people there to do tunneling, we need to make sure they can go inside to learn. If the partner refused our staff to learn from them, I could tell the partner that ‘we are JV, we are supposed to work together and learn, as a JV I learn from you and you learn from me’. So the management can organize the place for our staff to learn”.

Furthermore, before this JV, Econ had worked with Gammon in other JV projects and they knew some characteristics about each other. Econ knew although Gammon had been working in Singapore for a very long time, the management was originally from Britain and with some British characteristics, they could be classified between a foreign and local company, which did not behave like a local Chinese company, but also did not behave like foreign company which just arrived in Singapore. The president of Econ said “The culture is different. You cannot just criticize others on some of these things and you must compromise”. Knowing the different culture of Gammon, Econ also added the importance of building trust based on difference, “In order to work or whether you can learn or not, you must be transparent; you have to make a deal with your partners. You cannot hide things. You don’t let people have the feeling that you are not treating them properly. You must build trust. Otherwise, it will be very difficult to work, if the partner thinks you are taking advantage of them. Therefore, you must treat your partner as a real partner, not somebody you can try to cheat.”

In this particular JV, as each party came to jointly work through the whole project in 5 years, conflict in the JV couldn’t be avoided but they also learned from each other. Because the culture of a local company an international company is different, problems arise such as international contractors paying much more attention to safety

and completion on time even though it raises costs, local companies will cut costs this way. This was natural because at that time local company didn't establish the safety system, they just followed the foreign company. In this case, Gammon put a lot of efforts into safety, and at the beginning, Econ did not truly realize and believe it, they did it much because the JV committee emphasized the need for it again and again. However, Gammon provided safety training for the workers both in theory and practice; finally, it not only changed Econ's safety concept, but also provided some useful skills for Econ. One specific case was that as part of the plan to dismantle the Eu Tong Sen canal, the water flow was channeled into two pairs of 300-metre long pipes, each of 2.1 meters diameters. In total, 1.2 kilometers of pipe work was installed-one of the largest drainage diversion schemes ever undertaken in Singapore. It took an additional one million dollars to do it safely. At the same time, Gammon got all the compensation with their well-known claim job done by a British quantity surveyor. Finally this project got a CERTIFICATE OF MERIT AWARD in the ANNUAL SAFETY PERFORMANCE AWARD 2002. Econ also got new technology from this experience.

Because Gammon has more experience, Econ also learned certain design concepts in practice. There were many cases like this. For example, an excavation, some struts were needed to remove soil, but if too many layers were added, it would need too many steel structures; but if not enough, it may collapse. To do the design better, staff from Econ and Gammon engaged the problem very actively, and discussed it based on their past experience and wanted to find a better solution. There were also conflicts about it. Listening to the different opinions and suggestions from each partner, the management of the JV selected the better suggestion. The suggestion was from Gammon, because Gammon had more experiences than Econ and knew how to do certain work better. Gammon knew that with the same depth, stronger steel struts could be designed differently: using normal steel, five strut layers were needed, but using larger and stronger steel just three strut layers were needed. The advantage was that when concrete was poured inside, there would be much more space, and the process could be done faster. The excavation job was successful, and not only Econ learned the design concept after seeing the different insight and the benefit to change

their ways and improve their skill later, a more collaborative environment and continuous learning climate with better communication as a team between partners were also reached in the JV.

With the main objective for learning tunneling technology, foremen of Econ who were involved in the tunneling team worked actively, , and either by themselves or by the whole team meeting they knew shared their experience with their parent company. In this way, Econ understood the tunneling problems, such as how to operate the tunneling machine, what kind of technology it was, how to get the tunneling resources like machines, and workers from the market when there was a lack of them. Eventually, Econ won two circle line projects later. The staff involved in the JV project now are working actively in the circle line projects. Because the construction industry is thought not to change very fast, the technology learned has a long shelf life. The equipment may be better, but the methods are still there, and the know-how remains. After five years of learning all the tricks from the JV in Singapore, Econ built an MRT in India and Korea successfully.

Other than learning some key technology skills, Econ also learned how to present the tender better than before. Econ learned the skills from this JV when they recognized how its partner successfully delivered. When Econ got the job together with one local contractor later; Econ did all the presentation alone successfully even better than some Japanese companies. Furthermore, before the JV, Econ didn't have good time and budget control. Gammon could produce the budget every day to see the how much resources were need, every purchase, the initial budget, amendments; they had very sophisticated, very good software for project management, which Econ didn't have. When something was wrong, the JV referred to the budget and used the software to find which action to take, saving lots of money and time. After Econ finished the JV with Gammon, it changed its system based on what it learned such as how to do the budget and time control proactively, and gained confidence to be the main partner of future JVs in the circle line projects.

5.5.3 Experience and Findings from Gammon

Although Gammon had expertise and strong technology in the Singapore MRT market, they formed the JV not only because they considered the preferential margins in a JV mode with more chance of getting the project from the LTA, but also because they thought Econ could do cheaper foundations well and on time.

In this particular project, both the senior manager of Gammon and President of Econ thought Gammon also learned something from this JV and even from Econ with the collaboration. The interviewee of Gammon commented that “One common area for learning is partners must have willingness to learn from each other, and the alignment is very important and we learn how to align from the JV, to set up the JV object, and communicate better, to understand each philosophy; learning is a long term process”. One example is that he found the management of Econ was more efficient and could make decisions faster than Gammon because of less management layers in the company. Later on, Gammon tried to deduce its management layers without impacting on the company development to improve its management efficiency. He said “Because Econ have less levels of management, they can solve the problem and make the decision more efficiently, and then we learned it from them to improve our management efficiency”.

Econ is Singapore-based company, it knew more about the local market, the local contacts of suppliers or subcontractors than Gammon. The senior manager of Gammon admitted “We got many useful contacts from the local company for suppliers, subcontractors, and also learned the proper alignment from the JV”. For example, in terms of cost control for purchasing, Econ was better since it knew more about the market. Although Gammon had procurement management in the JV, sometimes they didn’t know something was wrong. Once, they bought a screw costing one dollar but the procurement management of Econ management noticed this and found that the normal price for this kind of screw was only 1 to 2 cents. Although it’s said that the expensive one was made in Germany and the cheaper one in Japan, it’s unreasonable for hundred times difference and had an impact on the

projects finances. Gammon learned how to save costs in procurement with local knowledge.

5.5.4 Discussion

The government encouraged local contractors to learn from their foreign partners, and the foreign contractors were encouraged to transfer technology in the JV. Evidence was found in the local contractors meeting held by the LTA and also mentioned by an interviewee from Gammon “in the LTA project, if you are the foreign company, you can not get a preferential margin, which can be 5% of the project”.

The MRT project was full of potential in the construction market all over the world. Therefore, although Econ didn’t do any big MRT tunneling work before this JV, they have planned MRT project as their main area later. Econ looked at the future, in Singapore or overseas, MRT project was the area that Econ could fight the European, Japanese and Korean companies because of cheaper management.

With the above environment characteristics, Econ told its staff they must learn the technology and management in JV. The president of Econ emphasized that “how much you can learn depends on the company’s learning attitude”. Econ has strong learning intent to acquire knowledge from JVs.

Gammon continued with projects all over the world, and combined different kinds of culture and technology; therefore, the company environment was regarded as open, the employees were considered to have adaptability, receptivity and experience to new knowledge. On the other hand, although Econ was a local contractor, the employees were also thought to be open, adaptable and receptive because of Singapore’s special characteristics, where people of different races live together very well. Staff that were sent to JVs had similar working experience before. In this research, the learning capability of companies was identified by the adaptability, receptivity, experience and openness to new knowledge of the employees; therefore, both parent companies in this case had very strong learning capability. The learning

effectiveness was observed by the interviewee of Gammon who said “in Singapore, the environment is open to accept different ideas and the local company had a very fast technology and management improvement”.

Although conflicts in the fully integrated JV are unavoidable, it was regarded as a good environment for learning because different people were involved in the same part to work together. The president of Econ recognized “If you create something like, you do one job, I do one job, people cannot learn that much”. In the fully integrated condition, the management of Econ in the JV also had the capability to arrange its staff in the right position to learn.

Heavily involved in the construction of the Mass Transit and Light Rapid Transit Systems in Singapore, Gammon also had its own concern such as understanding more about Singaporean local issues and building a good relationship with local contractors. In this case, although it was not that easy to find a JV where two could work together well with each other because of the different culture and also because the staff from different companies would be loyal to their own parent companies, they knew each other well. The interviewee of Gammon said “We know Econ from building the embassy together in a small JV, and everything was easy going, we are very satisfied with Econ. Econ also found it was ok to work with us, and said they know our way to work”. The relationship was measured by a similar degree of culture between partners, understanding partner’s culture difference and mutual trust between partners; therefore, the relationship can be regarded as good for the mutual collaboration in this case.

With the learning drive from the parent company, the staff of Econ knew if they wanted to stay with the company they must learn. They knew after they came back from the JV, what the company expected on them, and what the company targeted in the future. They were involved in the construction site actively. On the contrary, if the company was not involved in the project, they may not learn. The senior staff of Gammon found evidence “beside the Chinatown site (C709), at the Outtram Part Station site (C710), the project was done by Shimizu Corporation-Dilligham

Construction International Inc-Koh Brothers Building and Civil Engineering Contractor Pte Ltd. Nobody from the Koh brothers were there, Koh was not active at all in the project. The JV was in name only. Therefore I don't think Koh Brothers can learn from this JV". All the JVs in the NEL project were in a similar condition, but because the learning environment, learning attitude and learning activities were different, the learning outcomes would be different.

In this case, both Econ and Gammon had put their efforts together in the JV, as the president of Econ said "The people are very professional, for example, if they work for LTA, they will be together as a party to argue with LTA if anything happens". Some of the efforts were related to learning. They engaged the project problem actively, listened to each other, shared their experiences, the management provided supportive attitude and action for it, accept the best suggestion and improved systems like planning, procurement and budget control.

With the condition stated above, the JV built a collaborative environment and continuous learning climate for both partners; they aligned and communicated better with a consistent vision of the benefit from the JV, the problem solution was based on the system thinking of the JV, a learning environment was formed for the partners. In this learning environment, the knowledge, both in the technology and management of the JV and the parent companies was improved. Econ learned tunneling technology and relative knowledge, planning methods and budget control; Gammon learned to reduce the management level and save the purchasing cost. They also learned to align with each other as a team, which improved the working effectiveness as well. With some of the characteristics of a learning organization in JV, both partners achieved very good learning effectiveness.

5.5.5 Conclusions

In this case, the Singapore government provided policy support for the JV between local contractors and foreign contractors, to encourage foreign contractors to transfer and local contractors to acquire new technology through the JV. Other than that, the MRT project was full of potential in the international construction market. These

environmental characteristics increased the company's learning intent and also improved the company's learning ability in JVs.

With the main learning intent the acquisition of tunneling technology, Econ reached its initial learning objectives under its own learning capability, good relationship with partner, management capability and active learning activities in the fully integrated JV. These conditions became the dominant factors to form a learning organization in the JV to improve the learning effectiveness. Under the same conditions, although Gammon had no strong learning intent initially, it also learned something from the JV. The learning organization in the JV not only provided the better environment for learning, but also truly improved the learning effectiveness such as improving technology and management skill, and effective working. How to form a learning origination in the JV became the foundation of learning effectiveness in the JV.

5.6 Case 5 CCL Project C852

5.6.1 Background

Table 5.5 Case 5 CCL Project C852

Project Title	Construction and Completion of Serangoon Interchange Station including Tunnels (C852)				
Contract Sum	S\$155.958M				
Project Location	Singapore				
Project Duration	Aug, 2003 to Dec, 2007				
Partnerships	Woh Hup (33%)	Shanghai Tunnel (33%)			Alpine (34%)
Date of interview	Jul, 15 th , 2005	Sep 22 nd , 2004	Jul 26 th , 2005	Aug 29 th , 2005	
Interviewee	Mr. Quek	Mr. Ho	Mr. Ma	Mr. Soo	
Destination	Commercial Director	QA Engineer	Deputy General Manager	Manager	

The profile of Case 5 is shown in Table 5.5 and the detail background of this case is shown in the Appendix D-5. This project was taken by Woh Hup, Shanghai Tunnel and Alpine.

5.6.2 Experience and Findings from Shanghai Tunnel

Shanghai Tunnel is from China, they came to Singapore in 1996, and previously they did research and analysis on the market, the operation and running mode and the whole management style. Shanghai Tunnel used Singapore as a base for further international projects. . The general manager of Shanghai Tunnel Singapore Branch said he came to Singapore with a learning attitude.

The management from China is young, most of them have specialized knowledge and a technological background. They are very open and learned the local regulations, laws and life style easily and combined these to increase Singapore branch's growth. For example, they found there are quite a lot of differences between China and Singapore. For example, the configurations of a project in Singapore include all kinds of people, the financial, the construction and the commercial. And the culture, habit, language are also different from China. Therefore, when Shanghai Tunnel works with the local company Woh Hup, they can learn to understand more about the local issues and learn useful management and skills from them.

The other main difference is about the financial system, although the company has its own financial system and rules in China, the details are different from Singapore like cost control, which needs to be compatible with the local situation. In the JV, they worked with Woh Hup on it, and also recruited their own local staff for financial and audit matters. The project manager asked questions to understand cost control and other financial issues for the work undertaken. Step by step, the company upgraded the financial software and financial system to localize it

They hold an internal meeting every two weeks to discuss the project and the future of the company. Many quantity surveyors also do the additional jobs such as technical surveys by talking with people from different companies and looking for

direction of technical developments for the future. The management of the company knows the vision and works for it. Many staff that have been trained in the JV have been sent back to China or sent to other countries to explore the markets. They are appointed in important positions with new ideas and new management mode.

When one site has some problems they need to solve, they can handle it together. With different kinds of staff, when one partner needs to combine the knowledge of different parties, the other partner give feedback on how to manage the worker, and achieve more speed and efficiency. Therefore the knowledge and experience can be transferred. After these improvements, the useful new equipment, new technology and new knowledge will normally be transferred to the parent company. So in the end, everybody benefits from it. As a cycle, all the partners learn together.

For example, with tunnel boring machine, when Shanghai Tunnel encountered some problems in their scope of work, they would just ask their partner, such as the experienced Alpine, how they should solve the problem. Via meetings, email, telephone, fax. And Apline may also send some of their staff to Singapore to assist; sometimes they work with the consultant to the project. Mr Ma, Deputy General Manager of Shanghai Tunnel said “we first come here to adapt, and just like new friends, our partners have different ideals, it’s better that all of us in the team have the relationship as friends, especially overseas, so we can often have friendly discussions.”

5.6.3 Discussions

In this case, Shanghai Tunnel has a relatively apparent learning objective of learning the local characteristics of Singapore and applying this to their practices. With the intent to acquire the local knowledge they became well localized.

The young staff of Shanghai Tunnel were adaptable, receptive and open to accepting new knowledge. Shanghai Tunnel and its partners said these staff are very good at learning and learnt a lot from the JV.

Shanghai Tunnel had worked with Woh Hup both in sub-contract and JV styles. Therefore, they recognized each other and were satisfied with each other. And Shanghai Tunnel also has experience working with Alpine in China and knew each other well. Therefore, the three companies understand the cultural difference and trust their partners and have good relationships. The relationship provided a precondition for partners to help each other finish the project better.

When there are problems, Shanghai Tunnel like to consult to their partners, and keep the useful information in the parent company, and the top management was very supportive to them to learn and help them to understand the vision of the company. Woh Hup, Shanghai Tunnel and Alpine often discussed ways to find best solutions for the project. Shanghai Tunnel also collected and record useful knowledge and reported to the parent companies.

Under the above conditions and activities, Woh Hup, Shanghai Tunnel and Alpine have built a common vision to make the JV successful and transferred this common vision to its staff. Therefore, the staff could share personal vision, experience and lesson together to increase the construction efficiency.

Finally, Woh Hup, Shanghai Tunnel and Alpine knew although they JV provided learning platform for all the partners, they must learn to improve the capability to finish the JV project well, and that none should cheat or take advantage of the others. This common understanding became the consistent vision for all partners, and they a formed collaborative environment to help each other do better and a continuously learning climate was also formed in this JV.

Shanghai tunnel got local market knowledge and international management skill from the JV, many top managers were trained to coach their staff well. Other than the technology and management improvement of the partner company, the JV also provided a great opportunity for the training of its partner Company. Human resources are vital for the company's development. To manage JVs, the management needs a strong capability to communicate, negotiate and integrate different people

from different companies; they learn to know how to put people with different cultures in different environment. They also know the significant issues and how to manage a large project with different partners. This was good preparation for later more complex projects like build operate and transfer (BOT).

To Woh Hup, the manager believed they learned through the whole project, they learned to be more open to accept others opinions and they are also open to tell other partners what are the better ways.

After several years work with other partners; their staff were well trained and got much experience and knowledge and know how to work in the JV with other people with different backgrounds. The working efficiency of the JV improved in this ongoing project.

The JV project gave the partners a better reputation, and they gained a competitive edge on the MRT market. Later this JV also got the award of a civil works contract for Stages 4 and 5 of the Circle Line (CCL) worth S\$399,910,000 in Singapore.

5.6.4 Conclusions

This project was completed by a JV of three companies from different countries. As three partners with many different ideas, thinking ways and management styles, small little conflicts are unavoidable, but with mutual trust and understating, they have good relations.

With the learning mindset and capable staff, Shanghai Tunnel learned much and formed the learning organization in the JV. Shanghai tunnel said since 1999, it had been active in building itself into a learning enterprise to elevate its overall capability, as well as its comprehensive competitive capability. They not only learn how to live together but also get much new knowledge from others in the JV, which has helped the parent companies continue growth. To date, the project is continuing very successfully, the partners are very happy with each other. Consequently the three teamed up again for future projects.

5.7 Case 6 Republic Polytechnic New Campus Project

5.7.1 Background

Table 5.6 Case 6 Republic Polytechnic New Campus Project

Project Title	Republic Polytechnic New Campus project		
Contract Sum	S\$333M		
Project Location	Woodland Ave 9 Singapore		
Project Duration	Nov, 2003 to 2007		
Partnership	China Construction South Pacific (70%)	Taisei Corp (30%)	
Date of interview	Aug17th, 2005		
Interviewee	Mr. Fu	Mr. Li	Mr. Matsushita
Destination	Deputy Managing Director	Deputy Project Director	Deputy Project Director

The profile of Case 6 is shown in Table 5.6 and the detail background of this case is shown in the Appendix D-6. This project was taken by China Construction South Pacific and Taisei Corp.

5.7.2 Experience and Findings from CCDC

In the progress of the JV, the CCDC learned many lessons. Firstly, the management recognized the main reason of the mistake was that they underestimated the difficulty of the project in the beginning. Secondly, the project didn't involve enough human recourse; therefore, it was postponed. Thirdly, the managers recognized the importance of better communication with the architects and the partners to settle the different opinions smoothly. All of these learning experiences were discussed at CCDC's general meeting, and managers in charge of other projects could also learn.

The management found the differences with Taisei were related to problems and management decision-making. Some conflicts caused by the difference were reduced after cooperation of more than one year. The CCDC also found Taisei was very good at planning in detail and persisted to do work according to the planning.

The director from Taisei found CCDC was very powerful in human resource management and CCDC managed many people at the same time. Staff were open to work with others, and willing to share experience. Although the culture is totally different between the two partners, most of the problems were solved by discussion and communication. The management of the parent company came to site every month and checked all the programs. Taisei believed their staff could also learn from the JV, and gain much working experience.

5.7.3 Discussion

This case was a general building contract in Singapore, market competitiveness was very high, and CCDC-Taisei got the contract with much lower bid than the second lowest one. How to successfully complete the project in the limited financial budget on time was the main consideration for the JV.

CCDC regarded Singapore as a base to expand to other foreign countries. It's because Singapore construction market is very much internalized that the Chinese contractors wished to find an international firm JV in Singapore to occupy the market with their high technology background and lower cost.

The lessons of why the project was stopped were collected by CCDC and discussed in the parent company's meeting to increase the whole company's management skill.

The common vision of the JV is to successfully finish the project on time and enjoy a good track record and build a reputation from it. When difficulties are encountered, the JV must look at itself and resolve the problem. The management must provide support with positive attitude and action and re-arrange the management of the JV to be more powerful, so the lessons can be shared throughout the JV.

After the problems, the partners of the CCDC and Taisei recognized to improve their track record and reputation from the project was their consistent vision, therefore, communicated more smoothly, forming a more collaborative environment,

with the system thinking concept to improve the project performance. It also formed a continuously learning climate.

In case 5, from the lessons encountered, CCDC knew how to manage this large project to avoid the similar problems and how to work together with Japanese contractors in some specific environment. CCDC learned skills from Taisei. Both CCDC and Taisei also learned the difference from each other and know how to work better and more effectively.

In the first year of the project, although the government supported the project, the management had not enough capability to solve the problems encountered; the project was going very badly. Later on, more powerful management was appointed to solve the problem, and given more authority to recruit more capable staff to join the project. Although the natural cultural difference cannot be removed, staff from each company can be more understand the difference and made concessions to continue finishing the project under the limited budget.

5.7.4 Conclusions

Without enough attention to the project requirement, there was not enough capable staff involved in the JV, which caused the project being stopped by the owner. But finally, with the support of their parent companies, giving more power to the management of the JV, the issue was settled. CCDC learned a significant lesson from the JV. Both partners also learned how to work together with understanding and system thinking the common interest. With all these efforts, the partners changed the JV to be a better learning platform and improved the working efficiency to make the project go smoothly.

5.8 Summary of the Case Studies

The research model was supported by the above six ICJV cases gathered from China (Case 1~3) and Singapore (Case 4~6). According to the proposed model, relevant variables in the six cases were identified and summarized, as ticked and shown in

Table 5.7. The source of Table 5.7 can refer to the six tables of Appendix E. Having analyzed and discussed the six cases in detail, some dominant factors and dominant relationships for learning in ICJV were observed.

Table 5.7 Observations of Variables in the Case Projects

Constructs	Variables	Case Projects					
		1. Ertan I	2. Xiaolangdi I	3. Xiaolangdi II	4. NEL C709	5. CCL C852	6. Republic Poly
Conditions of learning in pre-inception stage	Government support	√	√	√	√	√	√
	Complex market	√	√	√			√
	Potential market	√	√	√	√	√	
	Partner's learning intent	√	√	√	√	√	
	Partner's development feasibility	√		√	√	√	√
	Partner's absorptive capability	√	√	√	√	√	√
JV's Characteristics in formation and organizing stage	Fully integrated JV	√			√	√	√
	Project's impartibility	√			√	√	√
	Independent and authority power	√	√	√	√	√	√
	Mutual trust	√	√	√	√	√	√
	Understand the difference of culture	√	√	√	√	√	√
	Partner company's support	√	√	√	√	√	√
	Training	√	√	√	√	√	√
Learning actions in implementation and adjustment stage	Self-examination	√	√	√			√
	Share personal vision, experiences and lessons	√			√	√	√
	Understand the common vision	√	√	√	√	√	√
	Management's supportive attitude	√	√	√	√	√	√
	Participants engage problems actively	√	√	√	√		√
	Communicate with each other and listen to others to accept better opinions	√	√	√	√	√	√
	Solve problems together	√	√	√	√	√	√
	Collect and record knowledge				√	√	
	Develop and apply new knowledge	√	√	√	√	√	
Learning effectiveness in completion and evaluation stage	Collaborative environment	√	√	√	√	√	√
	Continuous learning climate	√	√	√	√	√	√
	Consistent vision	√	√	√	√	√	√
	Coaching and respectable leader	√	√			√	
	Well communication	√	√		√	√	√
	System thinking	√		√	√		√
	Efficient working	√	√	√	√	√	√
	Individual improvement	√	√	√	√	√	
	Effective teamwork	√	√	√	√	√	
	Knowledge improvement	√	√	√	√	√	√
	Skill improvement	√	√	√	√	√	√

The learning determinants and relevant relationships can be found in these cases, and they are described following the construct of the learning model.

Firstly, under the construct of conditions of learning, government support was identified in each case. Cases 1~3 were very large Chinese projects: the government paid much attention to the projects and provided support through relevant supervision. Cases 4~6 concerned Singapore public projects: the government encouraged JVs whenever it published notices to bid on public projects, and requested the Singapore contractors to learn from their foreign partners. Cases 1~3 occurred in complex markets, as the Chinese market had not yet matured. Case 6 was regarded as complex due to the considerable competition in the market. Market potential was also identified in Cases 1~5, as Cases 1~3 concerned Hydropower markets in China and Cases 4~5 concerned a MRT project in Singapore.

The learning conditions in the company's learning intent can be clearly observed in five cases. In Cases 1~3, SinoHydro regarded the JV as an important opportunity to improve their international advanced construction technology and experience for future development. In Case 4, Econ intended to learn about tunnel technology to enable them to undertake MRT projects themselves in the future. In Case 5, Shanghai Tunnel intended to acquire local knowledge to better adapt to the Singapore environment.

Other learning condition development-feasibility was observed in four cases. In Case 1, SinoHydro Bureau 8 expected to explore both the local and overseas market, and the JV was found to have very flexible management characteristics, with an organic and decentralized structure. In Case 3, SinoHydro 11 also intended to expand to similar overseas markets. In Case 4, Econ had decided that MRT projects would be their primary future target market, both in Singapore and overseas. In Case 5 and 6, China partners regarded Singapore as a base to expand into other foreign countries such as Malaysia.

Absorptive capability was identified in all cases. In Cases 1~3, many employees with a high degree of adaptability and receptivity were sent to the JV to receive on-the-job training to further enhance their multiple skills. These people were trained as the key mainstay for the future development of SinoHydro. In Case 4, Econ sent its capable foremen with related experience to the tunneling site, where they received relevant training and technological skills for tunneling. In Case 5, Shanghai Tunnel's personnel were generally very young and adaptable to learning new skills: many staff were trained in the JV and later appointed to important positions within the parent company. In Case 6, personnel involved in the JV were, at the start, incapable; however, after appointing more powerful management staff, the project returned on track, with the management having gained valuable experience.

Secondly, under the construct of success factors of IJVs in relation to learning, various characteristics of the ICJVs were observed. For example, a fully-integrated structure was found in Cases 1 and 4~6, and its impact on learning was underlined in Case 4, where the Senior Manager of Gammon stated that "the fully-integrated JV is the best platform for learning". Under full integration, project cannot be divided easily; participants from different partners were found working closely with each other in the aforementioned cases.

JV management competency as an operational characteristic was observed in the JV's independency and authority power in five cases. In Cases 1~3, SinoHydro was capable of making decisions concerning technology innovation, which helped them to perform better as part of a JV. In Case 4 and 5, each partner in the JV had the management capability to arrange the staff and ensure they were sent to the correct place to learn. In Case 6, the rearranged management of the JV had the authority to recruit enough capable staff and drove the JV back on the right path.

Relationships and interactions as a JV characteristic were observed through cultural understanding, mutual trust, partner company's support, and training in all cases.

With a good relationship and interaction between partners, different partners have the opportunity to learn and teach openly.

Thirdly, a number of learning actions were observed in all the cases. In the aspect of cognitive learning actions, in Cases 1~3 and 6, participants self-examined themselves in order to understand their shortcomings, and to learn to overcome them. In Cases 1 and 4~6, the staff were allowed to share their personal vision, experiences and lessons together to help overcome problems and boost working efficiency. In each case, the management board tried to assist all participants to understand the common vision of the JV: in Cases 1~3, SinoHydro continually perfected its management system to ensure all staff knew their responsibilities, rights and benefits within the JV: the staff could therefore better understand the common vision of the JV; in Case 4, Econ informed their staff about their vision for the learning and development of the tunneling technology; in Case 5, Woh Hup, Shanghai Tunnel and Alpine had a common vision to ensure the JV worked successfully; in Case 6, the common vision was to successfully finish the project on time and to build a good reputation from the project. In Cases 1 to 6, the management's supportive attitude towards learning was also observed.

Concerning behavioral learning actions, some real learning actions with direct learning benefits were also observed. In Cases 1~4 and 6, participants actively engaged with problems. For example, in Cases 1~3, SinoHydro developed specialized tools for construction, and improved the foreign contractors' schedule several times. Participants communicated with each other in all cases, listening to each other and accepting beneficial opinions. Participants from different partnerships were also solved problems together. In Case 4, Econ collect and record tunneling and related knowledge and technology for their future reference while in Case 5, Shanghai Tunnel also gathered and recorded useful knowledge. In Cases 1~5, participants even developed new knowledge and applied it in the projects.

Finally, in relation to learning effectiveness, a collaborative environment with continuous learning and consistent vision within the JV was apparent in each case.

In Cases 1, 2 and 5, the managers knew how to coach those under them and won their respect. In Cases 1, 2, 4- 6, participants could communicate freely without hindrance. In Cases 1, 3, 4 and 6, participants could use system thinking to find solutions. Such observations demonstrate a collaborative environment improvement in these cases. On the other hand, participants in these cases also increase their knowledge and capability in the process of the JVs. For example, in all the cases, working efficiency was improved; in Cases 1- 5, individual capability improved; and in Cases 1-5, teamwork was also found to be more effective than earlier in the project. Knowledge and skill of all the participants also improved each case.

As a whole, during the pre-inception stage, most of the learning condition variables have been observed in the six cases. When the JV project went to the formation and organizing stage, the JV's characteristics of the six cases also showed sufficient evidence of the success factors for learning. During the implementation and adjustment stage, multifarious learning actions were implemented in all six cases. Concurring with the literature review mentioned and the research model proposed, during the completion and evaluation stage, the six cases showed great improvement in learning effectiveness. Based on these observations from the cases studies, it has been possible to suggest a number of relationships among the major variables. The case studies have therefore evidently shown the validity of the variables as proposed in the four constructs of the research model, and also illustrated the links among the four proposed constructs, as it demonstrated the relationships among the learning conditions, success factors of learning, learning actions and learning effectiveness.

The aforementioned six case studies provide a variety of field evidence that concur with the literature and at the same time lend credence to the validity of the proposed model. The empirical findings from the case studies suggest that the learning conditions from the market environment and the partner characteristics, the success factors of learning from a JV's general characteristics, and learning actions have a positive impact on learning effectiveness.

From the above descriptions, the constructs and the detailed variables of the conceptual model were identified in the case study, which support the reality of the conceptual model, built on the literature review and theoretical base.

This section highlighted some of the major observations made in case studies. It is difficult, however, to capture all such important soft observations for inclusion in statistical analyses. Nevertheless, based on these observations and other insights into the case studies, it has been possible to suggest a number of relationships between major variables. The case studies have, whenever possible, allowed integrating with the quantitative analyses for certain key parameters. After providing logical support for the conceptual model through the case studies, the next chapter will validate the model through quantitative study and statistical analysis based on the data gathered from the questionnaire survey.

Chapter 6 Quantitative Study

6.1 Overview

This chapter is about the quantitative study and statistical analysis. Firstly, it is the description of the results of validity and reliability assessments of major constructs of the model after the description of the respondent detail. Secondly, it is the factor analysis to reduce the variable number. Thirdly, multiple regression analysis is used to test hypotheses made in the chapter 4. Finally, the result is discussed.

6.2 Validity and Reliability Assessment

A measure that truly measures what it purports to has to be valid and reliable (Venkatraman, 1989; Kerlinger, 1986; Peter, 1979). But before the assessment of the validity and the reliability, the information of the respondent is described in detail.

6.2.1 Respondent Description

The survey was intended to achieve a particular research goal of being able to generalize the research results themselves from the studied sample to the target population rather than to reach a universal research goal of testing theoretically based hypotheses. This research goal was primarily to identify the determinant of learning effectiveness, second, to determine the relationship among learning conditions, learning actions and learning effectiveness.

The population was limited to companies that were registered in Singapore or China and engaged in ICJVs. No restrictions were placed on the home country of the partner or the JV, even it is different from the targeted companies.

A combined approach was taken to select both companies with reported ICJVs, and firms likely to be engaged in ICJVs based on company size. The respondents were senior executives who actually experienced at least an ICJV of the company selected.

The questionnaire was designed based on ICJV projects. Therefore, some selected companies, which have more than one ICJV, may provide more than one reply by different senior executives based on different ICJV projects.

The survey instrument was sent out via mail or email to verified appropriate senior executives of each of the companies in the sample. In total, 293 survey questionnaires were sent and 96 valid replies were gathered giving a response rate of 32%. As shown in the details of Table 6.1, a high percentage of the responding personnel (70%) are project managers or higher-level management personnel. It turns out accordingly that the respondent profile is made up of experienced construction executives with at least some ICJV project experience. Other than that, a relatively high percentage of the responding companies (53.2%) are listed in the “Top 225 International Contractors” of Engineering News Record (ENR) in 2005.

Table 6.1 Respondents’ Profile of the Survey

Respondent Groups	Respondent		List in Top 225	
	Size	Percentage of total	Size	Percentage of total
(Vice) General Manager/President/Chairman	28	29%	16	16.7%
Department Managers	25	26%	14	14.6%
Project Managers	14	15%	6	6.3%
Engineers	29	30%	15	15.6%
Total	96	100%	51	53.2%

6.2.2 Validity Assessment

In this study, the construct validity is selected to assess the validity. Construct validity is the degree to which a construct achieves theoretical and empirical meaning (Hughes, et al., 1986). Construct validity requires convergent validity and discriminant validity of a measure (Kerlinger, 1986).

Convergent validity is the extent to which the evidence from different sources about the construct indicates the same or similar meaning of the construct. Discriminant validity is the extent to which a construct can be empirically differentiated from other

similar constructs (Kerlinger, 1986). These two kinds of validity assessments are applied to the data gathered.

6.2.2.1 Convergent Validity

Factor analysis is considered to be an indispensable method for determining convergent validity (Dimovski, 1994). It is a method for reducing a large number of measures to smaller number called factors by discovering which measures go together, as well as the relationships between the clusters of measures.

Factor analysis identifies a set of dimensions and creates appropriate factors or measures for subsequent analysis. The identified perceived service quality factors together will be one of the independent variables attempting to explain the relationship in the hypotheses.

There are two types of factor models: component analysis (principal component analysis) and common factor analysis (Hair et al., 1992). The factor model used in this analysis is a principal component analysis with varimax factor rotation on every observable construct. Following the advice of Hair et al (1992), that latent root (eigenvalue) criterion should equal to one for the numbers of factors extracted was used. Factor analysis results for major constructs are shown in Table 6.2 to 6.8. The number in the item designation refers to the position of the item as it appears in the questionnaire.

Factors extracted from factor analysis with loadings more than 0.45 were considered adequate for establishing convergent validity (Kim and Mueller, 1978). Average of component items (factor loading>0.45) instead of factor scores as generated by factor analysis was used as the value of the factors extracted. The reason is that factors computed by the average of selected component items would be more meaningful than factor scores. In addition, factor scores are computed using all items and are therefore more difficult to interpret.

The original list of environment characteristics was extensive and it was felt that there might be coherent subsets representing relatively independent types of environment. To determine whether such subsets exist, principal factors extraction with orthogonal varimax rotation was performed through SPSS on the 3 items reflecting the environment characteristics of the ICJV project. The principal components extraction was used prior to principal factors extraction to estimate the number of factors and factorability of the correlation matrices.

Only one factor (shown in Table 6.2) was extracted with eigenvalue equaling to 2.368 which is over the criterion 1.0. This factor accounted for 78.931% of the variance. It can represent the environment and market's attractive characteristics (EMAC), including item (a) Government support and (b) Market complexity and entry difficulty and (c) Potential of the market.

Table 6.2 Results of Factor Analysis for Environment Characteristics ^a

Item	Description	Factor Loading ^{b,c}
		Factor 1
Ec1	Government support	<u>0.871</u> *
Ec2	Market complexity and entry difficulty	<u>0.894</u> *
Ec3	Potential of market	<u>0.900</u> *
Eigenvalue		2.368
Variance explained (%)		78.931

Note: ^aN=96. ^bOnly one component was extracted, the solution cannot be rotated.

^cUnderlined items included in the factor. *Factor loading higher than .45.

The original list of general company characteristics includes 9 Principal components. Extraction was used prior to principal factors extraction to estimate the number of factors and factorability of the correlation matrices. Two factors (shown in Table 6.3) were extracted with eigenvalues over 1.0. These two factors accounted for 57.763% of the variance. Item Cc5 is removed as its factor loading in both factors is less than 0.45.

Table 6.3 Results of Factor Analysis for Company's Characteristics ^a

Item	Description	Factor Loading ^{b,c}	
		Factor 1	Factor 2
Cc1	Organizational product development strategy	0.390	<u>0.698*</u>
Cc2	Organizational market development strategy	0.230	<u>0.689*</u>
Cc3	Organizational decentralization structure	0.348	<u>0.627*</u>
Cc4	Organizational organic structure	0.390	<u>0.626*</u>
Cc5	Market knowledge background	0.096	0.322
Cc6	Openness to accept new knowledge	<u>0.763*</u>	-0.100
Cc7	Employees' adaptability	<u>0.796*</u>	-0.320
Cc8	Employees' receptivity	<u>0.735*</u>	-0.443
Cc9	Employees' experience	<u>0.834*</u>	-0.321
Eigenvalue		2.836	2.261
Variance explained (%)		32.646	25.117

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

The first factor was interpreted as partner's development feasibility (PDF), and included the following items (a) Organizational product development strategy, (b) Organizational market development strategy, (c) Organizational decentralization structure, and (d) Organizational organic structure. The second factor, interpreted as partner's absorptive capability (PAC), including (a) Openness to accept new knowledge (b) Employees' adaptability, (c) Employees' receptivity, and (d) Employees' experience.

Factor analysis of the company's learning intent extracted one factor with an eigenvalue greater than one and explained 59.871 percent of variance (shown in Table 6.4). This factor explained partner's learning intent (PLI) including the following items: (a) Intent to transfer existing knowledge, (b) Intent to develop new knowledge, (c) Intent to receive exiting knowledge, (d) Intent apply new knowledge.

Table 6.4 Results of Factor Analysis for Company's Learning Intent ^a

Item	Description	Factor Loading ^{b,c}
		Factor 1
Lt1	Employees' intention to transfer knowledge	<u>0.725</u> *
Lt2	Employees' intention to apply new knowledge	<u>0.818</u> *
Lt3	Employees' intention to acquire knowledge	<u>0.742</u> *
Lt4	Employees' intention to create new knowledge	<u>0.805</u> *
Eigenvalue		2.395
Variance explained (%)		59.871

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

Factor analysis of the JV's operational characteristics extracted one factor that has an eigenvalue greater than one explaining 73.120 percent of variance (shown in Table 6.5). The extracted factor of JV's operational characteristics (JVOC) was indicated by four items: (a) Integrated degree of the JV, (b) Close degree of the JV, (c) Independence of the JV board, and (d) Authority power of the JV board.

Table 6.5 Results of Factor Analysis for JV's Operational Characteristics ^a

Item	Description	Factor Loading ^{b,c}
		Factor 1
Oc1	Integrated degree of the JV	<u>0.820</u> *
Oc2	Close degree of the JV	<u>0.832</u> *
Oc3	Interdependency of the JV board	<u>0.884</u> *
Oc4	Authority power of the JV board	<u>0.882</u> *
Eigenvalue		2.925
Variance explained (%)		73.120

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

Factor analysis of JV's internal relationship extracted one factor that has an eigenvalue greater than one and explains 50.180 percent of the variance (shown in

Table 6.6). All the items using in the questionnaire have factor loading higher than 0.45. Therefore, the items included in the factor of JV's Interactions and relationships (JVIR) were: (a) Trust degree among in JV, (b) Cultural similarity in JV, (c) Cultural understanding in JV (d) Business related degree in JV, (e) Management support in JV, and (f) Training in JV.

Table 6.6 Results of Factor Analysis for JV's Internal Relationship ^a

Item	Description	Factor Loading ^{b,c}
		Factor 1
Rp1	Trust among JV	<u>0.582</u> *
Rp2	Cultural similarity in JV	<u>0.700</u> *
Rp3	Cultural understanding in JV	<u>0.729</u> *
Rp4	Business related degree in JV	<u>0.796</u> *
Rp5	Management support in JV	<u>0.787</u> *
Rp6	Training in JV	<u>0.632</u> *
Eigenvalue		3.011
Variance explained (%)		50.180

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

Eleven items were used to measure the learning actions observed in the JV cooperation process. They were extracted with eigenvalues over 1.0 and reached two main factors (shown in Table 6.7). These two factors accounted for 59.161% of the variance. They can represent the specific JV's learning cognitive actions (JVCLA) and JV's behavioral learning actions (JVBLA). "JVCLA" includes items (a) Self-examination, (b) Share personal vision, (c) Share experience and lessons, (d) management helps to understand the common vision, (e) management's supportive attitude and action. And "JVBLA" includes (a) engage problem actively, (b) listen to each other and accept better suggestion, (c) management accepts staff's better suggestion, (d) develop and create new knowledge in work, (e) collect and record knowledge and (f) apply new knowledge

Table 6.7 Results of Factor Analysis for Learning Actions in ICJVs ^a

Item	Description	Factor Loading ^{b,c}	
		Factor 1	Factor 2
La1	Self-examination	<u>0.810*</u>	0.181
La2	Share personal vision	<u>0.663*</u>	0.337
La3	Share experience and lesson	<u>0.759*</u>	0.221
La4	Management helps to understand the common vision	<u>0.865*</u>	0.089
La5	Management's supportive attitude and action	<u>0.789*</u>	0.190
La6	Engage problem actively	0.146	<u>0.683*</u>
La7	Listen to each other and accept better suggestion	0.235	<u>0.672*</u>
La8	Management accept staff's better suggestion	0.093	<u>0.799*</u>
La9	Develop and create new knowledge in work	0.263	<u>0.671*</u>
La10	Collect and record knowledge	0.094	<u>0.779*</u>
La11	Apply new knowledge	0.302	<u>0.599*</u>
Eigenvalue		4.781	1.727
Variance explained (%)		43.460	15.701

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

Eleven items of learning organization characteristics were used to measure the learning effectiveness in the JV cooperation process. They were extracted with eigenvalues over 1.0 and reached two main factors (shown in Table 6.8)

These two factors accounted for 63.630% of the variance. The first factor represents the JV's collaborative environment improvement (JVCEI), including (a) Collaborative environment, (b) Continuous learning climate, (c) Consistent vision and (d) Coaching and respectable leaders, (e) Unhindered communication and (f) System thinking. The second factor represents JV's Knowledge and Capability Improvement (JVKCI), including (a) Efficient working, (b) Individual improvement, (c) Team learning, (d) Knowledge improvement and (e) Technology and management skill improvement.

Table 6.8 Results of Factor Analysis for Learning Effectiveness in ICJVs^a

Item	Description	Factor Loading ^{b,c}	
		Factor 1	Factor 2
Lo1	Collaborative environment	<u>0.720*</u>	0.241
Lo2	Continuous learning climate	<u>0.632*</u>	0.346
Lo3	Consistent vision	<u>0.808*</u>	0.249
Lo4	Coaching and respectable leaders	<u>0.732*</u>	0.396
Lo5	Unhindered communication	<u>0.772*</u>	0.251
Lo6	System thinking	<u>0.783*</u>	0.071
Lo7	Efficient working	0.441	<u>0.653*</u>
Lo8	Individual improvement	0.388	<u>0.683*</u>
Lo9	Team working effectively	0.365	<u>0.727*</u>
Lo10	Knowledge improvement	0.117	<u>0.857*</u>
Lo11	Technology and management skill improvement	0.122	<u>0.745*</u>
Eigenvalue		5.666	1.333
Variance explained (%)		51.513	12.117

Note: ^aN=96. ^bRotated factor pattern using orthogonal VARIMAX rotation.

^cUnderlined items included in the factor. *Factor loading higher than .45.

6.2.2.2 Discriminant validity

Discriminant validity can be measured via pairwise correlation among constructs. The measures should not only have convergent validity, but also have discriminant validity. Discriminant validity is the extent to which the measure is novel and not simply a reflection of some other construct or variable (Churchill, 1979). Discriminant validity is measured by pairwise correlation as suggested by Venkatraman (1989). High correlations among the constructs might invalidate the tests, because high correlations might indicate that the scales measure the same rather than different constructs (Campbell and Fiske, 1959). Discriminant validity is indicated by low correlations between the measures of interest and other measures that are supposed to measure different constructs (Heeler and Ray, 1972; Venkatraman and Grant, 1986).

Specifically, discriminant validity is attained when the correlation of a variable with another variable does not exceed 0.55 and is significant at $p < 0.05$ (Schwab, 1980). Additional evidence of construct validity is provided when the pairwise correlations between the variables of interest have the direction assumed by the theory (Venkatraman, 1989).

Table 6.9 indicates the results of pairwise correlations among variables of interest. The results indicate correlations among different variables for all variables lower than the cut-off value for correlation coefficient for the discriminant validity ($r = 0.55$). The highest correlation coefficient is 0.511 between variable of company's absorptive capability and the variable of JV's cognitive learning actions ($p < 0.01$). In addition, all of the pairwise correlations are positive, which giving an additional evidence of construct validity (Venkatraman 1989).

Table 6.9 Variables: Mean, Standard Deviations, and Pairwise Correlations^a

Variable ^b	Mean	SD	EMAC	PDF	PAC	PLI	JVOC	JVIR	JVCLA
EMAC	3.632	0.073							
PDF	3.461	0.061	0.314**						
PAC	3.573	0.073	0.319**	0.113					
PLI	3.654	0.058	0.464**	0.418**	0.327**				
JVOC	3.497	0.074	0.337**	0.299**	0.246**	0.432**			
JVIR	3.615	0.052	0.388**	0.291**	0.400**	0.424**	0.418**		
JVCLA	3.256	0.066	0.434**	0.252**	0.511**	0.497**	0.376**	0.432**	
JVBLA	3.538	0.060	0.338**	0.303**	0.347**	0.467**	0.386**	0.495**	0.483**

Notes: ^aN=96. ^bAll variables are summated scores of the items that were loaded on a particular factor.

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

6.2.3 Reliability Assessment

The exploratory nature of this study, and the fact that the questionnaire on learning used in this study has not been used in any previous studies, required an assessment of the extracted variables from factor analysis (Venkatraman and Grant, 1986).

Reliability is defined as the degree to which measures are free from error and therefore yield consistent results (Peter, 1979). Reliability may be estimated through a variety of methods that couldn't fall into two types: Single-administration and multiple-administration. Multiple-administration methods require that two assessments are administered. In the test-retest method, reliability is estimated as the Pearson product-moment correlation coefficient between two administrations of the same measure. In the alternate forms method, reliability is estimated by the Pearson product-moment correlation coefficient of two different forms of a measure, usually administered together. Internal consistency is a single-administration method. The most common internal consistency measure is Cronbach's alpha (α), which is usually interpreted as the mean of all possible split-half coefficients (Cortina, 1993). Cronbach's alpha (α) is a generalization of an earlier form of estimating internal consistency (Cortina, 1993).

Out of three basic methods for assessing reliability (test-retest, alternative forms and internal consistency) the internal consistency method has the fewest limitations and is more often used in assessment reliability (Carmines and Zeller, 1979; Venkatraman, 1989). In this study, only one assessment is gathered, this study cannot use the test-retest and alternative forms to assess the reliability as these two methods are multiple-administration methods which require two assessments. Therefore, internal consistency as a single-administration method is chosen and Cronbach's alpha will be computed.

Following the recommendations of Churchill (1979) and Nunnally (1967, 1978), Cronbach's alpha (α) was computed for all factors that were to be used as variables in hypothesis testing. Researchers usually used a cut-of value of $\alpha=0.7$ (α_1) for studies

in advanced phases (Nunnally, 1978), while for exploratory studies alphas ranging from 0.50 to 0.60 (α_2), are considered to be sufficient (Nunnally, 1967; Van de Ven and Ferry, 1979).

Totally, ten factors including two result factors were extracted from factor analysis in Section 6.2.2 with the values of Cronbach's alphas for all variables (along with variables designations and numbers of items) are shown in Table 6.10. The ten factors are (F1) EMAC - Environment and Market's Attractive Characteristics; (F2) PDF - Partner's Development Feasibility; (F3) PAC - Partner's Absorptive Capability; (F4) PLI - Partner's Learning Intent; (F5) JVOC - JV's Operational Characteristics; (F6) JVIR - JV's Interactions and Relationships; (F7) JVCLA - JV's Cognitive Learning Actions; (F8) JVBLA - JV's Behavioral Learning Actions; (F9) JVCEI - JV's Collaborative Environment Improvement; (F10) JVKCI - JV's Knowledge and Capability Improvement. The reliability is accepted as all the Cronbach's alphas are larger than 0.7 which met the α_1 criterion.

Table 6.10 Summary of Variables' Designations and Cronbach's Alphas

Factors	Designation	Number of items	Cronbach's alpha
F1: EMAC	Environment and Market's Attractive Characteristics	3	0.865
F2: PDF	Partner's Development Feasibility	4	0.742
F3: PAC	Partner's Absorptive Capability	4	0.855
F4: PLI	Partner's Learning Intent	4	0.758
F5: JVOC	JV's Operational Characteristics	4	0.877
F6: JVIR	JV's Interactions and Relationships	6	0.792
F7: JVCLA	JV's Cognitive Learning Actions	5	0.864
F8: JVBLA	JV's Behavioral Learning Actions	6	0.820
F9: JVCEI	JV's Collaborative Environment Improvement	6	0.878
F10: JVKCI	JV's Knowledge and Capability Improvement	5	0.850

The factors extracted are subsequently used for the hypotheses testing and discussion in the following sections.

6.3 Hypothesis Testing

6.3.1 Normality Testing

The normality of the variables will be inspected via an analysis of distribution shapes of variables through skewness and kurtosis and Shapiro-Wilk's test. Skewness is the tilt (or lack of it) in a distribution. A common rule-of-thumb test for normality is to run descriptive statistics to get skewness and kurtosis, then divide these by the standard errors. Skew should be within the +2 to -2 range when the data are normally distributed. Negative skew is left-leaning, positive skew right-leaning. Kurtosis is the peakedness of a distribution. Kurtosis also should be within the +2 to -2 range when the data are normally distributed (a few authors use +3 to -3). Negative kurtosis indicates too many cases in the tails of the distribution. Positive kurtosis indicates too few cases in the tails. Shapiro-Wilks W test is the standard test for normality. W may be thought of as the correlation between given data and their corresponding normal scores, with $W = 1$ when the given data are perfectly normal in distribution. When W is significantly smaller than 1, the assumption of normality is not met. The test rejects the normality null hypothesis if W is too small and $P < 0.05$. The normality testing results were shown in Table 6.11. Compare with the criterion mentioned, all the variables can accept the normality assumption.

Table 6.11 Shape, Normality Test of the variables of Interest

Factors	Shape		Normality test (Shapiro-Wilk)	
	Skewness/ standard errors	Kurtosis/ standard errors	Statistic	Std. Error
F1: EMAC	-0.945	-0.260	0.974	0.050
F2: PDF	0.479	0.377	0.978	0.116
F3: PAC	-1.020	-0.868	0.974	0.055
F4: PLI	0.010	0.793	0.974	0.054
F5: JVOC	-0.743	-0.942	0.978	0.100
F6: JVIR	-1.218	-0.681	0.976	0.078
F7: JVCLA	-1.124	0.566	0.983	0.251
F8: JVBLA	-1.436	-0.128	0.980	0.154
F9: JVCEI	0.172	1.252	0.975	0.064
F10: JVKCI	-1.150	0.536	0.979	0.131

6.3.2. Regression Analysis

In the following section, all the hypotheses are tested using regression analysis. The factors extracted from factor analysis are subsequently used for hypotheses testing with the corresponding regression model. Factors concerning environment and partner characteristics, and an ICJV's characteristics and learning actions – which were extracted from factor analysis – were first regressed on learning effectiveness. Those factors concerning the environment and partner's characteristics were then regressed on factors concerning the ICJV's characteristics and learning action factors. Finally, factors concerning the ICJV's characteristics were also regressed on learning action factors. Results of the regression analyses are demonstrated in Table 6.12~6.17. In each model, 'B' represents Unstandardized Coefficients, and its value for each independent variable shows the proportion of one-deviation change in the dependent factor made by a one-deviation increase in the independent factor. The adjusted R^2 values for each equation show the extent to which the independent factors in the equation explain the variations in the dependent factors.

In statistics, the coefficient of determination, R^2 is used in the context of statistical models whose main purpose is the prediction of future outcomes on the basis of other related information. It is the proportion of variability in a data set that is accounted for by the statistical model. As the number of co-efficient increases, the R^2 will also continue to increase, regardless of the goodness of fit of the model. Adjusted R^2 is a modification of R^2 that adjusts for the number of explanatory terms in a model. As the number of co-efficient increases, the R^2 will also continue to increase, regardless of the goodness of fit of the model. Adjusted R^2 takes this flaw into account, unlike R^2 , the adjusted R^2 increases only if the new term improves the model more than would be expected by chance. It adjusts R^2 based on the number of independent factors in the model and gives a more realistic measure of relationship. In this study, there are multiple independent factors in the multiple regression model, therefore, adjusted R^2 is selected to illustrate the adequacy of a fitted regression model.

Other than using adjusted R^2 to give some indication concerning whether or not the model is an adequate explanation of the true situation. One can test the null hypotheses that the regression is not significant by merely forming ratio f . F-value is used as the value of f . While P-Value is the probability of obtaining a result at least as extreme as the one that was actually observed, given that the null hypothesis is true. These two value are using together to explain the level of significance of rejecting the null hypotheses.

Critics of p-values point out that the criterion used to decide “statistical significance” is based on the somewhat arbitrary choice of level. In the lab experiment, it is often set at 0.05. This study would follow the relevant study of Lyle, Salk and Lyles (2001), and set p-values at 0.01 as the basis for accepting or rejecting a hypothesis. But to identify the different significance of different factors, different p-values, $P \leq 0.1$; $P \leq 0.05$; $P \leq 0.01$ are all considered.

All regression equations will also be tested for multicollinearity via tests of tolerance value and variance inflation factor. Tolerance is defined as $1 - R^2$, where R^2 is the multiple R of a given independent regressed on all other independent variables. If the tolerance value is less than some cutoff value, usually 0.20, the independent should be dropped from the analysis due to multicollinearity. This is better than just using simple $r > 0.80$ since tolerance looks at the independent variable in relation to all other independents and thus takes interaction effects into account as well as simple correlations. The variance-inflation factor (VIF) may be used in lieu of tolerance as VIF is simply the reciprocal of tolerance. The rule of thumb is that $VIF > 4.0$ when multicollinearity is a problem. Some authors use the more lenient cut-off of $VIF \geq 5$ when multicollinearity is a problem (Cohen, 1969, Hutcheson et al, 1999). As shown in Table 6.12 to Table 6.17, under the collinearity statistics, all the tolerance values are larger than 0.2, and all the VIF values are smaller than 4.0, which means that the multicollinearity is satisfied.

Although the significance of F-Value is clearly shown in the Analytical Software SPSS, for better understand the rationale, the definition of F and the cut-off value of

F-Values at 1% significant level used in this study is clearly pointed out. The statistic F is defined to be the ratio of two independent chi-squared random variables, each divided by its number of degrees of freedom. If k is the number of independent factors for regression analysis and n is the sample size, then the first freedom is k, and the second freedom is n-(k+1) (Ronald et al, 2002). In this study, n=96, in the regression analysis of H1, H4, and H5, k=4, the degrees of freedom of F-Value are 4 and 91, then the corresponding cut-off value of F-Values at 1% significant level is 3.532 which is calculated by Microsoft Excel (FINV(0.01, 4, 91)); while in the regression analysis of H2, H3, and H6, k=2, the degrees of freedom of F-Value are 2 and 93, then the corresponding cut-off value of F-Value at 1% significant level is 4.841 through the calculation in Microsoft Excel (FINV(0.01, 2, 93)).

Other research, such as that carried out by Kale (1999) and Park and Luo (2001), accepts regression models when the results of adjusted R^2 are larger than 0.11. The adjusted R^2 of the regression models for the six hypotheses are all larger than 0.11, with F-Values significance at 1%, and all the values of Unstandardized Coefficients B are positive, meaning that all the proposed hypotheses are generally supported by the results of multiple regression analysis. Each hypothesis is discussed, and those factors with regression analyses at $P \leq 0.01$ level are identified as critical factors that exert a highly significant influence on efforts invested in learning. Learning effectiveness in ICJVs can therefore be improved by focusing attention on those critical factors that are vital for learning effectiveness. Results of the hypothesis analyses are discussed, and critical factors are identified below.

Hypothesis 1 includes six factors of which four independent factors are EMAC (Environment and Market's Attractive Characteristics), PDF (Partner's Development Feasibility), PAC (Partner's Absorptive Capability) and PLI (Partner's Learning Intent). The other two predictors are JVCEI (JV's Collaborative Environment Improvement) and JVKCI (JV's Knowledge and Capability Improvement). A regression analysis is used to test the relationship between the independent factors and the predictors, and the results are presented in Table 6.12.

Table 6.12 Results of Regression Analysis of H1: Conditions of Learning as Predictors of Learning Effectiveness

Independent Factors: Conditions of Learning	Dependent Factors: Learning Effectiveness		Collinearity Statistics	
	JV's Collaborative Environment Improvement B	JV's Knowledge and Capability Improvement B	Tolerance	VIF
Environment and Market's Attractive Characteristics	0.099	0.133*	0.734	1.362
Partner's Development Feasibility	0.218**	0.271***	0.804	1.244
Partner's Absorptive Capability	0.198***	0.315***	0.855	1.170
Partner's Learning Intent	0.370***	0.275***	0.668	1.496
Adjusted R ²	0.413	0.523		
F-Value	17.691***	27.056***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.12, environment and market's attractive characteristics, and a partner's development feasibility, absorptive capability and learning intent, together explain 41.3% of the variation in the JV's collaborative environment improvement. A partner's absorptive capability and learning intent have a significant coefficient at $P \leq 0.01$ level. Of these two factors, a partner's learning intent was found to exert a higher influence on the improvement ($B = 0.370$) than a partner's absorptive capability ($B = 0.198$). These findings also indicate that companies must increase their learning intent and absorptive capability to improve a JV's collaborative environment. On the other hand, environment and market's attractive characteristics, and a partner's development feasibility, absorptive capability and learning intent together explain 52.3% of the variance in a JV's knowledge and capability improvement. A partner's development feasibility, absorptive capability and learning intent had a significant coefficient of $P \leq 0.01$ level. Of these three factors, a partner's absorptive capability was found to exert a greater influence on a JV's knowledge and capability improvement ($B = 0.315$) than a partner's learning intent ($B = 0.275$) or development feasibility ($B = 0.271$). Meanwhile, the results indicated that construction companies must pay attention to their absorptive capability, learning intent and development feasibility to reap rewards from a JV's knowledge and capability improvement. A partner's absorptive capability, learning intent and

development feasibility were therefore identified as three critical factors determining learning effectiveness.

Hypothesis 2 is about the relationship of learning effectiveness and JV's characteristics, which includes two independent factors of JVOC (JV's Operational Characteristics) and JVIR (JV's Interactions and Relationships). The results of regression analysis on Hypothesis 2 are presented in Table 6.13.

Table 6.13 Results of Regression Analysis of H2: JV's Characteristics as Predictors of Learning Effectiveness

Independent Factors: JV's Characteristics	Dependent Factors: Learning Effectiveness		Collinearity Statistics	
	JV's Collaborative Environment Improvement B	JV's Knowledge and Capability Improvement B	Tolerance	VIF
JV's Operational Characteristics	0.320***	0.222***	0.825	1.212
JV's Interactions and Relationships	0.440***	0.591***	0.825	1.212
Adjusted R ²	0.391	0.411		
F-Value	31.454***	34.189***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.13, analysis shows that a JV's operational characteristics, together with its interactions and relationships, jointly explain 39.1% of the variance in a JV's collaborative environment improvement and 41.1% of the variance in a JV's knowledge and capability improvement. The results indicate that a JV's operational characteristics, interactions, and relationships improve, learning effectiveness can improve accordingly. Of these two factors, a JV's interactions and relationships exert a greater influence on a JV's collaborative environment improvement (B = 0.440) than its operational characteristics (B = 0.320). Meanwhile, a JV's interactions and relationships also exert a greater influence on a JV's knowledge and capability improvement (B = 0.591) than its operational characteristics (B = 0.222). These two ICJV characteristics have a significant coefficient to learning effectiveness at P≤0.01

level, indicating that both a JV's operational characteristics and its interactions and relationships are critical factors for learning effectiveness.

Hypothesis 3 is about the relationship of learning effectiveness and learning actions in ICJVs. The two independent factors are JVCLA (JV's Cognitive Learning Actions) and JVBLA (JV's Behavioral Learning Actions). The regression results of Hypothesis 3 are shown in Table 6.14.

Table 6.14 Results of Regression Analysis of H3: Learning Actions in ICJVs as Predictors of Learning Effectiveness

Independent Factors: Learning Actions in ICJVs	Dependent Factors: Learning Effectiveness		Collinearity Statistics	
	JV's Collaborative Environment Improvement B	JV's Knowledge and Capability Improvement B	Tolerance	VIF
JV's Cognitive Learning Actions	0.495***	0.421***	0.766	1.305
JV's Behavioral Learning Actions	0.234**	0.405***	0.766	1.305
Adjusted R ²	0.439	0.517		
F-Value	38.214***	51.917***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.14, analysis of this hypothesis indicates that cognitive learning actions, together with behavioral learning actions, jointly explains 43.9% of the variation in a JV's collaborative environment improvement and 51.7% of the variance in a JV's knowledge and capability improvement. It can be assumed that more cognitive and behavioral learning actions increase learning effectiveness. Of the two, cognitive learning actions were found to exert a greater influence on a JV's collaborative environment improvement (B = 0.495) than behavioral learning actions (B = 0.234). Moreover, cognitive learning actions were also found to exert a slightly greater influence on a JV's knowledge and capability improvement (B = 0.421) than behavioral learning actions (B = 0.405). These two learning actions have a significant coefficient to learning effectiveness at P≤0.01 level: thus, both were identified as critical factors for learning effectiveness.

Hypothesis 4 measures the relationship between the conditions of learning and JV's characteristics. The results are shown in Table 6.15.

Table 6.15 Results of Regression Analysis of H4: Conditions of Learning as Predictors of JV's Characteristics

Independent Factors: Conditions of Learning	Dependent Factors: JV's Characteristics		Collinearity Statistics	
	JV's Operational Characteristics B	JV's Interactions and Relationships B	Tolerance	VIF
Environment and Market's Attractive Characteristics	0.114	0.120	0.734	1.362
Partner's Development Feasibility	0.127	0.102	0.804	1.244
Partner's Absorptive Capability	0.082	0.187***	0.855	1.170
Partner's Learning Intent	0.458***	0.185*	0.668	1.496
Adjusted R ²	0.230	0.264		
F-Value	8.079***	9.521***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.15, the hypothesis testing results indicate that environment and market's attractive characteristics, and a partner's development feasibility, absorptive capability, and learning intent, together explain 23% of the variation in a JV's operational characteristics and 26.4% of the variation in a JV's interactions and relationships. However, only a partner's learning intent has a significant coefficient to a JV's operational characteristics at P≤0.01 level (B = 0.458); and only a partner's absorptive capability has a significant coefficient to a JV's interactions and relationships at P≤0.01 level (B = 0.187). The results indicate that only a partner's absorptive capability and learning intent would more strongly influence an ICJV's characteristics as the most important factors concerning an ICJV's characteristics.

Hypothesis 5 tests the relationship of the conditions of learning and learning actions in ICJVs, which include the cognitive learning actions and the behavioral learning actions. The results of the regression analysis are shown in Table 6.16.

Table 6.16 Results of Regression Analysis of H5: Conditions of Learning as Predictors of Learning Actions

Independent Factors: Conditions of Learning	Dependent Factors: Learning Actions in ICJVs		Collinearity Statistics	
	JV's Cognitive Learning Actions B	JV's Behavioral Learning Actions B	Tolerance	VIF
Environment and Market's Attractive Characteristics	0.162*	0.076	0.734	1.362
Partner's Development Feasibility	0.040	0.121	0.804	1.244
Partner's Absorptive Capability	0.325***	0.167**	0.855	1.170
Partner's Learning Intent	0.321***	0.315***	0.668	1.496
Adjusted R ²	0.384	0.250		
F-Value	15.808***	8.937***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.16, the results of this hypothesis analysis indicate that environment and market's attractive characteristics, and a partner's development feasibility, absorptive capability, and learning intent, together explain 38.4% of the variation in cognitive learning actions and 25% of the variation in behavioral learning actions. Specifically, a partner's absorptive capability and learning intent have a significant coefficient to cognitive learning actions at P≤0.01 level, and a partner's absorptive capability exerts a slightly higher influence on cognitive learning actions (B = 0.325) than a partner's learning intent (B = 0.321). However, only a partner's learning intent has significant coefficient to behavioral learning actions at P≤0.01 level (B =0.315). The results indicate that a partner's absorptive capability and learning intent can be regarded as influential factors for learning actions.

The relationship between JV's characteristics and learning actions in ICJVs is tested in Hypothesis 6 with results shown in Table 6.17.

Table 6.17 Results of Regression Analysis of H6: JVs' Characteristics as Predictors of Learning Actions

Independent Factors: JVs' Characteristics	Dependent Factors: Learning Actions in ICJVs		Collinearity Statistics	
	JV's Cognitive Learning Actions R	JV's Behavioral Learning Actions R		
JV's Operational Characteristics	0.215**	0.175**	0.825	1.212
JV's Interactions and Relationships	0.413***	0.470***	0.825	1.212
Adjusted R ²	0.210	0.269		
F-Value	13.655***	18.459***		

Note: B: Unstandardized Coefficients, N=96, *P≤0.1; ** P≤0.05; ***P≤0.01

As demonstrated in Table 6.17, the results of this hypothesis indicate that a JV's operational characteristics, together with a JV's interactions and relationships, jointly explain 21% of the variation in cognitive learning actions and 26.9% of the variation in behavioral learning actions. A JV's interactions and relationships have a significant coefficient to cognitive learning actions at P≤0.01 level (B =0.413), to behavioral learning actions at P≤0.01 level (B = 0.470). Therefore a JV's interactions and relationships can be regarded as the critical influencing factor for learning actions here.

In summary, the results of the first three hypotheses identified seven critical factors that significantly and directly influence learning effectiveness: a partner's development feasibility, absorptive capability, and learning intent; and a JV's operational characteristics, interactions and relationships, cognitive learning actions, and behavioral learning actions. The results of the next two hypotheses also identified a partner's absorptive capability and learning intent as two critical factors that significantly influence a JV's characteristics and learning actions. As both a JV's characteristics and learning actions are critical factors for learning effectiveness, a partner's absorptive capability and learning intent also indirectly influence learning effectiveness. The results of this last hypothesis identified JV interactions and relationships as critical factors that significantly influence a JV's learning actions. A JV's interactions and relationships thus also indirectly influence learning effectiveness.

6.3.3. Findings of Hypothesis Testing

As a whole, the research findings in this study can be summarized in the following Tables 6.18~6.20. The results as shown in Table 6.18 suggest that with development strategy, good absorptive capability and learning intent, it is expected a JV partner company can generally improve its learning effectiveness. The results also show that though to a less significant level, the environment attractiveness has some effect on the learning effectiveness on the aspect of knowledge and capability improvement. It also indicates that if a partner company can improve a JV's characteristics such as in the areas of integration, independence, authority and power, interactions and building relationships in the JV board, it should lead to better learning effectiveness. Furthermore, a partner company, which takes more actions in cognitive and behavioral learning, would be also better positioned in reaping maximum benefits of learning effectiveness.

Table 6.18 Summary of the Research Findings for Hypothesis 1~3

Learning Effectiveness	JV's Collaborative Environment Improvement	JV's Knowledge and Capability Improvement
Conditions of Learning (H1)		
<i>Environment and Market's Attractive Characteristics</i>	NS	*
<i>Partner's Development Feasibility</i>	**	***
<i>Partner's Absorptive Capability</i>	***	***
<i>Partner's Learning Intent</i>	***	***
JV's Characteristics (H2)		
<i>JV's operational Characteristics</i>	***	***
<i>JV's Interactions and Relationships</i>	***	***
Learning Actions in ICJVs (H3)		
<i>JV's Cognitive Learning Actions</i>	***	***
<i>JV's Behavioral Learning Actions</i>	**	***

N=96, NS=Not Significant ($P>0.1$), * $P\leq 0.1$; ** $P\leq 0.05$; *** $P\leq 0.01$

Table 6.19 indicates that the partner with better absorptive capability can easier build better relationships among ICJVs. It also indicates that partner with stronger learning intent will more likely to construct a JV with more integration, impartibility (means

that project cannot be divided into a few neat work packages to be handled separately by different partners as measured in the questionnaire), interdependency and authoritative power to form better relationships among ICJVs.

Table 6.19 Summary the Research Findings for Hypothesis 4

JV's Characteristics	JV's Operational Characteristics	Interactions and Relationships
Conditions of Learning (H4)		
<i>Environment and Market's Attractive Characteristics</i>	NS	NS
<i>Partner's Development Feasibility</i>	NS	NS
<i>Partner's Absorptive Capability</i>	NS	***
<i>Partner's Learning Intent</i>	***	*

N=96, NS-Not Significant ($P>0.1$), * $P\leq 0.1$; ** $P\leq 0.05$; *** $P\leq 0.01$

Table 6.20 indicates that partner with better absorptive capability and learning intent would like to take more learning actions in both cognitive and behavioral aspects. Meanwhile, in a more attractive environment, the cognitive learning action may also happen more often. And more learning actions will happen in ICJVs with the JV's characteristics selected in this study as integration, project's impartibility, interdependency and authority power and the ICJV with better relationship.

Table 6.20 Summary the Research Findings for Hypothesis 5 and 6

Observed Learning Actions	JV's Cognitive Learning Actions	JV's Behavioral Learning Actions
Conditions of Learning(H5)		
<i>Environment and Market's Attractive Characteristics</i>	*	NS
<i>Partner's Development Feasibility</i>	NS	NS
<i>Partner's Absorptive Capability</i>	***	**
<i>Partner's Learning Intent</i>	***	***
JV's Characteristics (H6)		
<i>JV's operational characteristics</i>	**	**
<i>JV's Interactions and Relationships</i>	***	***

N=96, NS-Not Significant ($P>0.1$), * $P\leq 0.1$; ** $P\leq 0.05$; *** $P\leq 0.01$

6.4 Discussion of the Quantitative Study Results

To summarize, all the hypotheses are well supported by the corresponding models and the overall hypotheses testing results are shown in Figure 6.1. These findings are very useful to companies interested in learning through ICJVs, and may help them to achieve effective learning in ICJVs.

Those factors with regression analyses significant at $P \leq 0.01$ level are considered as critical factors exerting a highly significant influence on efforts invested in learning. The learning effectiveness in ICJVs can therefore be improved by focusing attention on critical influence factors which are vital for learning effectiveness. The results of the hypothesis analyses are discussed below.

In total, the results of the first three hypotheses identified seven critical factors that significantly and directly influence learning effectiveness. They are: a partner's development feasibility, absorptive capability, and learning intent, a JV's operational characteristics, interactions and relationships, cognitive learning actions and behavioral learning action. The results of the following two hypotheses also isolated a partner's absorptive capability and learning intent as two critical factors that significantly influence JV's characteristics and JV's learning actions. Due to the fact that both factors of JV's characteristics and JV's learning actions are critical for learning effectiveness, partner's absorptive capability and learning intent also significantly influence learning effectiveness as well. The results of the last hypothesis isolated those JV's interactions and relationships as a critical factor that significantly influences JV's learning actions. Thus, JV's interactions and relationships also significantly indirectly influence learning effectiveness.

Figure 6.1 Relationships among Constructs in the Learning Model

Seven critical factors, including a partner's development feasibility, absorptive capability, and learning intent; and a JV's operational characteristics, interactions and relationships, cognitive learning actions and behavioral learning actions, are discussed and analyzed in this section.

Firstly, a partner's development feasibility, measured by a partner's product development strategy, market development strategy, and decentralized and organic structure degree, is identified as the critical factor for learning effectiveness. The results give an insight into the implications of construction firms' organizational features when participating in ICJVs. The development strategy and organizational structure appear to have a significant influence on learning effectiveness. This concurs with the observation of Anderson (1990), who found that the development strategy of a company provides it with the ability to diversify and engage future business that, in turn, requires more knowledge and spurs a company to learn more proactively. Moreover, a more decentralized and organic company exercises more flexibility in its operations, providing further opportunities for learning in JVs. As a result, partners with more development feasibility would be more likely to improve their learning effectiveness.

Secondly, a partner's absorptive capability, consisting of its openness to new knowledge, and employee adaptability, receptivity and experience, is identified as both a direct and indirect critical factor for learning effectiveness. Construction companies that have stronger absorptive capabilities could improve its learning effectiveness faster, build a JV with more suitable ICJV characteristics, and absorb more learning actions in a JV and, subsequently, also achieve better learning effectiveness. This is similar to Li et al's study (2003), which identified a partner's capability as a critical success factor in ICJVs; and that of Hamel (1991), who demonstrated that the transparency and receptivity of a partner form the determinants of learning.

Thirdly, a partner's learning intent that includes intent to transfer, apply, acquire, and create new knowledge, both directly and indirectly significantly influences learning effectiveness. The construction company which plans from the pre-inception stage with a very clear learning intent in mind would be more likely to improve its learning effectiveness; it is further suggested that the company with more learning intent may form better ICJV characteristics and absorb more learning actions in a JV to achieve better learning effectiveness. The findings are supported by Hamel (1991), who stated that intent is also a determinant of learning, and Fishbein and Ajzen (1975), who suggested that a person's behavior is determined by his or her attitude, which in turn is determined by his or her intent behind the behavior.

Fourthly, factor concerning ICJVs' operational characteristics, including the degree of JV integration, project's impartibility and management competency – such as independency and authoritative power – is identified as a critical factor for learning effectiveness. This finding demonstrates that the integration of a JV provides collaborative as well as learning chances for partners; it also shows that a JV's management competency provides support for learning. The importance of these ICJV operational characteristics is supported by Egbu's (2000) findings, which indicated that a proper organizational structure, such as the degree of integration, is an important factor for the successful promotion of knowledge-sharing. It is also similar to Gido and Clements's (1999) observation that the structure of a JV's integration affects learning success. On the other hand, Inkpen (1998) pointed out the importance of management competency to the success of an IJV in a study of organizational learning in JVs. Lyles and Salk (1996) found that an organizational management competency to solve problems flexibly and independently is significant for a partner's acquirement of knowledge in an IJV. Wong (2002) reported that management competency is one of the key determinants of performance in ICJVs. Meanwhile, Inkpen (1998) discussed the importance of management competency to the success of IJVs in a study of organizational learning in JVs. All the above studies support the finding that management competency, from having the authority to run a JV independently, to the power to make major decisions, is strongly related to learning effectiveness. To improve learning effectiveness, therefore, partners in the

ICJV organization should be more integrated, work closer together, and give more independence and authority to the JV board to manage projects.

Fifthly, A JV's interactions and relationships as a critical factor for learning effectiveness, including trust, cultural similarity and understanding, business relatedness, management support, and training, not only directly influences learning effectiveness, but also indirectly through learning actions. This means that more interactions and better relationships in a JV would improve learning effectiveness; it also means that more interactions and better relationships would lead to more learning actions and thus improve learning effectiveness as well. The results are generally supported by the literature of various researchers and the authors' preliminary case studies. For example, Lei and Slocum (1991), with Inkpen (1998), found that trust is one of the primary variables for partnership success; Lorange and Roos (1993) suggested that an IJV's success was linked to a firm's ability to understand and adapt to cultural differences; Lane et al (2001) found that relatedness and prior knowledge are positively associated with an IJV's learning; and Inkpen (1998) also found that management support and training by the partner provide a vehicle and solution for learning and knowledge transfer. As a result, to improve learning effectiveness in a JV, partners should build better relationships with each other in order to improve trust, cultural compatibility, and business relatedness, so as to provide more management support and training opportunities for everyone involved in the JV.

Sixthly, the factor of a JV's cognitive learning actions, measured by actions such as self-examination, sharing personal visions, sharing experiences and lessons, explaining common visions, and support over blame, is found to be very influential for learning effectiveness. To increase learning effectiveness, therefore, participants should take more cognitive actions on these mental processes. These findings are well supported by Hoff et al. (2004), Bryan (2003), and Senge (1990) who identified the importance of cognitive actions to learning.

Finally, factors of behavioral learning actions as another factor of learning actions are also isolated as a critical factor for learning effectiveness. They were measured by the real actions of engaging problems actively, frequently communicating with each other, solving problems together, developing and creating new knowledge, collecting and record knowledge, and applying new knowledge. This shows that taking these real learning actions would also improve learning effectiveness. This finding concurs well with the works of Robbins (1997) who said, knowledge is only part of the equation of success, a major part is action, and action produces results. This finding also concurs with the research of And Hoff et al. (2004), Senge (1990), Jashapara (1993) and Watkins and Marsick (1993) also pointed out the significance of behavioral actions to achieve learning success. Therefore, to reap better learning effectiveness, partners should take more behavioral actions.

As a whole, seven critical factors for learning effectiveness in ICJVs were discussed, with corresponding support from literature. The discussion also provides important implications for construction companies to improve learning effectiveness in ICJV practice.

6.5 Summary

This chapter went through the quantitative study and statistical analysis and got important findings. Firstly, it justified the validity and reliability of major constructs of the research model. Secondly, 48 variables were reduced to 10 factors through factor analysis. Thirdly, multiple regression analysis is used to test the hypotheses, and all the hypotheses are accepted at 1% level. Finally, the result is discussed and seven factors were identified as the critical factors for improving learning effectiveness in ICJVs. The quantitative study and staticstic analysis provided the platform to find out the critical factors for effective learing in ICJVs. The study had also indentified the critical factors from the messive, unclear situations of ICJVs. The Next chapter will present the conclusions accrued as a result of the research.

Chapter 7 Conclusions and Recommendations

7.1 Overview

This chapter summarizes the main conclusions and contributions made by the research. It aims to present potential implications of the results in light of the research problem and the theoretical framework presented respectively in Chapter 1 and Chapter 3. It also addresses the limitations of the current study and provides directions for future research. This chapter is divided into four sections. Conclusions and Implications of the research is first presented, followed by research contributions for theory development and managerial practices. The limitations of the study and directions for future research are presented next. Finally, a brief summary of this study is given.

7.2 Conclusions and Implications

The purpose of this research was to contribute to the literature towards bridging the gap of learning issues in the ICJV. The objectives of this research were to identify critical determinants to the learning effectiveness in ICJVs, incorporate them into a learning model and test the relationships between the determinants and learning effectiveness. To this end, the current research is aimed to answering the questions “(1) What factors are conducive to learning effectiveness in ICJVs?” And “(2) How these factors contribute towards learning effectiveness in ICJVs?” All these objectives are achieved through a series methodology and implementation throughout the research.

This study firstly built a conceptual learning model comprising four constructs identified from four main stages of JV for improving learning effectiveness in ICJVs based on the theoretical grounding from the literature review. The four

constructs are characteristics of environment and partner companies as conditions of learning, JV's characteristics as success factors in learning aspects, learning actions of JV and characteristics of learning organization as measurements of learning effectiveness,

Secondly, the conceptual model was logically grounded with the support of six ICJV project cases. Variables and relationships forming the model are observed in the learning issues of ICJV projects which support the reality of the conceptual model built on literature review and theoretical base.

Finally, through quantitative study and statistical analysis based on the questionnaire survey, the proposed positive relationships between the determinants and learning effectiveness are testified, with the criteria of relationship at $P \leq 0.05$ level, and seven critical factors to the learning effectiveness in ICJV are identified, namely, a partner's development feasibility, absorptive capability, learning intent, a JV's operational characteristics, a JV's interactions and relationships, cognitive learning actions, and behavioral learning actions.

The findings of this research have implications for both existing academic theory and research and also for management practice. The implications of this research for theory and practice will be described in detail next.

The major theoretical implication of the research is that it synthesized and integrated the learning systems in ICJVs. It provided a more accurate and less biased picture of the determinants of learning effectiveness in ICJVs, than was possible when investigation within each field was constrained by disciplinary boundaries. Such a flexible model captured the complex and dynamic nature that evolved over time. The academics can find value in the identification of statistically reliable measures that will be used in further research designed to develop theoretical foundations that will explain the learning effectiveness of ICJV organizations.

The findings of the study provided an empirical support to the literature study which suggests positive relationships among conditions of learning, JV's characteristics, learning actions and learning effectiveness at JV's different development stages. This research has revealed some elements and gave perceptiveness on achieving learning effectiveness in ICJVs for participants. Moreover, it examined and confirmed the positive relationships development feasibility, absorptive capability, learning intent, interactions and relationships among JVs, learning actions and the learning effectiveness.

The findings of this study also have implications for management practice. Specifically, the results of this research may be useful for management practitioners who are involved in the ICJVs. To illustrate, it is pointed out that to achieve learning effectiveness in the completion and evaluation stages of ICJV, a partner company not only must take more learning actions during the implementation and adjustment stage, it must build suitable JV's operational characteristics and good relationship with other partners in the formation and organizing stages, it must also pay attention in the pre-inception stage to have more capable people involved and promote learning intent throughout the company.

The findings of the study are generally found to concur with contemporary theories and studies that contribute to the understanding of learning issues within construction companies participating in ICJVs. This research also streamlines the generality and applicability of these theories and models into finer layers of detail, and arouses implications for construction companies participating in ICJVs. Essentially, the research illustrates the intrinsic relationships among the seven critical learning factors and the learning effectiveness that exist during a typical JV's developmental stages. To achieve learning effectiveness in ICJVs, therefore, partners must pay attention to the seven critical learning factors in the different stages of a JV.

7.3 Contributions

The main contribution of this dissertation is to fill up the research gaps for general learning in ICJV context. Although a great many researchers studies and theories on

learning, their applications to JVs, especially with a construction context, remain limited. Much less of systematic models are directed to ICJVs as well. This study is the first study to combine the JV management theory and the learning organization theory in the ICJVs, which will help to increase the effectiveness of learning in ICJVs. It identifies a partner's development feasibility, absorptive capability, learning intents, a JV's operational characteristics, interactions and relationships, cognitive learning actions and behavioral learning actions as seven critical determinants to learning effectiveness in ICJVs. After incorporating the determinants identified into the proposed learning model, the positive relationships between the determinants and learning effectiveness in ICJVs are demonstrated.

The other main contribution of this dissertation is mainly to the field of management theory in ICJVs. It aims to develop an integrative framework for diverse approaches to achieve higher learning effectiveness in ICJVs, to enhance the understanding of progress, aspects of learning and the interconnectedness. It also specifies the role of effective learning as one of the key factors for the success of ICJVs.

This research provides some useful findings for construction companies learning in ICJVs and some valuable management considerations for venture companies. It can be a guideline and evaluation tool for construction companies to study before they enter into ICJVs. It can also help the venture companies to enhance their knowledge and competitiveness through learning from the venture projects. Therefore, it can contribute towards improving learning effectiveness and eventually serve as useful pointers for companies to increase their chances of success in ICJVs. However, as the results are based on the survey and interviews in the selected companies and hopefully they are applicable to construction management contexts in similar situations.

7.4 Limitations and Recommendations

Although this research has established the existence of important links between learning conditions, JV's characteristics, learning actions and learning effectiveness, there are several important limitations which have implications for future study. It is

impossible to cover all aspects related to learning effectiveness improvement in ICJVs. There are some limitations in terms of the scope of this research, which lead to the recommendations for others to research in the future.

(1) The questionnaire survey targeted mainly construction companies registered in Singapore and China. The opinions of other construction companies in other regions may be different but also variable. Those companies based with different cultural background in different economy would be able to provide a more objective view about learning determinants that would lead to learning effectiveness improvement in the ICJV context. In future research, it would be good to sample opinions from more countries and regions.

(2) There are thousands of construction companies in China and Singapore which have ICJV experiences. Although no significant non-response bias was found in this study, the relatively low response rate resulted in the smaller than expected sample size, which was less desirable for the statistical precision and confidence of the study. The sample size of this research is only 96, which might be inadequate to represent the whole population. Moreover, given the large number of variables involved, this small sample size limited the ability to develop a better model for practice. This is due to the reason that data collection is very difficult as it requires sufficient time and cost. In future research, the sample size can be enlarged over time more funding applied on research. This way, a much larger sample size would have provided stronger tests of all the hypotheses and greater confidence in the results.

(3) The respondent companies are mainly the general contractors. In the practice, there are more construction project stakeholders participating in the ICJVs which may include the owners, suppliers, design institutes and project consulting firms in the. As non-contractors, these stakeholders would provide more objective view about the learning determinants based on their different characteristics, which is also very valuable to provide full opinions for construction companies to improve their learning effectiveness.

As aforementioned discussion, future researchers should seek to overcome all the limitations of this study to develop a more comprehensive learning model for ICJVs. In the future, researchers could go to explore the scope of the research and further develop the research model from literature review and empirical study: to gather more sample opinions from more countries and regions, to enlarge the sample size and use different methodology to do the statistical analysis and to consider the opinion of construction related companies other than just the general contractors. Finally, the future researchers could compare the findings under different conditions and provide more comprehensive theory and knowledge for construction companies to improve their learning effectiveness in ICJVs.

7.5 Summary

This chapter summarizes the main conclusions of the thesis and contributions made by this research. The implications of these findings have also led to several imperatives that should be applied by construction companies who want to improve learning effectiveness when participating in IJVs. This is then followed by the limitations that cannot be fulfilled by this research and recommendations on possible future research directions. Despite the significance of the study, it is worth acknowledging the exploratory nature of this study. It is hoped that the framework developed in this research will provide theoretical foundation upon which more rigorous research can be undertaken in the future.

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APPENDICES

Appendix A: Questionnaire (English Version)

Dear Managing Director/Senior management,

Re: Questionnaire Survey on learning perspectives of international construction joint ventures (ICJVs)

I am currently a PhD student of Nanyang Technological University undertaking a research study in the area which requires me to gather data involving learning aspects in international construction joint ventures. As a reputed company, your management has been identified as one of the short listed few for sharing your valued experience and view in this area of study.

For many companies participated in joint ventures (JVs), though learning may not be deliberately planned or expressly formulated from the beginning, the effect of learning always take place in the process. In practice, participating companies of a JV will benefit one way or another in term of learning on various aspects such as technical, managerial, cultural, business practice, marketing and others. This would generally contribute toward better performance and raising success rate in their JV endeavor. My research focus is aimed to address the concern of how an organization can enhance the effectiveness of learning in international construction joint ventures.

Your participation is crucial in providing the much needed field data in my research study. Please be assured that all information provided will be used only for academic purposes and will be dealt with in strict confidentiality. Should there be any clarification on this survey, please do not hesitate to contact the undersigned directly.

I will very much appreciate that your management can spare about 15 minutes to complete the attached questionnaire and return it in the self-addressed envelope to the undersigned by 31 Jul 2005. Thank you for your effort and kind assistance on this matter.

Yours sincerely,

Zhang Liting

Fan

Phd Applicant

Email address: pg05074252@ntu.edu.sg

Supervisor: Dr Wong Wai

Associate Professor

QUESTIONNAIRE ON LEARNING PERSPECTIVES OF INTERNATIONAL CONSTRUCTION JOINT VENTURES

Introduction and explanatory notes

This questionnaire is designed to gather data which is crucial for research study of building a learning organization for the International Construction Joint Ventures (ICJVs). It comprises 5 pages and it should take about 15 minutes to complete.

The questionnaire consists of two parts. Part I is about the general information of the responding companies and the respondents. Part II is divided into six sections: Environment and partner's characteristics, learning intent, Operational characteristics in JV, Relationships among partners and the JV, Learning actions, and learning effectiveness assessment.

(About ICJV: ICJV is defined herein as a cooperative construction business entity formed by two or more separate organizations from different countries. It can also be applied to a case where construction organizations who formed a JV entity to participate in an overseas construction project located in another different country.)

Respondents are gently reminded of the following:

- 1) There are no correct or wrong answers. Each answer provided by respondent should represent his best view on the statement.
- 2) **Information provided will be treated with strictest confidentiality.**

Part I. General Information

1) Name of company:
2) Name of respondent:
3) Designation:
4) Contact No.:

Part II. Formulated Questionnaire

In answering questionnaire of Part II (Section 1 to 6), please make reference to one of your joint venture projects which can be past or current that your company has participated. If available, it is much desirable for you to provide the following details of the JV project you have herein referred to.

1) Project duration:	
2) Project value (S\$ millions):	
3) Each partner with equal equity share (Please circle one)	Yes / No

Part II -Section 1. Environment and Partner's Characteristics

Section 1 is designed to identify the characteristics of environment of the JV project referred to and also the characteristics of each partner in the JV. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.

(1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Environment and Partner's Characteristics	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) The host government is generally supportive in the aspect of forming a JV.	1	2	3	4	5
2) The host market is very complex for the entry of a single company.	1	2	3	4	5
3) The host market provides good potential for company's development.	1	2	3	4	5
4) Each partner of the JV has planned to widen its construction business range.	1	2	3	4	5
5) Each partner of the JV has planned to widen its own existing market exposure.	1	2	3	4	5
6) The power of control in each partner of the JV is decentralized and well dispersed to departments.	1	2	3	4	5
7) Each partner of the JV is flexible and adaptable toward work and procedure.	1	2	3	4	5
8) Each partner of the JV doesn't have full understanding of the host market and not in the possession of required technology.	1	2	3	4	5
9) Each partner of the JV is very open in terms of accepting new knowledge.	1	2	3	4	5
10) In general, staff in each partner of the JV is receptive towards new knowledge/techniques.	1	2	3	4	5
11) In general, staff in each partner of the JV has good experience in working with other companies.	1	2	3	4	5
12) In general, staff in each partner of the JV has strong adaptability to the changing environment.	1	2	3	4	5
Others (please specify):					

Part II -Section 2. Learning Intent

This section aims to identify various aspects of learning Intent of each partner of JV at the time of forming a JV. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.
 (1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Learning Intent	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) Each partner of the JV has planned and willing to transfer its existing knowledge to the JV.	1	2	3	4	5
2) Each partner of the JV has planned to develop new knowledge through joint activity.	1	2	3	4	5
3) Each partner of the JV has planned to learn its partner's exiting knowledge via the JV.	1	2	3	4	5
4) Each partner of the JV has planned to apply new knowledge/technique learned from the JV into its other business operation.	1	2	3	4	5
Others (please specify):					

Part II -Section 3. Operational Characteristics in JV

This section aims to identify the operational characteristics of the JV. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.
 (1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Operational Characteristics in JV	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) The JV project was managed in a fully integrated manner.	1	2	3	4	5
2) The project cannot be divided into a few neat work packages to be handled separately by different partners.	1	2	3	4	5
3) The management of JV is very independent in managing the JV.	1	2	3	4	5
4) The management of JV has very strong authority in decision making.	1	2	3	4	5
Others (please specify):					

Part II -Section 4. Relationships among Partners and the JV

In this section, we aim to identify the relationships among partners and the JV. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.

(Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Relationships among Partners and the JV	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) There is good mutual trust among partners in the JV.	1	2	3	4	5
2) Partners seem to have their cultures quite close to each other in the JV.	1	2	3	4	5
3) Partners can understand the cultural differences that exist among themselves in the JV.	1	2	3	4	5
4) Each partner of the JV has a major business area which is very much related to the JV project.	1	2	3	4	5
5) All the parent companies are seen to provide good management support to the JV.	1	2	3	4	5
6) All the parent companies provide good training for their staff in the JV.	1	2	3	4	5
Others (please specify):					

Part II -Section 5. Learning Actions

This section attempts to identify various efforts of the learning actions which were implemented during the JV. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.

(Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Learning Actions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) Staff of JV has shown effort in conducting self-examination on mistakes and negligence.	1	2	3	4	5
2) Staff from different companies in the JV has shown to put in effort to share vision to each other.	1	2	3	4	5
3) Staff from different companies in the JV has shown to put in effort to share experience and lesson learned.	1	2	3	4	5
4) Effort has been made by management of JV to help all the staff to understand the common vision.	1	2	3	4	5
5) When faced with problem, management has shown to be supportive towards their staff.	1	2	3	4	5
6) Staff has shown effort to engage question/problem actively in search of better solution.	1	2	3	4	5
7) Staff of JV has seen to make effort in listening and accepting better opinion from others.	1	2	3	4	5
8) The management of JV always makes an effort to consider opinion/suggestion of staff for better problem solution.	1	2	3	4	5
9) Staff of JV has shown effort to acquire and develop new knowledge/technique in the work.	1	2	3	4	5
10) The management of JV was seen to make effort in gathering and documenting useful knowledge of all staff.	1	2	3	4	5
11) There is a clear effort shown in the JV in applying new knowledge/techniques widely into the project.	1	2	3	4	5
Others (please specify):					

Part II -Section 6. Learning Effectiveness Assessment

In this section, we aim to identify the status of the learning effectiveness based on the characteristics of a learning organization. For each statement, please indicate your best assessment by circling one appropriate number on the five-point Likert scale provided.

(1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Learning effectiveness assessment	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1) Staff from different partners has regarded each other as someone whom they can share success.	1	2	3	4	5
2) The JV has developed a conducive and creative learning climate.	1	2	3	4	5
3) Vision between the JV and the individuals are discussed and well aligned.	1	2	3	4	5
4) The management of JV was very competent in facilitating, coaching and supporting individual's learning.	1	2	3	4	5
5) Free and open communication and dialogue pervades the entire JV, barriers that threaten to impede it were removed.	1	2	3	4	5
6) Staff of JV has been able to solve the problem from system perspective.	1	2	3	4	5
7) Staff of JV has shown to be able to work and learn very effectively as a team.	1	2	3	4	5
8) Individual's capability seems to be able to develop in the JV.	1	2	3	4	5
9) Staff of JV has been able to work efficiently and effectively.	1	2	3	4	5
10) The overall knowledge/technique of the JV has generally improved.	1	2	3	4	5
11) The engineering technology and management skill of the JV have been developed.	1	2	3	4	5
Others (please specify):					

End of Questionnaire & Thank You!

Appendix B: Questionnaire (Chinese Version)

来自新加坡南洋理工大学海外学子的邀请信

尊敬的朋友：

您好！请恕我冒昧的给您发了这封邀请信。

我是新加坡南洋理工大学的中国学生，现攻读建筑管理的博士学位。我的研究课题是在国际建设合作项目中，企业间如何相互学习共同提升，为此我需要对国内著名的建筑企业做相关的问卷调查。

在经济高度全球化的趋势下，外国承包商进入中国，中国承包商走向海外，国际合作成为各国承包商获得项目的主要方式之一。在国外建筑公司与国内建筑公司合作的过程中，双方可以相互学习，使双方的水平都得到提高，起到优势互补的作用。

然而在实际的合作过程中，由于种种环境、管理机制的限制，双方的合作学习效果往往不如人意。为着提高企业整体学习的效果，我的调查问卷将对与合作双方学习相关的各种因素进行研究，希望可以帮助企业在未来的合作项目中取得更大的学习成效。

因此，我希望可以通过这个问卷调查得到您对企业构建学习型组织的宝贵的经验和相关意见。

为了方便填写与收集，我设计了在线填写的调查问卷，网址如下：

<http://www.ntu.edu.sg/home5/pg05074252>

诚切的盼望您能给予海外学子支持和协助，在百忙之中填写调查问卷！谢谢！

新加坡南洋理工大学

张利婷

2005-3-14

关于在国际建设联营实体中学习的问卷调查

这个问卷调查是为收集参与联营的公司在国际建设联营实体中进行学习的状况而设计，任何有国际建设联营经验的个人都可以回答。（国际建设联营实体：指由两个或两个以上来自不同国家的公司为参与建设项目而建立的一个合作实体或项目公司，也可以指由两个或两个以上公司为参与另一不同国家的建设项目而建立的合作实体或项目公司）

问卷一共包括4页，大约需要15分钟完成。问卷由两个部分组成：

第一部分是公司和回答者的一般信息；

第二部分包括联营的环境和公司特点、参与联营的公司的学习思维、联营的特点、参与联营的公司及联营实体的关系、联营中实施的学习行动及对该联营实体学习的有效性的评估。

- 3) 所有问题的回答都是一种主观判断，没有“对”与“错”，“是”与“非”之分，请根据您的最好判断回答，谢谢！
- 4) 所有的回答将被严格用在学术研究中。

第一部分:一般信息

5) 公司名称:	
6) 姓名:	
7) 职位:	
8) 电话号码或Email:	

第二部分:正式问题

请根据您的所经历的一个国际建设联营项目, 填写该项目的一些基本信息, 然后再根据该项目回答后面的问题。

1) 项目历时:	
2) 项目总值(万人民币):	
3) 联营各方在项目中的所有权是否相同:	

第二部分：1. 联营的环境和公司特点

这部分了解联营的环境和参与联营的公司的一些特点, 请根据您对下面陈述的同意程度选择相应的数字。

(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

联营的环境和公司特点	非常不同意	不同意	一般	同意	非常同意
1) 当地政府在联营的问题上表示支持。	1	2	3	4	5
2) 单一企业要进入该项目所在的市场是非常困难的。	1	2	3	4	5
3) 该市场对公司的发展很有潜力。	1	2	3	4	5
4) 参与联营的公司有计划开扩其建筑业务。	1	2	3	4	5
5) 参与联营的公司有计划扩大其建筑市场。	1	2	3	4	5
6) 参与联营的公司把控制权分散给各个部门。	1	2	3	4	5
7) 参与联营的公司对工作的分配比较灵活机动。	1	2	3	4	5
8) 参与联营的单个公司没有对市场的全部了解或没有完成该项目所需全部技术	1	2	3	4	5
9) 参与联营的公司敞开接受新知识。	1	2	3	4	5
10) 参与联营的公司的员工接受新知识的能力很强。	1	2	3	4	5
11) 参与联营的公司的员工有很好的参与合作的经验。	1	2	3	4	5
12) 参与联营的公司的员工对环境的变化有很好的适应性。	1	2	3	4	5
其它, 请指出:					

第二部分：2. 学习思维

这部分了解参与联营的公司对于在联营中学习的一些想法, 请根据您对下面陈述的同意程度选择相应的数字。

(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

学习思维	非常不同意	不同意	一般	同意	非常同意
1) 参与联营的公司考虑过并且愿意把本公司的知识转让给联营实体。	1	2	3	4	5
2) 参与联营的公司考虑过在联营过程中通过合作发展新知识。	1	2	3	4	5
3) 参与联营的公司考虑过通过联营学习合作方的知识。	1	2	3	4	5
4) 参与联营的公司考虑过把联营中学到的知识应用到公司的其它项目中。	1	2	3	4	5
其它, 请指出:					

第二部分：3. 联营实体的特点

这部分了解联营实体运作中的一些特点，请根据您对下面陈述的同意程度选择相应数字。

(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

<u>联营实体的特点</u>	非常不同意	不同意	一般	同意	非常同意
1) 联营项目相互融合，非常完整。	1	2	3	4	5
2) 联营项目不能够简单的分割给各个参与联营的公司。	1	2	3	4	5
3) 联营实体的管理层能够独立的管理该项目。	1	2	3	4	5
4) 联营实体的管理层在决策方面有很强的自主权。	1	2	3	4	5
其它，请指出：					

第二部分：4. 参与联营的公司及联营实体间的关系

这部分了解参与联营的公司及联营实体相互间的关系，请根据您对下面陈述的同意程度选择相应的数字。

(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

<u>参与联营的公司及联营实体间的关系</u>	非常不同意	不同意	一般	同意	非常同意
1) 参与联营的公司及联营实体能够相互信任。	1	2	3	4	5
2) 参与联营的公司的文化很接近。	1	2	3	4	5
3) 参与联营的公司能够理解彼此间的文化差异。	1	2	3	4	5
4) 参与联营的公司的主要业务和和联营项目相关。	1	2	3	4	5
5) 参与联营的公司在管理及技术方面为联营实体提供了良好的支持。	1	2	3	4	5
6) 参与联营的公司给联营实体的员工提供良好的培训。	1	2	3	4	5
其它，请指出：					

第二部分：5. 学习的行动

这部分了解联营实体实施的学习相关行动，请根据您对下面陈述的同意程度选择相应数字

(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

学习的行动	非常不同意	不同意	一般	同意	非常同意
1) 联营实体的员工经常对自己过错进行反省。	1	2	3	4	5
2) 来自不同公司的员工经常一起分享个人的意愿。	1	2	3	4	5
3) 来自不同公司的员工经常一起分享经验及教训。	1	2	3	4	5
4) 联营实体的管理层帮助来自不同公司的员工理解联营实体的共同意愿。	1	2	3	4	5
5) 在问题面前，管理层给予员工更多的支持而不是责备。	1	2	3	4	5
6) 联营实体的员工主动为更好的解决问题提出看法并相互讨论。	1	2	3	4	5
7) 联营实体的员工倾听并接受他人较好的建议。	1	2	3	4	5
8) 联营实体的管理层考虑众人的建议以最好的方法解决问题。	1	2	3	4	5
9) 联营实体的员工在工作中发展已有的知识并创造出新知识。	1	2	3	4	5
10) 联营实体有员工收集和保存所以员工的有价值的知识。	1	2	3	4	5
11) 新知识在联营项目中得到广泛应用。	1	2	3	4	5
其它，请指出：					

第二部分：6. 联营实体的评估

这部分是根据学习型组织的特点对联营实体学习的有效性进行评估，请根据您对下面陈述的同意程度选择相应的数字。(1-非常不同意, 2-不同意, 3-一般, 4-同意, 5-非常同意)

联营实体的评估	非常不同意	不同意	一般	同意	非常同意
1) 联营实体的员工不视来自不同公司的人员为竞争对手，而是公共创造成功的人。	1	2	3	4	5
2) 联营实体保持着一种持续创新的学习氛围。	1	2	3	4	5
3) 联营实体的愿景与员工的个人愿景达成一致。	1	2	3	4	5
4) 管理层人员很有能力协助、指导和支持员工学习。	1	2	3	4	5
5) 联营实体中的沟通非常顺畅。	1	2	3	4	5
6) 联营实体的员工能够从系统思考的角度来解决问题。	1	2	3	4	5
7) 联营实体的员工在把联营实体作为一个团队取得非常有效的学习。	1	2	3	4	5
8) 联营实体的员工的个人能力在联营实体中不断进步。	1	2	3	4	5
9) 联营实体的员工的工作不仅有效果而且有效率。	1	2	3	4	5
10) 联营实体的知识不断提高,不断更新。	1	2	3	4	5
11) 联营实体的工程技术和管理水平不断进步。	1	2	3	4	5
其它，请指出：					

(问卷结束)

衷心感谢您的支持！

Appendix C: Interview Profile

Research Background:

Joint venture provides many benefits for companies, but in the practice, there are many unsuccessful ICJVs. One way to improve the performance is making use of the joint venture style to learn from each other and then to increase the strength and decrease the weakness.

Research Purpose:

A joint venture can be regarded as a learning platform. This research is trying to identify all the issues related to learning to build up a guideline to increase the effectiveness of learning in construction joint venture.

Interview purpose:

Gather some real joint venture cases from the experienced managers, to get information about the detail of the background of the company, the joint venture situation, JV partnership, operational problems, mutual cooperation, learning attitudes, learning actions and learning out come in construction joint venture to get more convictive and more accurate data for the research.

Interview questions related to:

1. The forming the JV

Motives, environment, market, project, etc

2. Company's characteristics

Organization strategy, culture, mindset, working background, employee's capability, etc

3. Relationships

Mutual trust, culture compatibility, etc

4. JV's operation

Integrated, work division, power of the JV management board, decision making model, responsibility, etc.

5. Learning attitude

The willing of learning, expectation of improvement from joint venture etc

6. Learning actions in the joint venture

Communication, sharing, listening, problem solving, management support etc

Appendix C: Interview Profile

7. Learning outcome

Any individual improvement, management improvement, reputation, technology improvement

8. Project performance

Quality, time, cost, safety etc

Appendix D: Detail Background of Cases

Appendix D-1: Detail Background of Case 1

Case 1 Ertan Hydroelectric Project in Yalong River is a large hydropower station under construction so far in China. It comprises a 240m concrete arch dam ranking 3rd among similar type of this dam in the world, and Asia's largest underground powerhouse, which is 280m long by 25.5m wide and 65m high, this scale of the underground powerhouse ranks 4th in the world. The project also boasts one of the world's longest diversion tunnels at 1167m.

Construction began in 1991. The Ertan power plant produced 3.9 billion kilowatt hours of power in the first year of operation since August 1998, when its first generating unit went into operation. Completed at the end of 1999, it has set a new record for speed of installation of a hydroelectric project. Total reservoir storage capacity is 5.8 billion Cubic Meter (CUM) and total installed capacity is 3,300 Million Watt (MW) with an annual output of 17 billion Kilowatt-Hour (KWH).

The site is located near Panzhihua on Yalong River, which is (a tributary of the Yangtze) in Sichuan province. Sichuan is a mountainous inland province in the south west of China with excellent hydro potential. Its development is a top priority for the government, since the region is poor and attracting foreign investment has proved difficult compared to the successes of the booming coastal provinces.

The World Bank funded the project with a \$380 million International Bank for Reconstruction and Development (IBRD) loan in 1992 and, in 1995, a second IBRD loan for \$400 million and a \$150 million guarantee for private commercial funding of the dam. The loans amount to the largest sum the World Bank has ever granted a single project. Other funding has come from the Chinese government (\$795.4 million), Sichuan Province (\$795.4 million) and \$30 million from the US export credit agency, the Export-Import (ExIm) Bank. The total project budget is \$2.5 billion.

Appendix D: Detail Background of Cases

Ertan was China's first hydropower plant to be built through international bidding. In addition to the large local work force, the project has involved 700 technicians and specialists from the 47 countries involved. The main project construction contract was Lot I with contract sum of \$776, which was undertaken by the Ertan JV, it included Torno (Italy), Dumez (France), GTM (France) and Bureau 8B (China). The implementing agency is the Ertan Hydroelectric Development Corporation (EHDC) and Impregilo was the lead company.

Based in the Northern Italian city of Milan, Impregilo has been involved in constructing more than 160 hydroelectric projects around the world. The majority of the company's orders are for infrastructure, hydroelectric dams and large-scale civil engineering works. Impregilo's web site describes the company as a "world leader" in construction of dams and hydroelectric schemes.

Appendix D-2: Detail Background of Case 2

Case 2 Xiaolangdi project Lot I is about the construction of a 51.8 x 106 Cube Meter volume main dam and associated structures of the Xiaolangdi Multipurpose Dam Project. The main contractor of Lot I is Yellow River Contractors (YRC).

Xiaolangdi Multipurpose Dam Project is located at the exit of the last gorge of the middle reach of the Yellow River, 130 Kilometers downstream of Sanmenxia, 128 Kilometers upstream of Huayuankou of Zhengzhou city, China. The main objectives of the project are: flood control, ice jam control, siltation control, irrigation, water supply, as well as hydroelectric power generation.

Xiaolangdi project consists of many main structures, such as 10 intake towers, 9 flood and sediment tunnels, 6 power tunnels, 1 underground powerhouse, and 1 zoned earth and rock fill dam with a sloping impervious core, 154 meters high, with a crest length of 1317 meters. The powerhouse mainly features 6 turbine and generator units

Appendix D: Detail Background of Cases

of 300 MW, totaling installed capacity of 1800 MW and annual energy output of 5.1 GWH.

The Yellow River Water and Hydroelectric Power Development Corporation is responsible for the project, which was designed by the Reconnaissance, Planning, Design and Research Institute in Zhengzhou, Henan. Site supervision falls under the remit of the Xiaolangdi Engineering Consulting Company, and all of the above companies fall under the umbrella of the Ministry of Water Resources of China.

The Central Committee of the Communist Party of China and the State Council has attached great importance on the construction of the Xiaolangdi Project. Assurance was obtained from the Government to minimize potential risks associated with the execution of the project and its resettlement program, that it would ensure an adequate and timely flow of funds, and establish and maintain effective project implementation management and detailed independent monitoring.

In 1994, the World Bank agreed a \$570 million loan package for the Xiaolangdi project (\$460 million IBRD loan for dam construction and \$110 million IDA loan for resettlement). The Bank subsequently agreed a new loan of \$160 million, for conservation of the Loess Plateau and another \$60 million in retroactive financing. The US ExIm Bank provided \$55 million in export credits to the project. The total project cost is \$4.5 billion.

It is planned that the construction will be completed by 2002. To make way for the reservoir, 180,000 people would be evicted from their homes and about 300,000 people would be affected by the project. The reservoir would also flood 100 archaeological sites where 10,000 year-old relics, and objects from the Song Dynasty (900-1279 AD), have been found. The World Bank-funded resettlement project includes the construction of housing, roads, mines, factories and electricity lines. Some 11,000 hectares is to be allocated for farming, which is to create 37,000 jobs, a tiny proportion of the almost half a million people who will be affected by the project.

Appendix D: Detail Background of Cases

In 1997, Nicholas Hope, director of the China and Mongolia department of the World Bank, told the Financial Times that the Xiaolangdi project is "a model".

The waters of the Yellow river are the most silt-laden in the world, and other dams on the Yellow river have run into serious sedimentation problems. For example, the Sanmenxia dam 130 kilometers downstream of Xiaolangdi was completed in the early 1960s. Within three years of the reservoir filling, the river had dumped more than 50 billion tons of sediment into the upper end of the reservoir. Originally planned as a 1,200 MW storage dam, Sanmenxia finally started to generate electricity in 1973 as a 250 MW dam. The reservoir flooded 66,000 hectares of some of the most fertile farmland in the world and involved the eviction of 410,000 people.

Yellow River Contractors (YRC) is a JV formed by Impregilo (36.5%), Hochtief (36.5%), Italstrade (14%) and SinoHydro Bureau 14 (13%).

Impregilo, the sponsor of YRC, is one of Italy's biggest construction firms; its experience goes from dams and hydroelectric schemes-a sector where it is world leader-to the construction of roads and motorways, railways etc.

Hochtief is the largest German construction services provider, and it is also one of the leading companies in this sector worldwide. Italstrade is an Italy's construction firm.

SinoHydro Bureau 14 is a branch under the SinoHydro. SinoHydro had gained some experience and knowledge as an international general contractor through international cooperation in the Lubuge Hydropower Project.

Appendix D-3: Detail Background of Case 3

Case 3 CGIC JV is the Lot II of Xiaolangdi Multipurpose Dam Project sponsored by Zublin (Germany). The project included Intake, Tunnels and Spillway of the Xiaolangdi Multipurpose Dam. It is responsible for the construction of the intake and outlet works, the numerous tunnels for the discharge of water and sediment, and for

Appendix D: Detail Background of Cases

the flood overflow. This project is comprised of 10 connected intake towers and a headrace wall, the tower is 290 meters long, 65 meters wide and 112 meters high, the headrace wall is 290 meters long, 76 meter wide in the bottom, it is an intake project with the most complex structure and most difficult construction in the world.

CGIC JV was formed by Züblin (26%), Strabag(18%), Wayss and Freytag (15%), Del Favero(15%), Salini(14%), Bureaux 7 (6%) and 11 (6%). Züblin, the sponsor of CGIC JV, is one of the largest German construction companies with subsidiaries and participations worldwide. The group is active in all fields of construction and operates its own plants for the production of pipes and precast elements. Strabag is a significant European construction company employed in all the fields of the construction industry works internationally. Wayss and Freytag is a special German construction company that specializes in all fields of civil engineering – tunneling projects, water treatment and sewage projects, dams, locks and weirs, conventional and nuclear power plants, harbor and industrial projects, airports and airport facilities. Salini has now more than 60 years of world wide experience in the construction of roads, highways, railways, dams and hydroelectric plants, tunnels, water pipelines, civil and industrial works. Bureaux 7 and 11 are branches under the SinoHydro.

Appendix D-4: Detail Background of Case 4

The project of case 4 C709 called for the design and construction of a two-level Chinatown underground civil defense station located in Eu Tong Sen Street and New Bridge Road and upgrading the existing Eu Tong Sen Canal. It is part of the North East Line (NEL) project in Singapore. NEL is the first major train line to be built since the completion of the main Mass Rapid Transit (MRT) system network in 1990. The decision to build NEL that would serve commuters from HarbourFront in the south through the Serangoon corridor to Sengkang/Punggol in the north-east of the island was announced in 1996. NEL is part of the long-term expansion plan of the Rapid Transit System (RTS). With a comprehensive and expanded RTS, Singapore

Appendix D: Detail Background of Cases

will be an attractive place to live and work in. It will also become comparable to major cities around the world such as London, Paris and Tokyo, where rail-based transit systems provide the primary means for people to move around within the city area.

The Chinatown station proved to be one of the most difficult stations to build on the NEL. The station box, 22 meters deep by 35 to 45 meters wide by 280 meters long, had a 1.5/1.2 Metres diameter hard-hard secant pile perimeter wall supported at four intermediate levels by twin steel waters and struts, lies right underneath Eu Tong Sen Street and New Bridge Road, which are main roads in the densely populated Chinatown area. Excavation of the station was undertaken in stages to suit installation of the four levels of struts. Throughout construction and particularly during excavation, extensive monitoring was undertaken of the surrounding structures, ground movements, secant wall movements and strut loading. Chinatown was one of the most challenging stations to be built on the NEL as it is sited in the heart of a bustling shopping, commercial and residential area and close to old and historic buildings with weak foundations. Construction had to be carried out with great care, as old buildings with shallow foundations were sited nearby. In addition, the 300-metre long Eu Tong Sen Canal, which sat directly over the station site, had to be relocated under one of the largest drainage diversion schemes ever undertaken in Singapore. It was described as “arguably the most difficult station on the North East Line to build” by the international trade magazine *Tunnels and Tunneling*. Working space for the MRT contractors was tight, and heavy traffic flow in the area had to be diverted over seven major phases and several sub-phases, resulting in one of the most extensive traffic diversion schemes ever conducted in Singapore.

The client is Land Transport Authority of Singapore, the main contractor is Gammon Construction Ltd-Econ Piling Pte Ltd JV, and the construction period is from June 1997 to June 2002 with contract value of S\$142 million (US\$100 million).

Gammon was first established in India in 1919 from which it expanded into Malaysia and Singapore in the mid 1920s. With its head office located in Hong Kong, the

Appendix D: Detail Background of Cases

Gammon Skanska Group of companies comprises some twenty five construction related companies operating throughout the South East Asia region. The principal company within the group is Gammon Skanska Construction Ltd. Gammon Skanska's businesses have established an enviable track record in major construction projects varying from infrastructure, high-rise commercial, engineering and foundations to specialized projects. This is particularly true of Singapore where Gammon Skanska has been heavily involved in the construction of the Mass Transit and Light Rapid Transit Systems for the Land Transport Authority, from Phase I until today.

Established in 1975, Econ Piling was renamed Econ Corporation Ltd in 2000 to reflect its spectrum of construction activities which span the foundation of engineering, civil engineering and building construction. It is renowned for its foundation engineering technology with the widest range of piling techniques. Econ has 38 overseas offices and subsidiaries across 16 countries. Gammon JV with Econ in that particular time, In all the LTA project, foreign companies could not get preferential margins, which can be 5% of the project.

Appendix D-5: Detail Background of Case 5

Contract 852 of case 5 is the Metro Circle Line (CCL) stage 3 about construction and completion of two-level underground Serangoon Interchange Station including Tunnels (length of 144 meters, width of 31 meters and depth of 22 meters). The Land Transport Authority of Singapore is the client and Architect for this project. The main contractor is Woh Hup-Shanghai Tunnel-Alpine JV, Construction Period is from August 2003 to December 2007, with contract value S\$155,958.

The contractor is a JV, made up of three experienced international contractors - Woh Hup (Pte) Ltd, Shanghai Tunnel Engineering Co., Ltd and Alpine Mayreder bau GmbH.

Appendix D: Detail Background of Cases

Woh Hup (Pte) Ltd is a Singapore-based contractor with more than 75 years history in building and civil engineering projects. The contractor has multi-national, professional and dedicated management to construct several major underground projects in Singapore. These include Rapid Transit System projects, such as the CCL contracts for the design, construction and completion of Millenia, the Convention Centre, Museum and Dhoby Ghaut stations. The company has extended its scope of operations to Design and Build projects and is registered with the Singapore Building and Construction Authority in the Grade A1 category which enabled Woh Hup to tender for Government projects of unlimited value. The company holds many accolades for quality and safety to demonstrate its capabilities. Today Woh Hup remains a family owned private company and is recognized as being one of the most prominent contractors in Singapore.

Shanghai Tunnel Engineering Co., Ltd specializes in bore tunneling and underground structures, and has extensive experience in the use of Tunnel Boring Machines. STEC has constructed bored tunnels for the North East Line project and is also the JV contractor with Woh Hup (Pte) Ltd for the CCL contract for the design, construction and completion of Millenia, Convention Centre, Museum and Dhoby Ghaut stations.

Alpine Mayreder bau GmbH is an Austrian-based contractor with proven capabilities in all types of tunnel construction, and they also specialize in mined tunnels. Alpine is currently involved in major tunneling works in Europe such as 30km of Gottard Tunnel.

The JV is fully integrated. In this project, Woh Hup, Shanghai Tunnel and Alpine took 33%, 33% and 34% share separately. These three companies combined the experience they have, with the management to work as a better team. Different partners covered different tasks. Woh Hup was more for the station, architect, workers, provides the station, station engineer, and safety. Shanghai Tunnel focused on tunnelling, providing more on the tunnel engineering side, to support the tunnel work, tunnel manager, tunnel engineer, and supervisor. Alpine is responsible for the

Appendix D: Detail Background of Cases

management, the planning and also some engineering parts, as they have a lot related experience.

With staff from different countries with different cultures, one strong leader is needed. The JV employed some managers from market. The leader had more than 25 year experience and was in charged of the different partners. There was a management team under the JV meeting regularly to make decisions. The members came from the parent companies and charged project management and financial control for the JV. The leader considered the opinions of all bosses from the different companies and tried to make a decision to benefit to every one.

Although Alpine is new partner, and Woh Hup and Shanghai Tunnel have a long term partnership, there was not much difficulty encountered. These partners want to work together again not just one time; therefore, they have built a very good relationship and trust with each other. There are workers from China, India, Malayisa, etc. The Chinese workers have a Chinese foreman to manage them. Woh Hup have more Indian workers, they have Singapore foreman or India foreman to handle them. Different companies have different foreman to deal with different group of workers. Within different groups, there are also senior workers to take care of the group and inform the other persons how to do the work. There are conflicts in terms of the way one partner works, but most of them are solved through meetings.

Appendix D-6: Detail Background of Case 6

This project of case 6 is to build a new campus for Republic Poly Technology of Singapore. It is the biggest ongoing project in Singapore except the Airport-terminal project. This project is directly under the management of Mr. Lee Hsien Yang, who is the chairman of the whole project development committee. Therefore the project' large social effect is large.

Appendix D: Detail Background of Cases

Incorporated in Singapore in 1992, China Construction (South Pacific) Development Co Pte Ltd (CCDC), a BCA-registered contractor of A1 status, enjoys unlimited tendering capability, is a regional subsidiary of China State Construction Engineering Corporation (CSCEC) in China, which has been listed as one of the world top 225 international contractors by Engineering News Record (ENR) since 1984. The company has successfully completed a number of prominent public and private projects achieved high CONQUAS score.

Over the past 131 years since its establishment, Taisei Corporation has undertaken many notable projects in Japan and overseas. The corporate roots coincided with Japan's development as a modern nation and we have continuously met the demands of a changing era and people's aspirations for the future through sound construction operations.

The CCDC and Taisei owned a 70% and 30% share separately. Therefore, the CCDC has much more control. Currently, about 150 staff was involved in the JV, but only six of them came from Taisei.

Initially, Taisei proposed to take responsibility for technology harmonization and part of the structure work, because the JV participated in the construction of the project, and the concept design was done by another Japanese architecture firm. The JV made shop drawing based on the concept design before the construction. Taisei is good at shop drawing and planning. Therefore, at the beginning, Taisei was asked to do this. One project vice-director from Taisei charged the planning; and one manager from Taisei was under him to charge the technical part.

However, during the first year of the project, their work was postponed. The project was even stopped by the client, because some of the shop drawings were not be finished on time, and could not be passed by the manager from Taisei who was in charge of the technical part. The architect even thought the shop drawing was wrong. The project encountered some difficulties.

Appendix D: Detail Background of Cases

In this situation, both partners' higher management committee made some re-negotiations, and later some management in the JV changed: a more powerful and more experienced general manager was appointed, and the technical management work was also transferred to the staff from CCDC to charge. From then on, the JV project finally went smoothly.

Appendix E: Observations of Variables in Cases

Appendix E: Observations of Variables in Cases

Table E-1 Observations of Variables in Case 1

Constructs	Variables	Observations in Case 1 Ertan Hydropower Plant Lot I
Conditions of learning in pre-inception stage	Government support	Under the authority and support of the Chinese government
	Complex market	The law for large project construction was not mature and the hydro power reform was not completed at that time.
	Potential market	China has the largest untapped hydro power potential in the world and less than 10% are being exploited.
	Partner's learning intent	Director of Bureau 8 ask their contractors to learn foreign managerial know-how and technology from the beginning of JV forming.
	Partner's development feasibility	Bureau 8 planning to build large hydro power station by themselves in the domestic market and bid in the international construction market. The organization was organic and decentralized under linear function management with seven levels.
	Partner's absorptive capability	Most staff of Bureau 8 are young, open and have strong receptivity to accept new knowledge, they have accumulated the JV's experiences and adapted to the changing environment, such as the four examples mentioned in the thesis.
JV's Characteristics in formation and organizing stage	Fully integrated JV	The project was fully integrated
	Project's impartibility	The project couldn't be divided clearly, the staff from different countries had to finish the same task together.
	Independent and authority power	The JV management can promote capable people without other consideration and had strong authority to make decision.
	Mutual trust	The partners built mutual trust with good communication and understanding after many conflicts and strikes of the beginning.
	Understand the difference of culture	After the conflicts in the first two years, partners learned the difference from each other, understood each other well about culture differences like living habit, beliefs, values etc.
	Partner company's support	The management gave great support to solving the conflicts, adjusted and comforted different partners.
	Training	The JV provided some training to improve the general capability of managers and staff.
Learning actions in implementation and adjustment stage	Self-examination	Four examples mentioned were all like learn from others's strong points to offset one's weakness in JVs.
	Share personal vision, experiences and lessons	The director Mr. Liu shared his vision, experiences and lessons to their staff at night.
	Understand the common vision	The sub-Bureau of Ertan help their staff to understand their working guild idea as "doing well in cooperation with foreign partners, with the sincere desire of making the JV a happy cooperating team to ensure the Ertan project's succees".
	Management's supportive attitude	The foreign mangers told their employees "don't look down on Chinese." And the Chinese managers asked they staff to be strong and confident to improve working spirit, technology ability and market competitive capability.
	Participants engage problems actively	Mr Yang solved the difficulty of transportation and uploading of big materials.

Appendix E: Observations of Variables in Cases

	Communicate with each other and listen to others to accept better opinions	Mr. Zhang liked to ask questions and listen to foreign colleagues, his suggestions for the development of a new car retropack was accepted; Mr. Li suggested providing training for the Chinese management staff, etc.
	Solve problems together	Mr. Li knew English and Italian as well as Chinese, in the conflict, he could directly communicate with foreigners, and solved the misunderstanding and developed a bridge to allow greater communication and harmony between different, lowering distrust between mutual partners.
	Collect and record knowledge	Haven't been observed.
	Develop and apply new knowledge	Mr. Wu developed the concrete placement technology and applied it to the Ertan project and created the world record.
Learning effectiveness in completion and evaluation stage	Collaborative environment	The staff and workers had fewer complain, and they can understand and help each other, a better cooperation climate was built.
	Continuous learning climate	The staff regarded difference and diversity as opportunity and valuable resource and happy to learn.
	Consistent vision	The general director Mr. Peng said "Chinese and foreign partners have consistent vision under project construction, which is to complete the Ertan Hydropower plan successfully according to the contract. To reach the vision, different partners must achieve harmonization and must build good partnerships."
	Coaching and respectable leader	The leader like Mr. Liu, coached their staff patiently, and got the respect form staff.
	Well communication	The staff learned the foreign language and could well communicate without obstacles with their partners.
	System thinking	The managers could solve the problem with the system thinking concept, for example, they can consider the Chinese characteristics and the benefit to all partners together to reach the better solution.
	Efficient working	Mr Wu efficiently managed concrete placement work, and created the best record of the world.
	Individual improvement	Individual like Mr.Li, Mr. Zhang, Mr. Yang and Mr. Wu have got a great improvement during the JVs.
	Effective teamwork	Participants learned to work as a team, for example, Yang solved the transportation difficulty together with the staff under him, and Zhang worked with technical staff from Italy to improve the new car retropack etc.
	Knowledge improvement	Through the JVs, many staff got the knowledge of international construction management and the international contracts.
	Skill improvement	The construction skill such as the concrete placement was improved.

Appendix E: Observations of Variables in Cases

Table E-2 Observations of Variables in Case 2

Constructs	Variables	Observations in Case 2 Xiaolangdi Project Lot I
Conditions of learning in pre-inception stage	Government support	Under the direct leadership of the Ministry of Water Resource of China, the government supported the project with assurance.
	Complex market	The law for large project construction was not mature and the hydro power reform was not completed at that time.
	Potential market	Chinese Hydroelectric market is a potential construction market.
	Partner's learning intent	The local contractors were encouraged to learn from foreign contractors and expand into foreign market. They were willing to understand FIDIC through the project. They regarded the JV as a magnificent learning opportunity and intended to acquire and apply international knowledge in contract management. They also intended to develop the technology or management skill according to the environment and the Chinese characteristics.
	Partner's development feasibility	Haven't been observed.
	Partner's absorptive capability	Employees with good adaptability and receptivity were sent to the JV.
JV's Characteristics in formation and organizing stage	Fully integrated JV	Haven't been observed.
	Project's impartibility	Haven't been observed.
	Independent and authority power	The management of JV from Bureau 14 had the independence and authority to make a decision for technology.
	Mutual trust	Haven't been observed.
	Understand the difference of culture	The partners of JVs understood they have different cultures, management style and value opinions and each partner has its own advantage.
	Partner company's support	Bureau 14 opened an "English Corner" learning area, computer classes, a special type of work class etc to build a better learning environment.
	Training	Bureau 14 put great human and resource efforts and used different methods to train the construction staff to guarantee the construction quality.
Learning actions in implementation and adjustment stage	Self-examination	The reason of project delay was examined in JV and solved later.
	Share personal vision, experiences and lessons	Haven't been observed.
	Understand the common vision	Bureau 14 improved its management system to ensure all staff knew their responsibilities, rights and benefits within the JV
	Management's supportive attitude	The management recognized human being as the basic unit of development and support their staff's improvement.
	Participants engage problems actively	Staff of Bureau 14 considered the success of the project as their responsibly and tried their best to solve the problems emerged.
	Communicate with each other and listen to others to accept better opinions	Bureau 14 communicated with its partners, listened and accepted the contract management of the experienced foreign contracts.
	Solve problems together	When the foreign colleagues had some difficulties, they would discuss with Bureau 14 actively to find the better solutions.
	Collect and record knowledge	Haven't been observed.
	Develop and apply new knowledge	The pressures double-wire without bond anchor technology developed and first applied in the construction of this project.
Learning effectiveness in	Collaborative environment	Local contractors and foreign contractors can help each other.

Appendix E: Observations of Variables in Cases

completion and evaluation stage	Continuous learning climate	Bureau 14 learned how the foreign contractors solve problems based on the FIDIC.
	Consistent vision	Different partners cooperated based on the international regulation and FIDIC contract clauses to reach the success of the project.
	Coaching and respectable leader	The management of Bureau 14 built a better international construction project management experience to coach their staff and gained the respect.
	Well communication	After training, the partners can communicate better with each other.
	System thinking	Haven't been observed.
	Efficient working	Concrete productions in this project reached more than 115,000 cubic meters per month from the planned 90,000.
	Individual improvement	Staff have improved their comprehensive capabilities after working actively together.
	Effective teamwork	Bureau 14 worked with other partners helped to reached the target date for river diversion when the work was one year behind schedule.
	Knowledge improvement	The knowledge of FIDIC had been well improved after solving problems based on it.
	Skill improvement	Bureau 14 designed and manufactured a series of special tools to suit the construction requirement.

Appendix E: Observations of Variables in Cases

Table E-3 Observations of Variables in Case 3

Constructs	Variables	Observations in Case 3 Xiaolangdi Project Lot II
Conditions of learning in pre-inception stage	Government support	Under the direct leadership of the Ministry of Water Resource of China, the government supported the project with assurance.
	Complex market	The law for large project construction was not mature and the hydro power reform was not completed at that time.
	Potential market	Chinese Hydroelectric market is a potential construction market.
	Partner's learning intent	Bureau 11 used Xiaolangdi as a little union and big school to train and develop different talents.
	Partner's development feasibility	Bureau had plan to open its oversea market strengthen the headquarters' management of the project referred to the experience of foreign contractors.
	Partner's absorptive capability	Your engineers with good education background from Bureau 11 were participated the JVs.
JV's Characteristics in formation and organizing stage	Fully integrated JV	Haven't been observed.
	Project's impartibility	Haven't been observed.
	Independent and authority power	Each management layer have its own power to independent manage their work.
	Mutual trust	All the project management participate and cooperate with each other.
	Understand the difference of culture	At the beginning, there were misunderstanding of the culture among partners, but with the project went on, partners can better understood each and work to finish the project earlier.
	Partner company's support	Company pushed the project construction and strengthened the project management in process of the intake main construction
	Training	The construction teams have been well trained in the practice.
Learning actions in implementation and adjustment stage	Self-examination	When an accident happened, the wrong-doing company must admit the responsibly.
	Share personal vision, experiences and lessons	Haven't been observed.
	Understand the common vision	Partners work together to understand their mutual goals.
	Management's supportive attitude	The management support the employees tried they best to finish the 27 months' task in 13 months.
	Participants engage problems actively	Internet office systems were built actively for the international project management.
	Communicate with each other and listen to others to accept better opinions	Staff of Bureau 11 communicated with the foreign partners to solve the conflict of the happened accidents.
	Solve problems together	Bureau 11 helped the partner Züblin to solve schedule delay problem together.
	Collect and record knowledge	Haven't been observed.
	Develop and apply new knowledge	The international project management mode have been well developed and applied to the project.
Learning effectiveness in completion and evaluation stage	Collaborative environment	After conflict every day in the first year, partners began to understand each other and work closely with each other.
	Continuous learning climate	Bureau 11 summarized experiences continually, actively explored the advanced project management mode, and strengthened the international project management of the company.
	Consistent vision	Quality, speed, safety and reputation as mutual goals.
	Coaching and respectable leader	Haven't been observed.

Appendix E: Observations of Variables in Cases

	Well communication	Haven't been observed.
	System thinking	The management can organize each operation with the system thinking opinion.
	Efficient working	The made it easier to accept all the operation test.
	Individual improvement	A group young technological staff and international project management elites have been trained by the project.
	Effective teamwork	Haven't been observed.
	Knowledge improvement	Bureau 11 has accumulated abundant experiences in aspects such as the international project management mode, project management and contract management.
	Skill improvement	The director of Bureau 11 said the technology level has been improved through the project.

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Table E-4 Observations of Variables in Case 4

Constructs	Variables	Observations in Case 4 NEL Project C709
Conditions of learning in pre-inception stage	Government support	LTA support the local contractors to get the job and work with foreign partners in a JV and expect them to learn.
	Complex market	Haven't been observed.
	Potential market	The market provided a good potential for company to develop MRT projects.
	Partner's learning intent	Econ planned to learn from the beginning.
	Partner's development feasibility	Econ targeted the MRT project as one of their main construction area and expanded to overseas.
	Partner's absorptive capability	Experienced staff were involved in the JV.
JV's Characteristics in formation and organizing stage	Fully integrated JV	The JV was fully integrated as stated in the contract requirement.
	Project's impartibility	The project haven't been clearly divided to the partners, partners work together in the same site.
	Independent and authority power	The JV management board from Gammon and Econ make decisions together.
	Mutual trust	Partners have worked together before, they knew some characteristics of each other and trust each other. They treated each other as a real partner.
	Understand the difference of culture	The know their differences and respect each cultural difference.
	Partner company's support	The management of Econ arrange the position of their staff to guarantee them work in the right place to learn.
	Training	Gammon provide safety training to all participants.
Learning actions in implementation and adjustment stage	Self-examination	Haven't been observed.
	Share personal vision, experiences and lessons	Staff from different partners shared their experience and lessons to get better design for some work.
	Understand the common vision	The management put their effort to help their staff to understand their common vision of make to the project done successfully.
	Management's supportive attitude	The management support their staff to learn and share with each other.
	Participants engage problems actively	Participants engage to solve the excavation problems actively and get better design concept there.
	Communicate with each other and listen to others to accept better opinions	Partners discussed together, talked and listen to others, and the JV management selected better suggestion.
	Solve problems together	Partners work together to solve the technical and management problems.
	Collect and record knowledge	Econ collect and record tunneling and related knowledge and technology for their future reference.
	Develop and apply new knowledge	Econ applied the new budget control knowledge and Gammon applied the new knowledge on procurement.
Learning effectiveness in completion and evaluation stage	Collaborative environment	Partners knew each other and treated each other as a real parter.
	Continuous learning climate	Partners are transparent to each other and help each other to improve their capability.
	Consistent vision	The better benefit of the JV.
	Coaching and respectable leader	Haven't been observed.
	Well communication	Partners aligned and communicated better with a consistent vision.
	System thinking	Partners solved problems based on the system thinking of the JV.

Appendix E: Observations of Variables in Cases

	Efficient working	Econ learned time and budget control using a software from Gammon and saved lots of money and time.
	Individual improvement	Staff of Econ involved in the JV project learned a lot tunneling technology.
	Effective teamwork	Partners worked together as a team to better solve problems with their client.
	Knowledge improvement	Econ improved their knowledge of tunneling, design concept and budget control etc. Gammon improved their local knowledge and saved cost in procurement.
	Skill improvement	Both Econ and Gammon have improved their technology and management skill from the JV.

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Table E-5 Observations of Variables in Case 5

Constructs	Variables	Observations in Case 5 CCL Project C852
Conditions of learning in pre-inception stage	Government support	LTA support the local contractors to get the job and work with foreign partners in a JV and expect them to learn.
	Complex market	Haven't been observed.
	Potential market	The market provided a good potential for company to develop MRT projects and provided platform for Shanghai Tunnel to go overseas.
	Partner's learning intent	Shanghai Tunnel planned to learn local characteristics of Singapore and applying this to their practices
	Partner's development feasibility	Shanghai Tunnel used Singapore as a base for further international projects.
	Partner's absorptive capability	The staff of Shanghai Tunnel were young, adaptable, receptive and open to accept new knowledge.
JV's Characteristics in formation and organizing stage	Fully integrated JV	The JV is fully integrated.
	Project's impartibility	The project haven't been divided to different partners, instead, the partners worked together as a group.
	Independent and authority power	The management of JV was powerful to solve the problem encountered.
	Mutual trust	Partners recognized each other, satisfied with each other and trusted each other.
	Understand the difference of culture	Partners understood their differences.
	Partner company's support	Management support their staff to learn from each other.
	Training	Staff are trained in site.
Learning actions in implementation and adjustment stage	Self-examination	Haven't been observed.
	Share personal vision, experiences and lessons	Staff from different partners shared their experience with each.
	Understand the common vision	Management helped the staff to understand the vision of the company.
	Management's supportive attitude	The top management was very supportive to staff's learning.
	Participants engage problems actively	Haven't been observed.
	Communicate with each other and listen to others to accept better opinions	Managers from different partners meet regularly to communicate with each other and find the better solution to problems.
	Solve problems together	Partners were worked as a team to solve problems.
	Collect and record knowledge	Shanghai tunnel collected and record useful knowledge as the company's resource.
	Develop and apply new knowledge	Shanghai Tunnel got much new knowledge and apply it to the project.
Learning effectiveness in completion and evaluation stage	Collaborative environment	Partners consulted with each other for the benefit of the JV.
	Continuous learning climate	Partners learned how to live and work with each other.
	Consistent vision	To finish the JV project well through capability improvement and not cheat or take advantage of the others.
	Coaching and respectable leader	Leaders were trained to coach their staff well and got respect of them.
	Well communication	Partners communicated well both in the meeting and in site.
	System thinking	Haven't been observed.

Appendix E: Observations of Variables in Cases

	Efficient working	Management knew how to arrange staff with different cultures in different environment and increase the working efficiency.
	Individual improvement	Both management and staff got improved from the JV.
	Effective teamwork	Partners as a team increased their working effectiveness.
	Knowledge improvement	Shanghai Tunnel improved their local knowledge and international management knowledge from the JV.
	Skill improvement	Shanghai Tunnel improved the skill of using new equipment and technology to the project.

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Table E-6 Observations of Variables in Case 6

Constructs	Variables	Observations in Case 6 Republic Polytechnic New Campus Project
Conditions of learning in pre-inception stage	Government support	This project is directly under the management of Mr. Lee Hsien Yang, who is the chairman of the whole project development committee.
	Complex market	Market competitiveness was very high.
	Potential market	Haven't been observed.
	Partner's learning intent	Haven't been observed.
	Partner's development feasibility	CCDC regarded Singapore as a base to expand to other foreign countries.
	Partner's absorptive capability	Capable staff were recruited to joint the project.
JV's Characteristics in formation and organizing stage	Fully integrated JV	The JV is fully integrated.
	Project's impartibility	The project wasn't divided to partners.
	Independent and authority power	Management of JV was very powerful to control the project.
	Mutual trust	After solved the conflict of the problem, partners began to help each with mutual trust.
	Understand the difference of culture	Partners' learn from each other and got to understand their cultural difference and made concession to each other.
	Partner company's support	Company support the participants to solve the problem encountered.
	Training	Haven't been observed.
Learning actions in implementation and adjustment stage	Self-examination	Participants recognized their mistake on the shop drawing, and solved it later.
	Share personal vision, experiences and lessons	Lessons were shared throughout the JV to avoid the similar problems.
	Understand the common vision	Management held participants to understand the JV's benefit as their common vision.
	Management's supportive attitude	The management provided support with positive attitude and action to re-arrange the management of the JV.
	Participants engage problems actively	Partners engaged actively to solve the shop drawing problems to make the project ongoing.
	Communicate with each other and listen to others to accept better opinions	Management from different partners woke in the same site office to communicate and discuss each issue emerged.
	Solve problems together	Partners faced the client and solve problems together.
	Collect and record knowledge	Haven't been observed.
	Develop and apply new knowledge	Haven't been observed.
Learning effectiveness in completion and evaluation stage	Collaborative environment	Partners recognized their common benefit and well cooperated with each other
	Continuous learning climate	Partners learn a significant lesson from the JV and learned how to better work together.
	Consistent vision	To successfully finish the project on time and enjoy a good track record and build a reputation from it.
	Coaching and respectable leader	Haven't been observed.
	Well communication	Partners communicated with each other more smoothly later, and most problems were solved by discussion and communication.
	System thinking	Partners finally can use system thinking of their common interest to solve problems.

Appendix E: Observations of Variables in Cases

	Efficient working	Even with some delayed in the first year, partners improved their working efficiency to make the project go smoothly.
	Individual improvement	Haven't been observed.
	Effective teamwork	Haven't been observed.
	Knowledge improvement	Partners improved the knowledge on the management of different culture in different country.
	Skill improvement	CCDC improved the skill of shop drawing and planning.