

**KNOWLEDGE TRANSFER PROCESSES
IN INTERNATIONAL CONSTRUCTION JOINT VENTURE
PROJECTS IN THAILAND**

Achara Khamaksorn
School of the Built Environment
Faculty of Technology, Design and Environment
Oxford Brookes University

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This thesis is dedicated to my mother

Anna Thep Khamaksorn

My mother was immensely proud that her daughter was working toward a Ph.D.

Unfortunately, she did not get to see my completed dissertation.

She passed away on 14th April 2016 when I was collected the data
with a pilot case study in Thailand.

So it is with pride and affection that I dedicate this dissertation to my mother.

ABSTRACT

In recent years, companies around the world are trying to expand internationally through collaborative agreements. 'International Joint Ventures' (IJVs) are a specific type of strategic alliance between contractors from developed and developing countries. The use of IJVs between multinational organisations is considered to be a successful strategy in order to benefit from international market opportunities in the globalised world. Moreover, 'International Construction Joint Ventures' (ICJVs) have become of significant interest as the global construction market continues to be integrated into the more competitive business environment. IJVs can be a mechanism for transferring knowledge between partners and a way of improving the knowledge and skills of the local partner(s). However, there is currently a gap in the existing literature on the key enabling and inhibiting factors that influence knowledge transfer processes in ICJV projects. Furthermore, despite the growing number of studies relating to ICJV projects, there is limited research conducted with regard to developing countries and especially in Thailand. Therefore, a better understanding of how knowledge in ICJV projects is transferred and adopted in Thailand is required. The purpose of this study is to identify and evaluate the processes of transferring knowledge in ICJV projects in Thailand. Previous research indicated that social network analysis (SNA) provides benefits to enable an understanding of how to enhance Knowledge Transfer (KT) processes in the projects. As a result, SNA was used to correlate KT practices in ICJV Projects in Thailand.

A literature review led to the development of a conceptual framework that characterises the key concepts in the areas of knowledge transfer and social networks. A multiple case study approach was adopted to facilitate the investigation within the context of the ICJV projects. A combination of quantitative and qualitative data was utilised in this study. The data was analysed using a combination of descriptive statistics, Qualitative Content Analysis, SNA using UCINET and NetDraw Software Package, and the use of NVivo Software Package. The data analysis led to the identification of the key enabling and inhibiting factors in the areas of ICJV performance and success, knowledge facilitators, type of knowledge, and knowledge transfer methods and mechanisms all influence knowledge transfer processes. ICJVs performance and success factors determine the effectiveness and efficiency of successful knowledge transfer. The type of knowledge impact on knowledge transfers success. KT methods and mechanisms have been found to be critically essential in transferring the partners' crucial knowledge. Knowledge facilitators were considered to be important in effective and efficient knowledge transfer. These findings were used to revise the conceptual framework.

The knowledge transfer framework is the most important output of this study, which provides important contributions to examine and understand knowledge transfer in the context of ICJV projects. The framework can not only be applied in practice, but it can also be used by other researchers for further research in KT processes in different contexts. It is expected that these findings would serve as a valuable reference for ICJV projects for use by construction organisations in their KT processes to strengthen their competitive advantage.

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ABBREVIATIONS

AEC	- ASEAN Economic Community
IJVs	- International Joint Ventures
ICJVs	- International Construction Joint Ventures
JVs	- Joint Ventures
KM	- Knowledge Management
KT	- Knowledge Transfer
SET	- Stock Exchange of Thailand
SMEs	- Small and Medium Enterprises
SN	- Social Network
SNA	- Social Network Analysis

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1. INTRODUCTION

1.1 RESEARCH BACKGROUND

Globalisation has particularly strengthened since the 1980s ([Mohamed, 2003](#)). [Akiner and Yitmen \(2011\)](#) indicates that there has been an unprecedented change in the nature of the global business environment and the key to sustainable competitive advantage in today's knowledge economy is the ability to deliver new products and services to market ahead of competitors. Joint Ventures (JVs) have been one of the contractual forms most frequently used in strategic alliances. Although, JVs have become the principal vehicle for the foreign partner firm to gain entry into the local market ([Hong and Chan \(2014\)](#)). It is considered that strategic alliances have been widely discussed in the context of international businesses ([Carrillo, 1996](#)). JVs are a special type of strategic alliance that offers a unique opportunity to combine the distinctive competencies and complementary resources of the participating firms and this enable them to offer new products and services. The Joint Venture Company (JVC) is the most ordinary form of organizational structure where the parties wish to establish and operate a jointly owned business ([V.V. et al., 2000](#)). In recent years, companies around the world are trying to expand internationally through a collaborative agreement between them. International Joint Ventures (IJVs) are defined as joint ventures with at least one partner headquartered outside the joint venture's country of operation ([Ozorhon et al., 2008](#)). IJVs are considered to be a business arrangement for companies to enlarge their international activities and business. The trend towards forming IJVs has become increasingly common since the 1970s ([Ozorhon et al., 2007](#), [Ozorhon et al., 2008](#)). Thus, it is clear that construction firms are able to exploit business opportunities and enter new markets abroad through the formation of IJVs. IJVs between multinational organisations in developed and developing countries are considered to be a successful strategy in order to benefit from international market opportunities in the globalised world ([Carrillo, 1996](#), [Gale and Luo, 2004](#), [Ozorhon et al., 2008](#), [V.V. et al., 2000](#)). They are also recognised as a latent means of enhancing construction firms' international competitiveness ([Carrillo, 1996](#), [El-Diraby et al., 2006](#), [Ozorhon, Dikmen, and Birgonul, 2007a](#), [Ozorhon et al., 2007b](#), and [Mo, Omran, and Pakir, 2011](#)). IJVs can be a mechanism for transferring knowledge between partners and a way of improving the knowledge and skills of the local partner(s) ([Hajdimitriou and Rotsios, 2009](#)).

Moreover, collaborative ventures have been used in the construction industry to mitigate and avoid expected risks in overseas projects ([Son, Han, and Rojas, 2015](#)). International Construction Joint Ventures (ICJVs) has become of significant interest as the global construction market continues to be integrated into a more competitive and turbulent business environment. A critical review carried out by [Grimschheid and Brokmann \(2010\)](#) highlighted that an ICJV often faces a highly complex and dynamic environment. Nowadays, ICJVs have increasingly become a notable form of international market growth for multinational

organisations attempting to exploit opportunities in both developing and developed businesses (Gale and Luo, 2004, and Abdul-Aziz and Cha, 2008).

As global competition continues to intensify, knowledge is increasingly becoming a crucial strategic resource and is regarded as a key factor, not only for the successful completion of projects but also as a critical asset of an organisation's competitive advantage (Kivrak et al., 2008, and Teerajetgul and Charoenngam, 2006). The success of an organisation in today's competitive business environment is strongly related to its ability to utilise knowledge and build its capacity. The effective management of its knowledge and capacity may help an organisation to sustain its competitive position in the constantly changing business environment (Kivrak et al., 2008). Many researchers state that knowledge plays a most significant role in firms. It is regarded as the most valuable resource and its transfer within and between organisations. Thus, Knowledge Transfer (KT) is an important process whereby an organisation identifies and learns from specific knowledge that exists in another organisation or in its different parts (Oshri et al., 2008). Transferring knowledge effectively has long been viewed as an important indicator for an organisation to acquire knowledge and competence (Tang, 2012). Moreover, it has also been recognised as one of the key factors of the successful implementation of all types of projects (Pavel and Andre, 2006, Lech, 2011).

In the construction industry, globalisation together with the information revolution and the improved knowledge-based economy has fundamentally altered the market (Wethyavivorn, Teerajetgul, and Charoenngam, 2009). In recent years, Thailand's economy and infrastructure development have risen significantly and rapidly. The construction industry continues to play a major role in this development since many construction activities have been undertaken to meet the high demands of an expanding market. Thailand has made significant steps toward economic and infrastructure development since the financial crisis in 1997 and has thus become one of the newly industrialised countries (Aksorn and Hadikusumo, 2008). In this new era of globalization, it is undeniable that many Thailand's construction firms have come to rely on alliances as a strategic necessity for sustaining competitive advantage and creating customer value through knowledge sharing and transfer. Successful knowledge transfer between partners is not only a key factor of ICJVs success (Hajidimitriou and Rotsios, 2009) but also an important key objective of growing firms to attract foreign investment through an ICJV (Gale and Luo, 2004, Tsang, 2010).

As a result, the Thai government has continuously invested in large infrastructure projects, such as underground train lines, Bangkok Sky Train lines, cable-stayed bridges, and the renowned Suvarnabhumi International Airport. Moreover, a number of international construction firms entered Thailand to assist with these sophisticated projects (Wethyavivorn, Teerajetgul, and Charoenngam, 2009). Local contractors who wish to enter an emerging market and achieve long-term competitiveness in this new environment need to quickly develop the required resources. A better understanding of how knowledge in International Construction Joint Venture (ICJV) projects is transferred and adopted in Thailand is required. The purpose of this study is to integrate knowledge transfer and social networks to better conceptualise and explain knowledge transfer processes in selected ICJV projects in Thailand.

1.2 RESEARCH AIM AND OBJECTIVES

The aim of this study is to identify and evaluate the processes of transferring knowledge in International Construction Joint Venture (ICJV) projects in Thailand.

The objectives are:

- To identify the key concepts in the area of knowledge transfer and social networks.
- To identify the key enabling and inhibiting factors that influences the transfer of knowledge in ICJVs.
- To develop a conceptual framework based on these key concepts and factors.
- To validate the conceptual framework in practice using fieldwork data.
- To develop a knowledge transfer framework for joint venture partnerships for Thai construction companies and makes recommendations for its application.

The research design and methodology adopted for this study are briefly described in the next section.

1.3 RESEARCH DESIGN AND METHODOLOGY

The approach taken to achieve the aim and objectives of this research is illustrated in Figure 1.1.

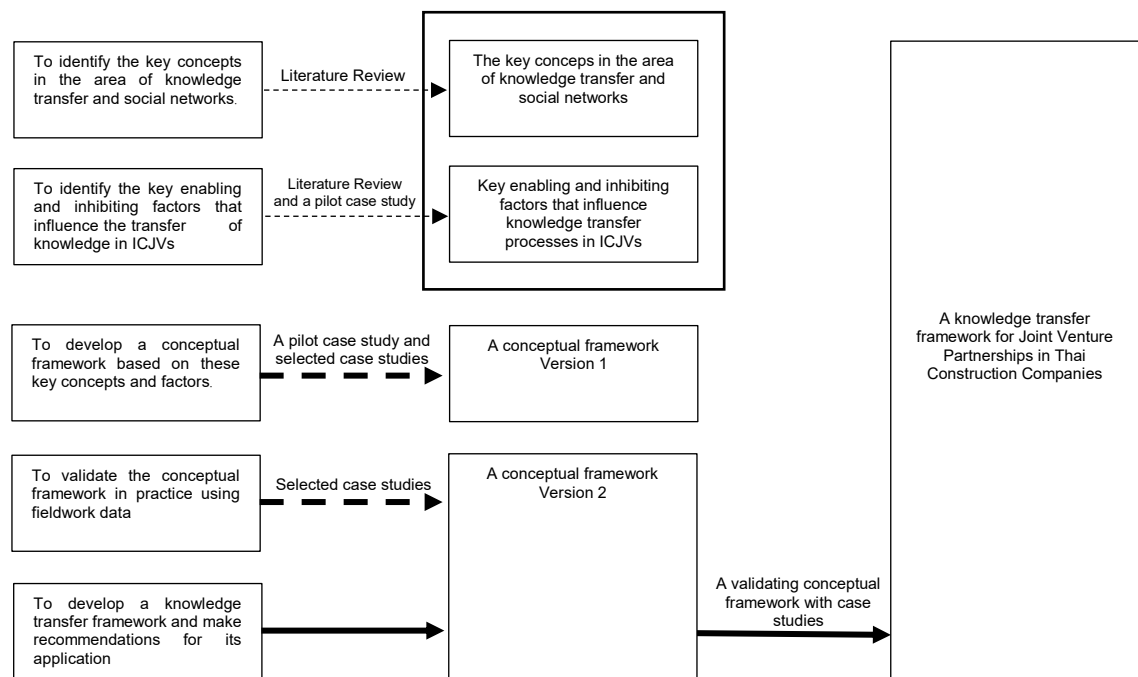


Figure 1.1 Research Framework

The interpretivist approach was chosen as the methodological basis for this study. This is the best and most appropriate approach for developing a holistic picture of a phenomenon by in-depth exploration, observation, face-to-face contact, listening to participants, and studying dynamic processes. The key concepts in the areas of knowledge transfer and social network theory were identified through an in-depth review of the literature and this was used to establish

a conceptual framework for the study. This framework was used as the basis for the collection and analysis of quantitative and qualitative data in a multiple case study context (Gerhard and Christian, 2010). Two ICJV companies were selected as the case study contexts. Three projects were studied in each ICJV company in order to establish and evaluate how knowledge is transferred within project teams, and to identify the key enabling factors that influence this process. The selected companies are the two leading construction companies involved in ICJV projects in Thailand. They are comparable in terms of their size and construction volume. Three unique ICJV projects were selected from each company in order to collect data on general information, organisational and actor attributes, and the respondents' knowledge transfer ties.

Pilot interviews were conducted to gain a preliminary insight into the knowledge transfer processes in ICJV projects in Thailand and to test the interview schedule. Findings of these interviews were also integrated into the conceptual framework that was developed through the literature review. This framework was then used to validate, revise and develop a knowledge transfer framework for joint venture partnerships in Thai construction companies through the main study. Discussions with practitioners and recommendations from the initial phases of the fieldwork led to the modification and improvement of the data collection tools.

A questionnaire and an interview schedule were the two main data collection tools. The questionnaire was used to collect data on general organizational and actor attributes, the respondents' knowledge transfer ties, and the knowledge transfer methods they use. The interview schedule was used to interview key management experts, e.g. the general manager, managing director, senior engineer, project manager and key construction workers from both local companies and their partners, to enrich the quantitative data

1.4 CONTRIBUTION TO KNOWLEDGE

This study brings together the key concepts that relate to knowledge transfer in organisations and social network theory. It offers a framework for effective transfer of knowledge in ICJV projects in Thailand, and makes recommendations on how to use it for ICJV projects in Thailand.

The contribution to new knowledge is made by;

- 1) Identifying the key concepts and key factors that influence the knowledge transfer processes in ICJV projects.
- 2) Developing a conceptual framework to define and analyse the key concepts and key factors that influence knowledge transfer processes in ICJV projects.
- 3) Developing a knowledge transfer framework for joint venture partnerships for Thai construction companies.
- 4) Identifying more generic implications of social networks on knowledge in ICJV projects in Thailand.

1.5 THESIS STRUCTURE

This thesis consists of the following eight chapters.

- Chapter 1: Introduction
- Chapter 2: Literature Reviews
- Chapter 3: Conceptual Framework for Knowledge Transfer in ICJV Projects
- Chapter 4: Research Methodology
- Chapter 5: Analysis and Findings (Case Study One)
- Chapter 6: Analysis and Findings (Case Study Two)
- Chapter 7: Discussion of Key findings
- Chapter 8: Conclusions

The structure of each chapter is briefly described.

The purpose of Chapter 1 (this chapter) is to introduce the research. Hence, it includes a brief description of the research background, research problem, the aim and objectives of the research and a brief explanation of the research design and methodology.

The aim of Chapter 2 is to establish a theoretical foundation for the research with an in-depth review of significant literature related to Globalisation, International Competitiveness, Joint Ventures, International Joint Ventures, International Construction Joint Ventures, Knowledge, Knowledge Management and Knowledge Transfer. The review of previous studies helped to establish the boundaries of this project and identify gaps in the existing research. The development of International Business and its development through cooperation based on International Joint Ventures are firstly reviewed before examining different types of knowledge and knowledge transfer methods and mechanisms and highlighting critical significance to construction organisations. Moreover, this chapter brings together the relevant and significant literature on Knowledge Transfer and Social Network Theory.

Therefore, Chapter 3 explores the possibilities social networks could offer to enhance KT Processes in order to overcome the performance gap between ICJV Projects. The IDEF0 Functional Modelling method which is used as a basis for developing a framework is presented together with the literature related to KT processes. A demonstration of the development of a conceptual framework for knowledge transfer in ICJV projects is thus proposed. The key enabling and inhibiting factors that influence knowledge transfer processes are highlighted and explained from a theoretical perspective.

The research philosophy adopted for this study is defined and discussed in Chapter 4, together with the methodology used to complete the research. The research approach and methods used to conduct the empirical investigation are presented with a detailed rationale for the use of particular research methods. The data analysis techniques used in the research are also explained in this chapter.

The key findings of the empirical investigation of each case study are reported in Chapter 5 and Chapter 6. These chapters contain an overview of the context in which the data was collected. They also include a within-case study analysis.

A cross-case analysis is presented in Chapter 7 with an in-depth interpretation and discussion of the main findings of the research. A revised knowledge transfer framework for ICJV Projects in Thailand is offered based on the interpretation of these findings.

Chapter 8 is the final chapter of this thesis, which contains an overall summary of the research. Moreover, the key theoretical, methodological and practical contributions to the research are highlighted in this chapter and the chapter ends with an acknowledgement of the research limitations and some suggested areas for further research.

1.6 CHAPTER SUMMARY

An overview of the research background, research problem and research issues related to International Construction Joint Ventures and the need for knowledge transfer in ICJV projects have been presented in this chapter. The aim and objectives of the study have also been specified and the research methods and methodology have been summarised. The key findings and contributions to knowledge were briefly presented and the chapter was concluded with an outline of the thesis structure. The context-related literature will be reviewed and synthesised in the next chapter.

2. LITERATURE REVIEW

2.1 INTRODUCTION

A brief background and the overall structure of this study were provided in the previous chapter. The purpose of this chapter is to review the existing literature related to International Joint Ventures (IJVs), International Construction Joint Ventures (ICJVs), Knowledge Management (KM), Knowledge Transfer (KT) and the Social Network (SN) theory. The chapter is divided into three main sections, the first of which will contain a review of studies of the general background of the IJVs, ICJVs, and ICJV projects in Thailand and their key motivations. A critical review of research related to Knowledge Management and Knowledge Transfer will be presented in the second section, while studies pertaining to the influence of Social Network on Knowledge Transfer will be examined in the third section.

The chapter contains seven sub-sections beginning with a review of the background and various definitions of JVs and IJVs that fit the research context. The aim of Section 2.3 is to provide the overall background of ICJVs, discuss numerous ICJV Projects, and highlight their performance and success factors. The overall background of ICJV Projects in Thailand and its market will also be provided in this section. Section 2.4 will contain an overview of Knowledge, including its dimensions, and importance. Section 2.5 will contain an overview of KM and, in Section 2.6 an overview of KT, KT within and across the organisational border will be provided with an explanation of the importance of KT in the context of ICJV Projects. The connection between KT and Social Network will be clarified in Section 2.7, while the key gaps in the literature will be highlighted in Section 2.8 and the contents of the chapter will be summarised in Section 2.9.

2.2 OVERVIEW OF JOINT VENTURES (JVS) AND INTERNATIONAL JOINT VENTURES (IJVS)

Globalisation has particularly strengthened over the last two decades and strategic alliances have been widely discussed in the context of international business. There has been an unprecedented change in the nature of the global business environment with the term 'Joint Ventures (JVs)' being increasingly used. A Joint Venture (JV) is a specific type of strategic alliance between contractors from developed and developing countries, which is a recognised mechanism for the transfer of technology; hence, it provides the opportunity to combine the dominant competencies and supplementary resources of the participating organisations. JVs have become increasingly common in the construction industry (Mba, and Agumba, 2018). As [Ozorhon et. al., \(2008\)](#) points out JVs involves at least two organisations that contribute equity and resources. JVs also provide an opportunity to rationalise the operation, enter a new market, share risks and costs and acquire new knowledge ([Carrillo, 1996 and ibid](#)). Therefore, JVs are convenient tools that enable the parties involved to exploit each other's strengths for a limited time and a specific cost ([ibid](#)). A Joint Venture Company (JVC) is the most ordinary form of

organisational structure when parties wish to establish and operate a jointly-owned business (Kale et al., 2000). A JV generally affords a great variety of sharing and learning opportunities. One dimension of what JVs want and offer includes a pathway to business development and the maintaining of profits and/or new business opportunities, while another dimension is related to optimising joint services to meet customers' needs (Walker and Johannes, 2003). This is why companies around the world are trying to expand internationally through a collaborative agreement. Hajidiitriou and Rotsios (2009) define IJVs as a business arrangement for companies to enlarge their international activities and business.

The trend to forming International Joint Ventures (IJVs) has become increasingly common since the 1970s (Ozorhon et al., 2007). IJVs between multinational organisations in developed and developing countries are considered to be a successful strategy in order to benefit from international market opportunities in the globalised world (Carrillo, 1996, Gale and Luo, 2004, Ozorhon et al., 2008, V.V. et al., 2000). An IJV can be defined as a joint venture with at least one partner headquartered outside the joint venture's country of operation (Ozorhon et al., 2008). IJVs have emerged as a popular strategy in which fast access to up-to-date technology and expanding markets is more critical than ever (Mohamed, 2003). They provide an excellent environment for inter-partner learning particularly between firms in developed and developing countries; hence, learning in IJVs is perceived as a means of acquiring knowledge, collaborative know-how and collective experience (Hau and Evangelista, 2007). Moreover, IJVs can be a mechanism for transferring knowledge between partners and a way of improving the knowledge and skills of the local partner(s) (Hajidimitriou and Rotsios, 2009). Studies of IJVs provide valuable information of the way in which knowledge is transferred between partners (Goh, 2002). It is clear that construction firms are able to exploit business opportunities and enter new markets abroad by forming an IJV.

2.3 OVERVIEW OF INTERNATIONAL CONSTRUCTION JOINT VENTURES (ICJVs)

There has been an unprecedented change in the nature of the global business environment over the past two decades. Since construction covers a wide range of products, activities, and services, it is an extremely important part of the global economy. The construction sector represents between 5% and 15% of the value of nations' economy with 8% to 10% appearing to generally be the norm (Mawhinney, 2001). The construction industry is an economic investment and its relationship with economic development has been well documented. Many researchers have highlighted the significant contribution of the construction industry to national economic development (Myers, 2016). Many construction and engineering companies are searching for their expansion possibilities in foreign markets (Picha et. al, 2017). The importance of the construction industry is unique regardless of whether the country is undeveloped, developing or developed. The construction sector is active and features prominently in terms of policy formation and implementation and according to Bon and Crosthwaite, (2000); construction is a major industry throughout the world accounting for a sizeable proportion of most countries'

Gross Domestic Product (GDP). Moreover, the development of multinationals has been an important factor in the context of international construction. It could be said that the growth of multinationals in global operations has been an important factor in international construction. Multinationals are quick to form joint ventures with local partners, since they recognise the need for local knowledge (*ibid*). The purpose of this section is to examine the related literature in an overview of the International Construction Joint Ventures (ICJVs), the Thai construction industry and then a critically review some ICJV projects in Thailand.

International construction is a subject that requires a definition. The definition of international construction is when a company in one country works and delivers services in another country (*ibid*). A case study of international construction needs to incorporate socio-cultural factors and economics. It is difficult to find a formal definition in all studies of construction in international business. Mawhinney (2001) points out that international construction traditionally referred to companies from developed countries working in developing countries. As indicated in the literature, construction firms have extensively used IJVs as a vehicle to enter new construction markets around the world (Mohamed, 2003). The numbers of construction joint venture firms have increased rapidly since the early 1990s. International construction projects involve multinational companies from different economic, legal, political and cultural backgrounds (Ozorhon et al., 2007). The internationalisation of construction firms has become of significant interest as the global construction market continues to be integrated into more competitive and turbulent business environments. The number of ICJVs is continually growing worldwide, especially in developing countries, even though they are perceived to be one of the many mechanisms used by foreign investors to meet the competing interests of the development of the national economy. ICJVs are essentially formed to execute project-based activities in different business environments which could influence their performance. Similarly, an ICJV can take one of three legal forms, namely, cooperation, partnership, or contractual/ consortium (*ibid*). In their critical review, Girmscheid and Brockmann (2009) emphasised that IJVs in construction often encounter a highly complex and dynamic environment. They have increasingly become a notable form of international market growth for multinational organisations that are attempting to grasp business opportunities in both developing and developed countries (Gale and Luo, 2004). As mentioned above, since the number of ICJVs is growing worldwide, especially in developing countries (*ibid*), the purpose of this section is to understand the internationalisation and business performance of construction firms and the lifecycle of an ICJV. The viability of any international construction business needs to be viewed in a number of contexts (*ibid*). However, this situation has become more complex and fluid. The map in Figure 2.1 represents a useful starting point to examine the world patterns and flows. The big three exporters of construction influence, advanced techniques and skills are generally perceived to be the Americans, the Japanese and the Europeans. While the definition of international construction has traditionally implied companies from developed countries undertaking work in developing countries, this is changing within regional blocks with South East Asia now playing a greater role in the international construction business.

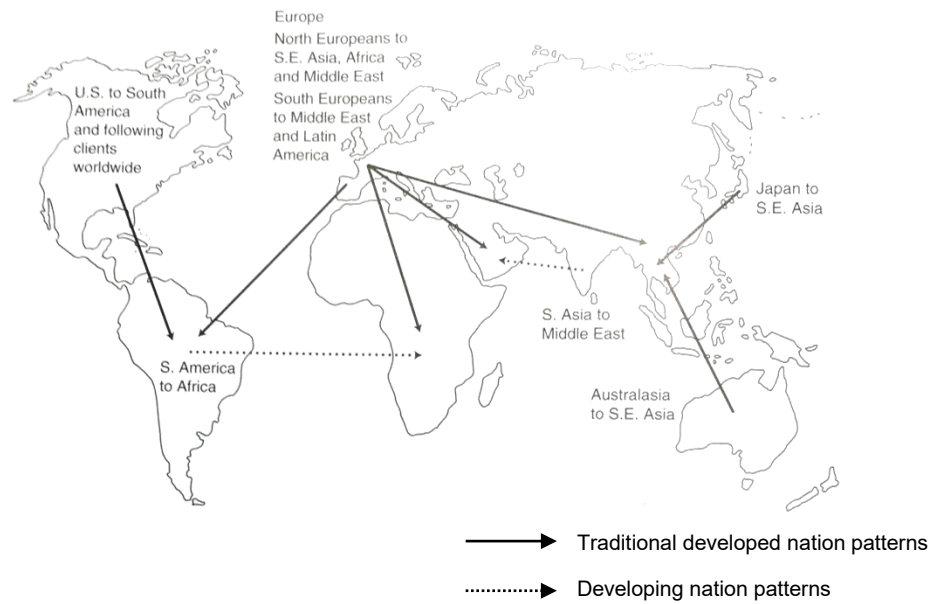


Figure 2.1 World's construction trade flows (Mawhinney, 2001, p.92).

The Asian region has rapidly grown in terms of industrialisation and economic growth over the past 20 years (Takim, Akintoye and Kelly, 2004), much of which can be attributed to the international transfer of technology in the construction industry. Therefore, it is important to study a group of national markets to understand how they are influenced by international investment. South East Asia is frequently perceived as being the most international of regional global markets and also frequently viewed as the most international of regional global markets (Mawhinney, 2001). There is no doubt that this region was viewed as a sampling platform for any consultants and contractors with global intentions in the 1980s and early 1990s. The main group of countries that form the Association of Southeast Asian Nations (ASEAN) is shown in Table 2.1 and a comparison of the size of its construction industry with that of other countries suggests that its contribution has been consistent and stable (See details in Table 2.2).

Table 2.1 South East Asia region (1993 figures)

Country	GDP (US\$bn)	Population (Million)	GNP/ Capital (US\$)	Construction (US\$bn)	Market (% of GDP)	Status
Brunei	4.0	0.3	13,450	0.4	10	Developed
Hong Kong	90.0	5.8	18,060	8.1	9	Developed
Indonesia	144.7	187.2	740	21.7	15	Developing
Malaysia	64.5	19.0	3,140	9.7	15	Developing
Philippines	54.1	64.8	850	7.0	13	Developing
Singapore	55.2	2.8	19,850	10.5	19	Developed
Taiwan	218.5	21.1	10,350	28.4	13	Developed
Thailand	124.9	58.1	2,110	22.5	18	Developing
Vietnam	12.8	71.3	170	1.9	15	Emerging

Source: Davis Langdon & Seah (1997) Asia Pacific Construction Costs Handbook. E & FN Spon (ibid)

Table 2.2 Percentage share of GDP for selected countries for the construction sector

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013
South Korea	5.7	5.5	5.3	5	5.1	4.6	4.2	4.1	4.1
Hong Kong	3.4	2.9	2.7	2.9	2.7	2.9	3.3	3.5	3.5
Taiwan	2.8	2.7	2.6	2.4	2.3	2.3	2.3	2.2	2.2
Singapore	n.a	n.a	3	3.6	4.2	3.8	3.8	4	4.1
Thailand	2.4	2.4	2.4	2.2	2.2	2.2	2.1	2.1	2.1
Philippines	4.4	4.6	5	5.1	5.4	5.7	5	5.4	5.6
Indonesia	5.9	6.1	6.2	6.3	6.4	6.5	6.5	6.5	6.6
Malaysia	3	2.9	2.9	2.8	3.1	3.2	3.2	3.5	3.8

Source: [Thailand National Statistical Office \(2014\)](#)

As can be seen from Table 2.2, although the Thai construction industry was not the highest performer among the countries cited, it made a reasonable contribution to the country's GDP.

2.3.1 Lifecycle of an ICJV

The lifecycle of an ICJV consists of three key processes, namely; Partner selection, ICJV formation and ICJV operation. Figure 2.2 presents the key processes in the life cycles of an ICJV. [Mohamed \(2003\)](#) posits that ICJV selection (partner and task) is the key to the formation and operation of an ICJV and the selection of a local partner are increasingly critical to ICJV's success. Partner-related factors consist of variables such as the history of partners, their character and culture, while task-related factors are the operational skills and resources needed to achieve project success.

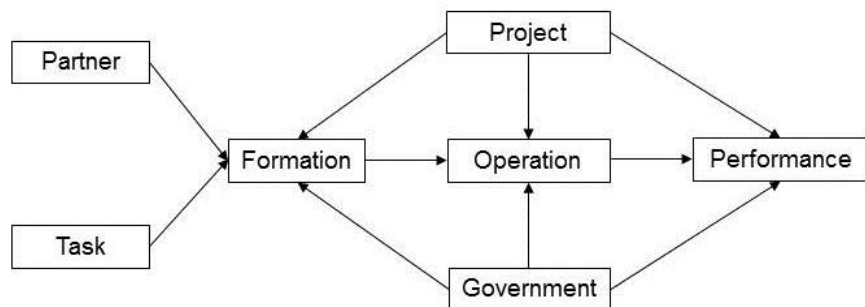


Figure 2.2 Key processes in the life cycles of an ICJV ([ibid](#)).

During the formation stage, potential partners identify their ordinary corresponding interests in the task-related areas. Foreign companies that are strongly desired by the local partner are usually in a position to negotiate an agreement. [Mohamed \(2003\)](#) identifies a number of critical factors to be considered during the negotiation. These include clarifying each partner's contribution to the venture, the means of control and the decision making process, the sharing of risk, and the diffusion of profit and loss. The review of the literature indicates that there is a wide range of risk factors from the host government policies which directly affect the business operation stability, such as corruption, expropriation, delay in approval and reliance. Furthermore, the economic and political stability of the host country is an extremely significant condition for working on overseas construction projects.

It has been shown in several studies that successful collaboration relies on relational forms of exchange characterised by a high level of trust ([ibid](#)). Most ICJV operational problems can be traced to cultural differences, different languages, and behaviour. Cultural differences can lead to a failure of communication. There are various project-related risk factors that are significant to ICJV project, such as the inability to understand the local business context, culture and tradition, poor participant's relationship, cash flow problems, employing local staff and no or little international experience. A four-dimensional construct was proposed by [Ozorhon et al., \(2010\)](#) to measure the success of an ICJV. It includes Project performance, Partner performance, Performance of IJV management and Perceived satisfaction with IJV.

2.3.2 The Thai Construction Industry

As mentioned earlier, the construction industry plays a significant role in Thailand's economic and social development. It not only enhances the growth of the economy, but it also contributes to a better society and maintains the country's infrastructure. The Thai construction industry registered a Compound Annual Growth Rate (CAGR) of 6.03% during the review period (2009–2013), which was supported by public and private investment in residential, infrastructure and commercial construction projects. The introduction of the Real Estate Investment Trust (REIT) in January 2013 also helped to boost the country's construction activities; however, political and social uncertainty is expected to lead a comparatively moderate growth over the forecast period (2014–2018) compared to the review period. The output of the construction industry was expected to grow at a forecast-period CAGR of 3.19%, supported by government investment in infrastructure development with the aim of becoming the regional hub of the proposed ASEAN Economic Council (AEC) in 2015. However, both the public and private Thai construction sectors expanded by 17.3 percent in the second quarter of 2015, compared to a 23.4 percent growth in the previous quarter. Specifically, public construction rose by 25.6 percent as opposed to a 44.2 percent increase in the previous quarter, although, government construction expanded by 35.6 percent in line with a continual increase in government budget disbursement, while state owned enterprise construction contracted by 4.0 percent. The growth of private construction continuously rose by 2.7 percent from 1.8 percent growth in the previous quarter due to an increase in demand for condominiums in Bangkok and the neighbouring areas as well as factory expansion ([Thai Economic Performance, 2015](#)).

In the first half of 2014, the projects of both the public and the private sectors were clearly slowing down. Public sector departments led by the caretaker government were unable to approve of new projects due to the limit of their authority and investment in the private sector also declined due to the influence of the government's policy. In the second half of the year, the National Council for Peace and Order (NCPO) announced an investment policy statement and made a great effort to promote the infrastructure projects necessary for the social and economic development of Thailand. This was a sign for the private sector to accelerate delayed projects, especially commercial projects in growing business and investment areas, such as department stores and modern building materials stores (Modern Trade), as well as the construction of residential buildings, including condominiums, along the BTS and MRT extension lines. From

investors' perspective, the government was sufficiently stable to boost projects, which led to the private sector being confident of future investment. The Thai Construction sector grew by 20.1 percent in the first half of 2015, with 34.2 percent growth in public construction and 2.3 percent growth in the private sector. Moreover, the government funded several infrastructure projects totalling Baht 247 billion (Euros 6.7 billion) in the second half of 2015. These projects included the Bang Pa-in to Nakhon Ratchasima motorway (Baht 85 billion), the Bang Yai-Bang Pong-Kanchanaburi motorway (Baht 55 billion), Suvarnabhumi Airport, Phase 2 (Baht 60 billion); Three Track-Doubling Metre Gauge Projects (Baht 40 billion) and the third Green Line Morchit-Khu Khot contract (Baht 7 billion). They did not include the continuing construction of the Blue Line, Purple Line and Red Line extensions or any privately-financed commercial, housing or industry projects. In addition to the above domestically-financed projects, the government was negotiating government-to-government agreements with China, Japan, and other countries for the following projects: The Nong Kai-Map Ta Put standard gauge freight rail line, The Bangkok-Chiang Mai high-speed rail line, and The Tak-Mukdahan rail line.

In total, the government approved a budget of more than Baht 1.9 trillion (Euros 51 billion) for the next eight years for the construction of infrastructure projects. This is a huge investment for a country like Thailand, despite the current low-interest rates. Hence, it is of the utmost importance that these projects are carefully planned and integrated, since they will form the backbone of the country's critical future infrastructure in terms of transportation, logistics, flood protection and energy supply. However, the Thai construction industry was expected to benefit tremendously from the launch of the ASEAN Economic Community (AEC) in 2016. It was anticipated that the planned AEC would facilitate the free flow of goods, services, labour and investment in the ASEAN region and the government of Thailand would kick-start the regional growth of the Thai construction industry with measures aimed at developing the industry as the regional hub of the AEC. The construction industry in Thailand is now dominated by a small number of large companies and a large number of Small and Medium Enterprises (SMEs) representing 23% and 77% respectively of the 29,360 organisations in this industry ([National Statistical Office, 2009](#)). Thai contractors are not only among the largest construction companies in the ASEAN region, but some of them already have extensive experience of working abroad, as well as on local megaprojects such as the MRT, hydropower dams, and airports. This experience gives them a good competitive edge. Large-scale infrastructure projects in Thailand have tended to be delivered using JVs of local construction organisations and foreign construction partners.

2.3.3 ICJV Projects in Thailand

Globalisation together with the information revolution and the improved knowledge-based economy has fundamentally altered the market in the construction industry ([Wethyavivorn, Teerajetgul, and Charoenngam, 2009](#)). Thailand's economy and infrastructure development have significantly and rapidly risen in recent years. The construction industry continues to play a major role in the country's development as many construction projects are being commissioned to meet the high demands of the expansive market. Thailand made significant steps toward

economic and infrastructure development after the financial crisis of 1997 and has thus become one of the newly industrialised countries or 'NICS' in Asia, together with Hong Kong, South Korea, Singapore and Taiwan (Aksorn and Hadikusumo, 2008). The Thai government has continuously invested in large infrastructure projects such as underground train lines, Bangkok Sky Train lines, cable-stayed bridges and the renowned Suvarnabhumi International Airport. Construction joint ventures in Thailand are becoming increasingly popular with multinational construction companies, local construction firms and local governments forming a JV to achieve their objectives. The government of Thailand is encouraging and supporting local contractors to participate in regional and global markets based on their expertise and experience of building construction, infrastructure projects, and airport construction. As a result, a number of international construction firms from other countries have entered Thailand in order to complete these sophisticated projects (ibid). Therefore, local contractors who wish to enter the emerging market and achieve sustainable long-term competitiveness in this new environment need to quickly develop the required resources. Moreover, the importance of international trade agreements and the steady expansion of the construction industry have led to a huge increase in the number of foreign contractors in Thailand, which has a significant effect on Thailand's construction industry. Thai construction companies have already formed joint ventures with firms from China, Taiwan, Korea, Japan and the European region and Thai construction contractors have gained extensive experiences by working on international construction projects during the past decade (Thirakomen, 2004). Thirakomen (2004) proposes that a government and private "partnership" will be the key development network to overcome any inadequate and ineffective control strategies or construction and project management problems that are likely to have a negative effect on construction projects in Thailand and other developing countries (ibid). As mentioned above, there has been a huge increase in the number of foreign construction contractors operating in Thailand due to the importance of international trade agreements and the expansion of the construction industry (Pornkasemsuk and Tongthong, 2010) (See details in Figure 2.3).

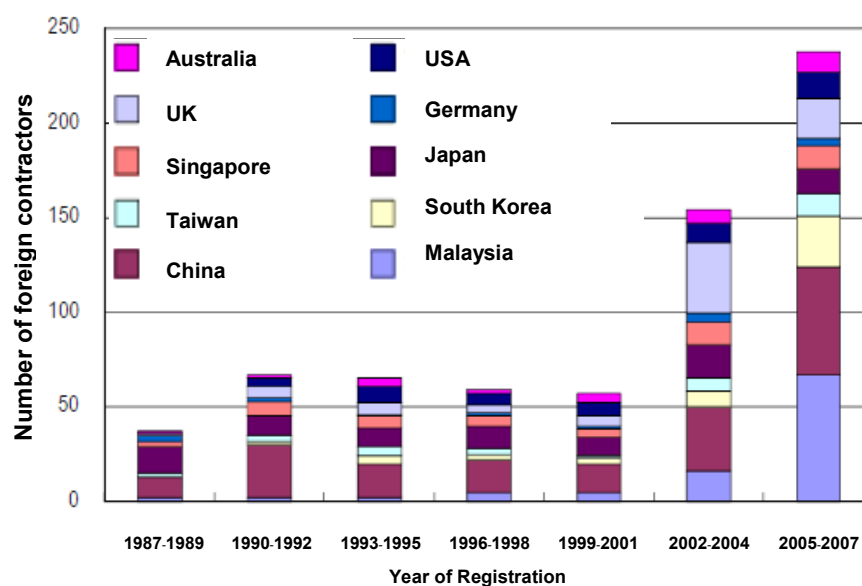


Figure 2.3 Number of foreign companies registered in the Thailand

Competition in the local construction industry is intense. New project awards are typically determined based on a competitive bidding process, and after potential bidders pre-qualify to bid on a project, the principal competitive consideration is the price of the bid. This increase in competition for construction projects has led to price competition and a general decrease in contract prices (ITD Annual Report, 2014). More than 500 companies operating in the construction business, including Thai companies, foreign companies and joint ventures between Thai and foreign companies are members of the Thai Contractors Association. Competition is mainly based on price, but a key factor that affects the ability to price a bid competitively is the sourcing of materials. The fluctuation of the price of materials has an impact on the construction industry because the value of materials typically represents approximately 30 to 40% of the entire project cost. Other than the availability of materials, significant competitive factors include the expertise and experience of employees and subcontractors, as well as the formation of a joint venture for technological support and business alliances. Thai public sector agencies typically only allow contractors who meet certain criteria to bid for contracts. Construction contractors may be categorised by their level of expertise, technical knowledge, and available resource. Those that are categorised in the highest level typically pre-qualify to bid for all types of contracts, while others are typically excluded from bidding on contracts that require higher levels of expertise.

Table 2.3 Construction contractors in Thailand that are listed on the SET in 2014

Company Name	Revenues (million Baht)	% of Total
Italian-Thai Development Public Company Limited	49,160.50	24.07%
CH. Karnchang Public Company Limited	35,443.40	17.36%
Sino-Thai Engineering Public Company Limited	21,944.40	10.75%
Toyo-Thai Corporation Public Company Limited	19,794.00	9.69%
STP&I Public Company Limited	12,054.10	5.90%
Christiane & Nielsen (Thai) Public Company Limited	9,437.20	4.62%
Power Line Engineering Public Company Limited	9,360.00	4.58%
Unit Engineering and Construction Public Company Limited	8,200.10	4.02%
Nayarit Patinkin Public Company Limited	7,853.00	3.85%
Symtec Construction Public Company Limited	7,083.70	3.47%
Pre-Built Public Company Limited	6,238.70	3.06%
BJC Heavy Industries Public Company Limited	4,481.30	2.19%
TRC Construction Company Limited	3,127.70	1.53%
Sirach Construction Public Company Limited	2,658.10	1.30%
Thai Polygons Public Company Limited	2,373.60	1.16%
EMC Public Company Limited	1,904.60	0.93%
SEAFCO Public Company Limited	1,903.30	0.93%
PAE (Thailand) Public Company Limited	1,193.60	0.58%
Total	204,211.30	100.00%

Source: Stock Exchange of Thailand (SET)

However, not only are Thai companies operating in Thailand, but also foreign construction companies, but, the latter are prohibited from bidding for government projects because the government's regulation requires bidders to be a Thai juristic person (i.e. a Thai national hold more than 50% of the shares). Foreign construction companies cannot establish a company or

branch in Thailand to bid for government projects without Thai national shareholders apart from the duration of specific and approved projects. This is generally only possible for projects undertaken by the public sector or with Government support; therefore, most foreign construction companies must be registered to undertake general construction work in Thailand as a company in which Thai nationals own the majority of the shares and contribute the majority of the capital, which effectively restricts their participation in the Thai construction sector. As a result of this restriction, many foreign construction companies form joint ventures with Thai construction companies or act in a consortium. These arrangements often provide foreign companies with greater access to the Thai market and enable Thai companies, including ours, to benefit from the technical expertise and, in some case, the financial strength of the foreign company. These arrangements tend to be project-specific and are usually dissolved at the end of the project. The majority of competitors are joint ventures between local contractors and foreign contractors from countries such as China, Taiwan, Korea, Japan, Australia and countries from the European region.

2.4 OVERVIEW OF THE AREA OF KNOWLEDGE

The background and various definitions of JVs and IJVs were presented in the previous section with the overall background of ICJVs, ICJV Projects, and an explanation of how the adoption ICJV Projects in Thailand and its market fit the context of this research. Therefore, the aim of this section is to discuss the theories of knowledge, knowledge management and especially knowledge transfer in order to understand the process of transferring knowledge in ICJV projects, which will facilitate the formation of a knowledge transfer framework for joint venture partnerships for Thai construction companies. The subject areas are defined by the nature of the knowledge in this section and types of knowledge are allocated.

2.4.1 Nature of knowledge

Knowledge became technology, which strongly influenced the process of industrialisation. The concept of knowledge and its role in production changed dramatically and traditional knowledge institutions were side-lined by profit-orientated organisations. Knowledge is a vital resource that organisations can use for market leverage. It is considered as an asset that can be transferred, stored and basically used like a product (Kivrak, et.al, 2008 and Haghirian, 2010). Knowledge is one of the most important resources for managerial decision-making in any organisation (Wethyavivorn, Teerajetgul, and Charoenngam, 2009); moreover, it helps firms to develop faster than their competitors and create a sustainable competitive advantage (ibid). Knowledge becomes more valuable to organisations when it is transferred (ibid). It is evident from these previous studies that, knowledge is a difficult concept to understand research and investigate and the management of knowledge an extremely challenging task based on its many aspects. Furthermore, knowledge is one of the key capabilities that enable projects managers and project-based organisations to cope with a myriad of challenges. Knowledge is typically categorised as either tacit or explicit (Chen and Mohamed, 2010) and it has been suggested that the possession of knowledge is one of the strongest competitive advantages in modern markets. The effective management of organisational knowledge has become a critical

capability and it is suggested that KT across different stages of projects can positively influence their outcome. Cross-project KT facilitates the movement of knowledge from project sources to project recipients with the goal of improving performance and capabilities (Landaeta, 2008). However, before attempting to discuss the concept of knowledge, it is important to understand the meaning of data, information and knowledge, and especially the difference between knowledge and information (Al-Salti, 2011).

‘Data’ is the smallest item in the knowledge hierarchy which represents raw numbers or signs. Data is isolated from a context and needs further interpretation by an individual to become useful or be further processed. Al-Salti (2011) states that data is a series of facts in the form of words, numbers, images and/or sounds. It is considered to be a carrier of knowledge and information and a presenter of facts. Data can only be useful if it is converted into information (ibid).

‘Information’ is defined by Al-Salti (2011) as “a set of data that is organised within a context”. It refers to details of an event or situation in the past or simply a scientific fact. Pure data cannot be used alone; it needs to be transformed into information. In contrast to data, information can describe a current situation; it enables reality or a certain situation to be pictured. Therefore, information is subjective and purely descriptive and explicit and it does not enable one to decide or act, nor does it trigger new questions. Hence, information is simply considered to be a flow of messages, whereas knowledge provides a link between different information and an interpretation. Information can be rather easily transferred when it consists of different pieces of data connected to each other (Haghirian, 2010).

Al-Salti (2011) indicates that ‘Knowledge’ is the application of information. There is a clear distinction between information and knowledge. Knowledge is created by interpreting information. It can be viewed as a thing to be stored and manipulated and as a process of simultaneously knowing and acting. There are two main types of knowledge, namely, know-what and know-how. Know-what specifies what action to take when presented with a set of incentives, while, know-how specifies how to decide on an appropriate response based on a characteristic of the process. Know-how refers to knowledge that is embedded in an individual and so becomes the basis of the capacity to act. Know-how is based on repeatedly performing a certain activity or business process. It can be divided into tacit and explicit know-how. Tacit know-how refers to embedded individual or organisational know-how, which cannot be easily documented and codified, such as expertise, capabilities, and skills, whereas, explicit know-how refers to procedures, product specifications, manuals, software or codified systems (Haghirian, 2010). Some definitions of knowledge are shown in Table 2.4.

Table 2.4 Arguments and definitions of Knowledge

Authors	Arguments and definitions
Landaeta (2008)	Knowledge has become a critical organisational capability
Kivrak et.al (2008)	Knowledge is the result of a combination of expertise, values, personal approach, know-how, technical abilities, skills, successes and failures that individuals and organisations acquire from personal, social and organisational interaction. Knowledge is an essential organisational resource that gives market competence.
Teerajetkul and Chareonngam (2008)	Knowledge is a critical asset that is widely recognised as a primary resource of a firm or an organisation's competitive advantage in today's fast growing industries.
Stevens (2010)	Knowledge is an organisation's only visual asset and knowledge work continues to increase.
Mohamed (2010)	Knowledge is typically classified as either tacit or explicit
Forcada et.al (2013)	Knowledge is managed across projects by considering them to be part of wider institutional and organisational ecologies, rather than focusing on the individual projects as the unit of analysis.

2.4.2 Knowledge locations and Knowledge Types

Knowledge can be located in a tacit form in people, physical objects, artefacts, processes, operations and relationships (Haghirian, 2010). Knowledge has a number of dimensions, including tacit and explicit. An overview of the locations of knowledge is provided in Table 2.5.

Table 2.5 Knowledge locations

Knowledge locations	Examples
People	Employees, Teams, Communities of Practice (COP)
Physical objects and artefacts	Books, Reports, Products, Theoretical material
Processes	Organisational routines, business processes, manufacturing processes
Relationships	Relationships between employees, customer relationships, cooperation with suppliers/ with experts, relationships with shareholders.

Source: Knowledge locations (Haghirian, 2010, p.14).

As mentioned above, knowledge is typically classified as either tacit or explicit (ibid). Tacit knowledge is perceived to be the most strategically important resource of a construction organisation, as well as the only renewable and sustainable basis of its activities and competitiveness (ibid). Mohamed (2010) argue that tacit knowledge is needed to create, execute and maintain explicit knowledge, select appropriate data and produce an analysis of the output. It is necessary to provide an empirical understanding of tacit knowledge in order to effectively utilise it in construction organisations. Tacit knowledge is associated with terms such as "skill", "know-how" and "expertise", which are used to describe knowledge of the kind necessary to undertake work. This is an important element in work and workplace learning. Tacit knowledge has recently been recognised as an important phenomenon and its role in knowledge management has been extensively explored.

In developing an understanding of the knowledge transfer processes, it is important to begin with a brief discussion of the two main dimensions of knowledge mentioned above, namely, tacit Knowledge and explicit knowledge (Nonaka and Takeuchi, 1995). Tacit knowledge is deeply rooted in the behaviour and actions of individuals, who are committed to a specific context, such as a particular area of expertise or a series of work practices (Al-Salti, 2011). Tacit knowledge cannot be transferred through a written document. This type of knowledge is learned through

extended periods of experience and the repetitive performance of tasks. Tacit knowledge often requires very close and extensive personal contact between the source and the recipient in order for it to be effectively transferred (ibid). Tacit knowledge is also called sticky knowledge because it may be relatively difficult to pull it away and transfer it from its source (ibid), especially in the case of inter-organisational knowledge transfer. On the other hand, explicit knowledge exists in a symbolic or written format and is stored in readily accessible media such as manuals, documentations, procedures and programme codes. An installation manual accompanying a new software package is an example of explicit knowledge. Nonaka and Takeuchi (1995) explain that explicit knowledge can be articulated in formal language, including specifications, technical drawings and manuals. Similarly, Inkpen (2000) suggests that explicit knowledge can be expressed in diagrams and charts and therefore, is relatively easy to transfer and acquire. An overview of the types of knowledge is presented in Table 2.6.

Table 2.6 Knowledge types

Knowledge type	Definition	Example
Tacit knowledge	Tacit knowledge cannot easily be articulated or written down. It is strongly connected to its holder and cannot be easily transferred.	Knowledge about how to perform intercultural negotiations or how to best repair a certain machine.
Explicit knowledge	Explicit knowledge can be easily articulated or written down. It is not strongly connected to its holder and can be easily transferred.	Company reports, blueprints, best practices, technical drawing, videos, tapes

Source: Knowledge types (Haghirian, 2010, p.13).

Pathirage, Amaratunga and Haigh (2007) states that knowledge plays a key role in today's fast-changing business environment and makes a huge contribution to a sustained business performance. Knowledge, particularly in the form of experience, can provide a competitive advantage in the construction industry (Tserng and Chang, 2008). A number of sources of knowledge and information are useful to the specific needs of construction (Mawhinney, 2001). Hence, it is necessary to consider the relevance of the domain of knowledge management in order to add a knowledge perspective to collaborative project processes.

2.5 KNOWLEDGE MANAGEMENT (KM)

The concept of knowledge management (KM) has been centre stage in the literature related to construction management for more than a decade (Kale and Karaman, 2011) and it is an ever evolving practice in construction firms. In the construction context, the KM process has been perceived as the combination of a series of activities for identifying, capturing, sharing and using knowledge (Mohamed, 2010). Knowledge Management is recognised as a vehicle through which innovation and improved business performance is possible (ibid) and it has also been defined as the establishment of a management system of cognitive flows, the use of which enables all components of an organisation to enrich the corporate knowledge. Therefore, Knowledge Management (KM) enables knowledge in the firm to be located, formalised, shared, enriched and developed, specifically knowledge with critical and strategic characteristics (Ermine, Boughzala and Tounkara, 2006). In today's knowledge-based economy, effective KM

can reduce the cost and time of a project and, improve the quality: as such, it is a major source of competitive advantage for construction firms (Kivrak et.al, 2008). Knowledge plays an important role in organisations and knowledge-based theory identifies knowledge as the main source to develop and sustain a competitive advantage (Haghirian, 2010).

Knowledge management enablers demonstrate the organisational tools, techniques, and mechanisms that stimulate the creation and development knowledge within an organisation. A firm need to find and access the knowledge within it to retain and sustain its competitive advantage. KM revolves around the concept of the firm as a social institution and the kind of problem solving that accompanies day-to-day operations. To make the most effective use of its knowledge, an organisation needs to ensure that it 1) finds knowledge, 2) shares knowledge, 3) receives knowledge and 4) applies knowledge, and these actions will result in an increase of its competitive advantage. Kale and Karaman (2011) argue that knowledge management provides important benefits and the opportunity to establish standard for processes, services and products. Evaluating knowledge management practices is considered to be one of the most important challenges facing firms today (ibid). The way knowledge is managed within an organisation is illustrated in Figure 2.4.

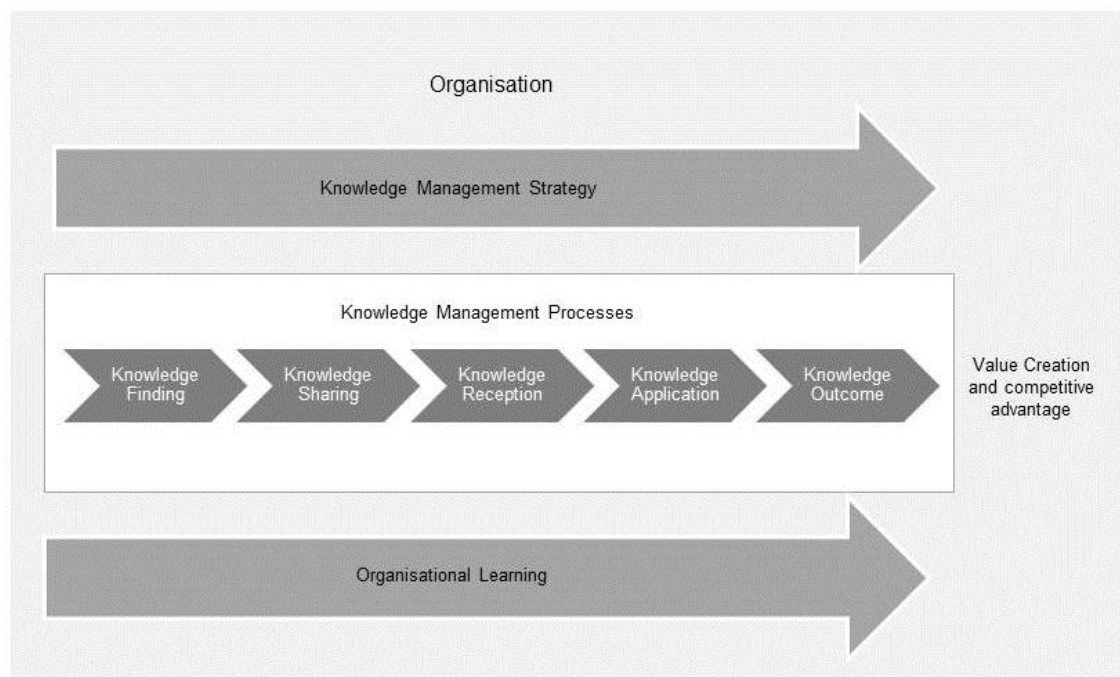


Figure 2.4 Knowledge management within an organization

According to Kale and Karaman (2011), knowledge management processes have four sub-processes, namely, the knowledge creation, knowledge conversion, knowledge utilisation, and knowledge protection.

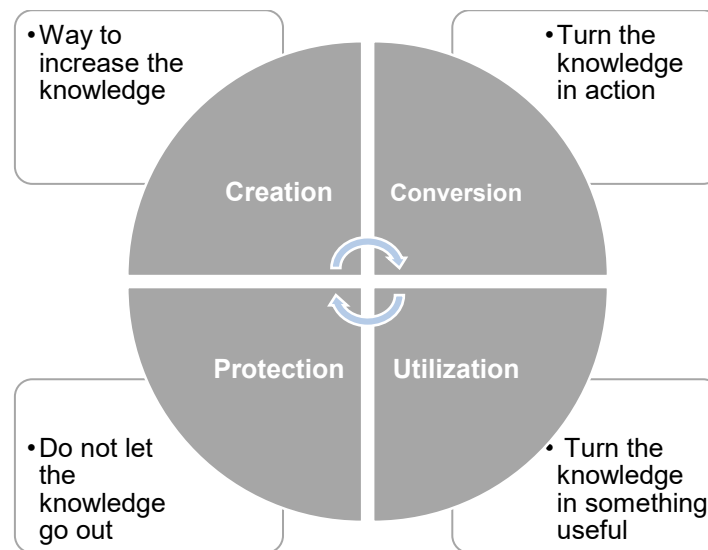


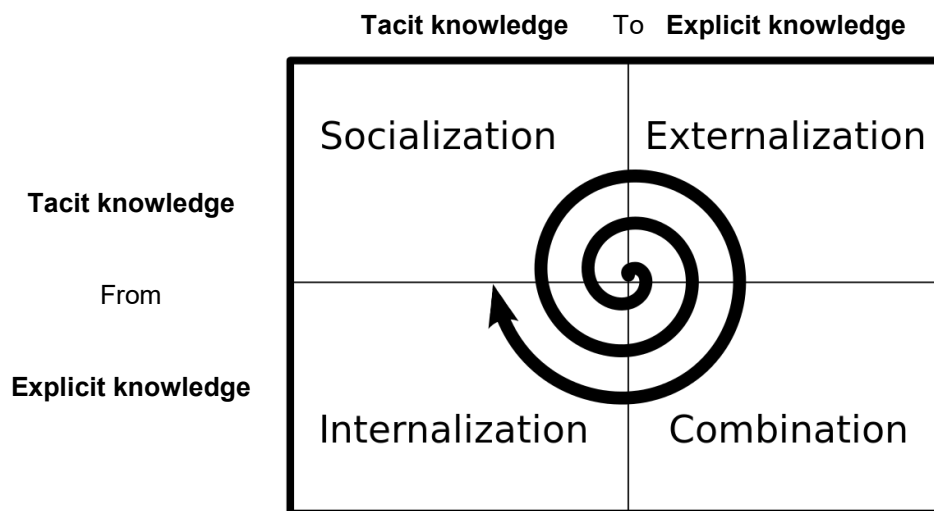
Figure 2.5 Knowledge Management Processes ([ibid](#))

It can be seen from Figure 2.5 that, the knowledge creation process involves searching for and finding entirely new knowledge or creating new knowledge from existing knowledge. The knowledge conversion process involves the transfer of knowledge among social actors and the knowledge utilisation process involves the utilisation of knowledge to improve the efficiency and effectiveness of activities and operations. The knowledge protection process involves securing knowledge from inappropriate and illegal use. When knowledge is being shared, it is communicated between members of the firm. Therefore, sharing knowledge is the most critical process within knowledge management because it can also be most easily interrupted. KM tools are often difficult to understand and there is no incentive to share intellectual assets within corporations. The issue of Knowledge Management in cross-national alliances have engaged the attention of many academic scholars in recent years. Many organisations are seizing the opportunity to acquire new knowledge and the ability to seek, absorb and transfer knowledge through these collaborative arrangements has become a crucial skill leading to the suggestion that a strategic alliance should be regarded as a learning arena ([Hau and Evangelista, 2007](#)). As a result, knowledge transfer is the process that underlies all stages of knowledge management and the aim of this study is to identify and understand the process of transferring knowledge in ICJV projects in order to develop a knowledge transfer framework for the Thai construction industry. In summary, it can be said that successful knowledge management leads to competitive advantages for multinational corporations.

Moreover, the concept of knowledge management has been centre stage in the construction literature for more than a decade. Knowledge management refers to the creation and subsequent management of an environment in which the creation, sharing, learning, and organisation of knowledge is encouraged for the benefit of the firm ([ibid](#)). Several scholars have analysed the perception and implementation of KM in firms in the construction industry and it is generally perceived to be a fundamental. However, organisations' culture, business strategy and individual motivation to share knowledge must also be considered for a successful implementation of KM ([Forcada et.al, 2013](#)). The construction industry is highly disordered,

extremely competitive and project-based with the input of, engineering, architecture, surveying and other construction-related service sectors. The focus of KM application within the construction industry is now moving toward building the capability of value creation. There is now a steady increase in collaborative working practices in the construction industry, including partnering, alliances, joint ventures and framework agreements. This indicates a situation in which organisations need to collaborate and share their knowledge, skills, and expertise in order to meet their clients' need (Anumba, Egbu and Carrillo, 2005). In addition, many construction organisations have begun to develop extranets to facilitate collaborative working on specific projects. Anumba, Egbu and Carrillo (2005) contend that 'grafting knowledge from the outside environment is not easy; an organisation needs mechanisms to bring public knowledge in, to transmit this knowledge within the firm and to fuse the new knowledge with existing sticks of knowledge'. Therefore, networking relationships and collaboration are key sources of knowledge building, language sharing and the building of shared meaning. Organisations working together in network are likely to spread and share best practice. The definition of KT and its process are presented in the following sub-section.

According to Nonaka and Takeuchi's (1995) theory of knowledge creation, there are four distinctive models that attribute the success of companies to their effective creation of knowledge, the so-called 'SECI Model'. The spiral of knowledge (Exhibits in Figure 2.7) represents the dimensions of tacit and explicit knowledge and also symbolises the number of people involved in the process. The model not only explains knowledge creation, but also describes the process of transferring knowledge.



Source: Nonaka and Takeuchi (1995, p.62)

Figure 2.6 The Knowledge Spiral

Nonaka and Takeuchi (1995) identify the following four specific conversion processes;

(a) **Socialization** [Tacit-to-Tacit]

Socialisation is the process of sharing tacit knowledge, including skills and ideas, through face-to-face communication, dialogue or shared experience, often through joint activities, observation, imitation and practice rather than written or verbal instructions. Socialisation may also occur during an informal gathering outside the workplace. For example, in the context of ICJV project, a simple discussion about a project during a business lunch between individuals from a local staff and a foreign staff may yield knowledge creation and transfer.

(b) **Externalisation** [Tacit-to-Explicit]

Externalisation is the process by which an individual attempt to present his or her tacit knowledge and makes it accessible to others. It refers to converting and articulating tacit knowledge into new explicit knowledge and the success of this process depends on the sequential use of metaphors, analogies and models. An example of externalisation in the context of ICJV project is when the technical expert of a foreign partner writes down step-by-step instructions for the local partners on how to troubleshoot a particular technical problem.

(c) **Combination** [Explicit-to-Explicit]

Combination is the process of converting explicit knowledge into more systematic sets. The creation of new explicit knowledge is conducted by merging, categorising, reclassifying and synthesising existing explicit knowledge. This is often achieved using large databases and computerised communication networks. An example of combination in the context of ICJV project is when different types of new knowledge collected from various foreign partners consolidated and categorised in more systematic reports.

(d) **Internalisation** [Explicit-to-Tacit]

Internalisation refers to the creation of new tacit knowledge from explicit knowledge (e.g. the learning-by-doing, on-the-job-training and understanding the results by reading or from a discussion). An example of internalisation in the context of ICJV project is when the partners provide training programmes and workshops for the local staffs of the local company at different stages of the ICJV project. The local staffs in the local organisation internalise the tacit knowledge by reading these training manuals and documents, and try to create new knowledge after the internalisation process.

Based on the above discussion, it is worth highlighting that knowledge has been recognised as the key to obtaining and maintaining a competitive advantage. While explicit knowledge can be formally and easily articulated, expressed and transferred the effective transfer of tacit knowledge requires individuals to directly communicate network and socially interact on a face-to-face social basis. Knowledge transfer is defined in the next section and the way knowledge is transferred within and between organisations is explained.

2.6 KNOWLEDGE TRANSFER (KT)

The changing business environment has made organisational knowledge a critical factor of businesses' competitive advantage. Knowledge Transfer (KT), being one of the two core processes of knowledge management. Knowledge transfer plays a critical role in the long-term existence of organisations and it has been found to affect key organisational outcomes ([Pérez-Nordtvedt et al., 2008](#)). Additionally, knowledge transfer has been recognised as one of the key factors of the successful implementation of any type of project of any type ([Lech, 2011](#)). [The success of KT in the joint venture has emerged in the last few decades](#) (Jayady, Pribadi, Bahagia, and Abduh, 2017). Previous researchers have suggested that four different factors are likely to influence the transfer of knowledge, namely; Type of knowledge, source, the recipient and the context in which the transfer takes place ([Hau and Evangelista, 2007](#)). [Lech \(2011\)](#) defines knowledge transfer as “a process of exchange of tacit and explicit knowledge between two actors” and [Dobrai et.al. \(2012\)](#) suggest that knowledge can be transferred on three levels, namely, individual and group level, organisational level and global level. The purpose of this section is to explain the process of KT and Knowledge creation. Knowledge flow and the key factors that influence knowledge transfer processes will then be explained in the conceptual framework chapter. As organisations increase their international business development, they must learn the new knowledge and skills involved in international projects. Knowledge management and knowledge transfer become highly prominent in this scenario. The flow and transfer of knowledge are strategically important to organisations for several reasons and an attempt is made in this section to characterise the knowledge creation and knowledge flows associated with Multinational Enterprises (MNE) and operations and analyse firms' strategic behaviour in managing these flows (both intra-firm and inter-firm flows). [Mahnke and Pedersen \(2003\)](#) characterises competence of knowledge creation and knowledge flows as shown in Figure 2.7.

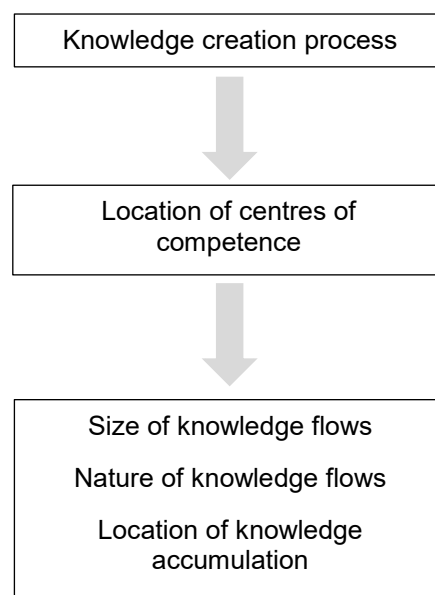


Figure 2.7 Knowledge creation and knowledge flows ([Mahnke and Pedersen, 2003, p.39](#))

Chini (2004) observes that the outstanding relevance of KM and KT for organisations is now widely considered. The growing role of KM and KT in organisations is design and the transition from a resource-based view to a knowledge-based view of the firms. This could be due to the fact that knowledge creation, which represents the dimensions of tacit and explicit knowledge, involves the continuous transfer, combination, and conversion of various types of knowledge as users practice, interact, and learn. Hence, it may be considered that knowledge sharing and knowledge creation go hand in hand. Knowledge is created through practice; collaboration, interaction, and education, as the different type of knowledge are shared and converted. Beyond this, knowledge creation is also supported by relevant information and data which can improve decisions and serve as building blocks in the creation of new knowledge.

Efficient in-organisation KT can be obtained from an institutional guarantee or incentive mechanisms (Wang and Zhong, 2014). According to Chini (2004), the measure of knowledge transfer capabilities includes the frequency of use of different tools. The most frequently utilised KM tools are face-to-face meetings, learning-by-doing and on-the-job training, all of which are KM tools that are closely tied to personal contacts. Moreover, Chini (2004) also posits that both senders and recipients are necessary for the transfer process. Transfers 'between individuals' and 'with the internal structure' is a necessary phase of the transfer process. Meanwhile, the key concepts in the area of KT that contributed to the development of the conceptual framework of this study are presented in Chapter 3.

The transfer of knowledge across different construction projects is situated within a firm's overall strategy for KM (Anumba, Egbu and Carrillo, 2005). It is suggested in the literature on KM practice that the management of knowledge in construction organisations includes the following elements:

- 'A strong reliance on knowledge accumulated by individuals and on informal networks and collaboration'
- 'The use of framework agreements with suppliers to maintain continuity in the delivery of projects for specific client'
- 'The capture of lessons learned and best practice in operational procedure, etc., which serve as a repository of process and technical knowledge'
- 'The involvement (transfer) of people in different activities as the primary means by which knowledge is transferred'
- 'The use of formal and informal feedback from providers and users of knowledge'
- 'Within firms with hierarchical organisational structures'
- 'The use of appropriate IT tools to support information sharing and communication'

In this context, knowledge transfer is found to affect key organisational outcomes (Pérez-Nordtvedt et al., 2008). The KT in organisations has a huge impact on their development and improvement. Therefore, it is essential for construction companies to evaluate and benchmark their knowledge transfer processes and knowledge transfer enablers by developing or adopting

a knowledge transfer framework. There are several terms used in the literature to describe KT, such as 'knowledge flows' and 'knowledge sharing'. A schematic representation of knowledge transfer is shown in Figure 2.8.

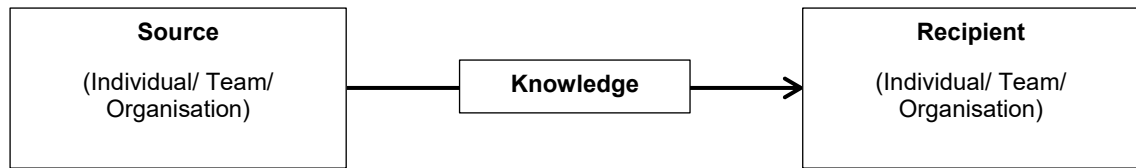


Figure 2.8 Schematic representation of knowledge transfer (Al-Salti, 2011)

Performance improvement has become a fundamental aim of transformational governments since the 1990s. The performance of government agencies is related to the benefits of their social management activities (Lin and Tan, 2014). Knowledge is recognized as a set of primary resources that are a critical asset for an organisation and since construction projects inevitable consist of a complex series of knowledge and tasks; construction firms are now facing the challenge of how to manage their knowledge and skills (Teerajetgul and Chareonngam, 2003). Similarly, construction project managers are often faced with the challenge of managing a complex construction process that consists of multiple tradesmen working on a large number of interdependence tasks (Wambeke, Liu and Hsiang, 2012). A Social Network Analysis (SNA) was used to understand relationship between the actors in an organisation and their performance in order to expose the underlying factors that cause a poor performance in firms (ibid). Wambeke, Liu and Hsiang (2012) also recommend the use of a social network analysis to generate a series of social networks for the multiple trades involved. Moreover, Social Network helps to reduce uncertainty during construction. A social network analysis can also be used to identify the key actors of a network and network centrality reflects their relationship throughout the project (ibid). Social networks among knowledge actors can be defined as 'knowledge networks'. Therefore, the social network perspective should facilitate an analysis of the transfer of knowledge between actors and groups. The theory of Social Networks discussed in the next section.

2.7 SOCIAL NETWORK THEORY

The concept of a Social Network Analysis (SNA) was first proposed in the 1930s. SNA is a methodology used to identify the condition of social structures by analysing the relations and interrelations of a set of actors (Park et. al., 2011). SNA is a sociological approach and a set of theories that has been used as an appliance in various areas for analysing patterns of relationships and interactions between social actors in a network in order to discover the underlying social structure (Hoppe and Reinelt, 2010, and Woo, Kang and Martin, 2013). SNA is a set of techniques used to understand more specific types of relations, such as, firm alliances, international trades, and friendship (Son, Han, and Rojas, 2015). It can be being used to generate, visualise and analyse collaborative research networks (ibid) and to increase the awareness of principals to further catalyse relationships and linkages to strengthen the capacity of the network (ibid). Moreover, SNA is used to investigate various relationships between an

individual's centrality in the organisation (Park et. al, 2011 and Lin and Tan, 2014). In the SNA literature, the perspective of a Social Network has begun to reveal a pattern of ties between actors and different entities in the relational concept of processes (Wambeke et al., 2012 and Some, 2013). SNA can be used to examine the structure of social relations in a group to expose the informal relationship between people, organisations, and countries.

According to Wasserman and Faust (1997) and Park et. al (2011), a Social Network is a social structure of actors (nodes), organisations or other social entities that are linked by one or more specific types of relations (ties), such as friendship, firm alliance, or international trade. Furthermore, SNA has become as an important tool to analyse the intrafirm relationship between patterns of interactions and business outcomes that comprise a collaborative construction project. A set of SNA-specific statistics has been developed, such as centrality and density which provide measures of interdependency. Therefore, SNA can improve the quality of the international project planning and capabilities of a firm (ibid).

2.7.1 Social Network Characteristics

In this phase of globalisation, manufacturing is being transferred across geographical boundaries, often to countries with newly developing technological capabilities. The global construction business has grown substantially in the past decade and an increasing number of construction firms have extended their market opportunities in the more developed world to create and offer knowledge and knowledge-based services. Therefore, the success of a company in the twenty-first century will be determined by the extent to which its leaders can develop intellectual capital by creating and sharing knowledge on a global basis. Companies must develop and retain excellent managers who accumulate valuable knowledge assets in order to complete successfully and they must also be able to manage knowledge in a strategic fashion. Therefore, the creation and transfer of knowledge creation and are the core duties of the development team. To understand how successfully a team transfers knowledge, it is important to examine the transfer process in more detail. During a team's development, an efficient knowledge flow frequently involves overcoming problems that affect the team, the relationship between the team and other functions inside and outside the organisation. Social Networks (SN) among knowledge actors can be defined as 'knowledge networks'; therefore, the Social Network perspective should facilitate an analysis of the transfer of knowledge between actors and groups.

Since a Social Network Analysis (SNA) focuses on the characteristic of ties within a set of social actors, e.g., persons, groups, organisations, nations, human activities and so on, it is linked to the significance of the relationship between social actors and their behaviour, opinions, and attitudes. The characteristics of social actors, for instance actors in the network, and the intensity, frequency, valence, or type of social relationship, are represented by line weights, line values, line signs, or line types (Wasserman and Faust, 1997). There are two key measures of social networks, namely, network density and network centrality which affect performance and can be derived from a social network analysis (Ichijo and Nonaka, 2007). Network density is a

measure of cohesion and shows the looseness of the relationship between network members. It is one of the key extensively used social network measures. If every actor in the team were connected, the network density would be 1.00. Although the density of the links among team members and, between the team and the organisation's stakeholders provides an indication of the overall communication activity, it does not identify the team members who have the power to influence others. Moreover, a person's degree of centrality is a second measure, which shows whether that person is in a broker's position between two subsets of members, and can thus be used to provide the knowledge necessary for one of the subsets. Therefore, network density, degree of centralisation and betweenness centralisation were selected as the key indicators in this study (Zhang et al., 2013). Woo, Kang and Martin (2013) indicate that Relational Ties, Network Density and Network Centrality are the three main characteristics of an SNA.

According to Park et. al (2011) and Woo, Kang and Martin (2013), there are various characteristics with relevant indicators to assess a Social Network. 'Centralisation' is determined by geodesic distance, degree centrality, betweenness centrality and closeness centrality. An SNA is used to analyse the relationship among actors (nodes) in the project and their personal relations (ties) (Lin and Tan, 2014). The connections between them form a sociogram, which is the basis of the social network concept. The components of a social network are actors, groups or subgroups, and relations.

Actors' Attributes

In this new era of globalisation, it is undeniable that many more firms have come to rely on alliances as a strategic necessity for sustaining a competitive advantage and creating customer value (Grant, 2012). Many organisations have successfully shared and transferred expertise between individuals and units (Argote, 1999). The form of knowledge sharing relates to the learning process of individuals and groups. Individuals share their knowledge in order to generate new knowledge (Ackerman, et al., 2003). Actors' attributes and interpersonal relationships among actors represent the individuals and the links between them. These interpersonal relationships affect the exchange of information and knowledge in projects (Ehrlich and Carboni, 2008 and Zhang et al., 2013). A Social Network Analysis (SNA) was conducted in this study in order to map the ties that exist between the local company and the IJV partner, analyse them to establish how knowledge is transferred within ICJV projects and identify the experts involved in the transfer of knowledge. Hence, it was considered to be important to collect information about the actors' attributes, such as their age, gender, nationality, qualifications, job position, work experience, and attitude before referring to other information such as their educational background, and expertise (ibid) to explore the influence of these attributes on the KT processes in ICJV projects.

Relational Ties

A Social Network Analysis (SNA) examines the relational ties (linkage), also referred to as the links or ties among actors. Ties represent the kind of existing relationship between actors and the pattern of interactions in a group is called a social network. The set of ties of a group is

called relational. Ties include attitudes, social roles, kinship, and flow of resources, actions, and knowledge and group memberships. Bonding and bridging are two different kinds of connectivity. Bonding and bridging are often called 'strong ties' and 'weak ties' in the SNA literature (Hoppe and Reinelt, 2010). 'Strong ties' and 'Weak ties' enables significant outcomes, such as efficiency and innovation, to be predicted. Moreover, ties can be directed (e.g., seeks advice from) or undirected (e.g., shares information with). SNA addresses both directed and undirected networking. Directed ties can be one-way or two-way. Directed ties and in-directed ties are ordinary indicators that identify a node's status and the degree of power in a network (Park et. al, 2011).

Network Structure and Network Density

Many researchers (e.g. Schropfer, Tah and Kurul, 2017) argue that the network structure affects the transfer of knowledge. The characteristics of the network structure are the number of actors (nodes), the number and size of components, network range, structural hole and network density. Density is related to the number of links that exist in the network divided by the maximum number of links that could possible exist in it (Hoppe and Reinelt, 2010). Pryke (2004) describes network density as the most common indicator of a network's linkage because it represents the density and cohesion of the interconnection of the nodes in a network. Likewise, network density is the total number of links between the nodes of a network. Schropfer, Tah and Kurul (2017) claim that network density has an obvious effect on knowledge transfer because a lower density may mean that less knowledge is transferred. The network density value is calculated by dividing the number of existing ties by the number of maximum possible ties (ibid), as shown in the following equation:

$$\text{Density} = l / (n*(n-1)/2)$$

(l = number of existent lines, n = number of existent nodes)

The density varies ranging between 0.0 (no connection in a network) and 1.0 (every node is interconnected) (Park et. al, 2011 and Schropfer, Tah and Kurul, 2017). A high-density network with 1.0 would represent a very dense network with all the nodes linked to each other (ibid), while a value toward 0.0 would indicate a sparse network (ibid). Schropfer, Tah and Kurul (2017) suggest that network density also influences the type of knowledge, while Hoppe and Reinelt (2010) propose that density helps to define cliques or clusters.

Network Centrality (Degree centrality and Betweenness centrality)

Centrality is a property of a node's position in a network which determines any issues and it is also important to identify the centre of the network (Borgatti, Everett and Johnson, 2013). Moreover, centrality also indicates the importance of a node in the network structure. A node may be important because a large number of ties in the network are involved with it. A node may be highly central in terms of being well positioned to bridge different nodes, or it may be central in being able to control the flow of the information in its way. Moreover, centrality is a

rough indicator of the social power and influence of a node based on how well connected it is in the network. Centrality is also interpreted in a wide variety of ways; for example, actors refer to central nodes as a key person, or influence, leader, gatekeeper, or having great control, involvement, power, and so on. Furthermore, centrality tends to be viewed as a positive aspect of nodes, providing actors with the opportunity to influence others and receive flows of information, material and support. Hence, centrality is often used as an independent variable to predict the positive outcomes of a node because a person at the centre of a face-to-face interaction network may have many positive consequences. [Schropfer, Tah and Kurul \(2017\)](#) claim that centrality measures are important Social Network characteristics in order to identify which actor is more central in the network. According to [Park et. al \(2011\)](#) there is various types of centrality, such as degree centrality, betweenness centrality and closeness centrality 'Degree centrality' can be divided into out-degree and in-degree centrality ([Lin and Tan, 2014](#) and [Schropfer, Tah and Kurul, 2017](#)). Out-degree centrality is the number of links initiated by a node (actor) and is also decided by an actor's subjective opinion. In-degree centrality refers to the number of links received by a node (actor) and shows how an actor is recognised by others ([ibid](#)). It is suggested in the SNA literature that in-degree centrality would be more appropriate to measure the centrality of an individual in terms of retrieving knowledge or information.

[Park et. al \(2011\)](#) defines degree as the number of nodes linked to one particular node, whereas direct ties represent the number of lines. Degree is further classified as in-degree or out-degree depending on the direction of the relationships, as follows;

In-degree = the number of nodes that supply directed relationships to a given node

Out-degree = the number of nodes that accept directed relationships to a given node

'Betweenness centrality' represents centrality as a moderator and is defined as the proportion of all the shortest paths between pairs of other nodes ([ibid](#)). Moreover, [Prell, Hubacek and Reed \(2008\)](#) also claim that 'Betweenness centrality' represents actors that are linked across disconnected segments of the network. They can mobilise and diffuse information to the larger network. Moreover, a group of project members who have all possible direct ties among themselves and create a maximum complete subgroup can be regarded as a clique ([Khamaksorn, Kurul and Tah, 2018](#)).

Clique of the network (Cluster)

'A clique' is a subset of actors in the network who are all close to each other and highly bonded subgroup in the subset ([Hoppe and Reinelt, 2010](#) and [Borgatti, Everett and Johnson, 2013](#)). Identifying cliques or clusters is one of the most important applications of SNA ([Hoppe and Reinelt, 2010](#)). In order to improve the tacit knowledge sharing within the project team, a clique analysis was conducted to identify the informal subgroups in the team ([Zhang, He and Zhou, 2013](#)).

Table 2.7 Summary of general network characteristics

Network characteristics	Definitions
Network Size (Boonyanan, 2012)	Number of actors involved in a project
Network Density (Pryke, 2004, Hoppe and Reinelt, 2010 and Park et. al, 2011 and Park et. al, 2011)	Network density is the most common indicator of a network's linkage. It represents the extent of the density and cohesion of the interconnection of the nodes in a network. Likewise, Network density is the total number of links between the nodes of a network. Density is calculated by dividing the number of existing ties by the number of maximum ties possible. The density varies ranging between 0.0 (no connection in a network) and 1.0 (every node is interconnected). A high-density network with 1.0 represents a cohesive organisation and means that all the nodes are linked to each other in the network.
Network Centralisation (Park et. al, 2011)	Centrality is a rough indicator of the social power and influence of a node based on how well connected it is in the network. There are various types of centrality, such as degree centrality, betweenness centrality and closeness centrality.
Degree Centrality (Park et. al, 2011).	'Degree centrality' can be divided into out-degree and in-degree centrality.
Out-degree Centrality (Park et. al, 2011).	'Out-degree centrality' is the number of the links initiates by a node (actor) and also decided by an actor's subjective opinion.
In-degree Centrality (Hubs) (Hoppe and Reinelt, 2010 and Lin and Tan, 2014)	'In-degree centrality' refers to the number of links received by a node (actor) and shows how an actor is recognised by others. Authors in the SNA literature suggest that in-degree centrality would be more appropriate to measure the centrality of an individual in terms of retrieving knowledge or information. 'Hubs' are individuals in a network with the most influence
Betweenness Centrality (Hoppe and Reinelt, 2010 and Park et. al, 2011)	'Betweenness centrality' represents centrality as a moderator and is defined as the proportion of all the shortest paths between pairs of other nodes.
Cluster (Hoppe and Reinelt, 2010 and Boonyanan, 2012)	A cluster is a strongly knit and highly bonded subgroup. Identifying clusters is one of the most important applications of an SNA. The average density is all the members that affect the efficiency of inter-organisational knowledge transfer and management.
Cliques (Boonyanan, 2012)	Group of project members with all possible direct ties and a maximum complete subgroup.
Experts (Schropfer, Tah and Kurul, 2017)	Experts or knowledgeable people identified from the in-degree centrality value.
Knowledge Consumers (Schropfer, Tah and Kurul, 2017)	Actors who do not possess any in-degree centrality value, but a high out-degree centrality value.
Knowledge Broker (Schropfer, Tah and Kurul, 2017)	Combination of a high in-degree and out-degree value.
Gate Keeper (Bridgers) (Freeman, 1979 and Scott, 2000 and Hoppe and Reinelt, 2010)	Actors who have a high betweenness centrality. Bridger's are found in a network by a calculation called betweenness centrality.

According to Zhang, He and Zhou (2013), network density, network centralisation and betweenness centralisation are regarded as the core indicators in a social network analysis. Moreover, a clique analysis can also be conducted to identify the informal subgroups that exist in a project team (ibid). As a result, network density, degree centralisation and cliques in the network were selected as the key indicators in this study.

2.7.2 Rational for adopting Social Network Theory

The study of social networks is a new, but rapidly widening multidisciplinary area that involves social, mathematical, and statistical and computer science. The term social network refers to the articulation of the social relationship among individuals, communities, regions and so on and they each can play a dual role, acting both as a unit or node of a social network as well as a social actor. Woo, Kang and Martin (2013) define the focus of an SNA as an examination of the

relationships among the social actors within the group using of a variety of statistical and visual analyse. Since this research involves an examination of how the knowledge transfer process improves and develops ICJV projects, each project will resemble one social network. Therefore, the body of methods developed by social network theory makes it more applicable to this research. Furthermore, the SNA process involves collecting information about relationships within a defined group or network of people (e.g. team, group, department, etc.) by interviewing managers and key players. Moreover, the network can be mapped out visually using a software tool in order to facilitate the understanding of the social connections and knowledge flows within the group or network. When the social relationships and knowledge flows become visible, they can be evaluated, compared and measured. As a result, an SNA can then be applied to individuals, teams or organisations to identify key actors and isolated players improve knowledge flows and raise awareness of the significance of informal networks. This is especially important to know what knowledge and skills to gather in the ICJV projects. A possible subgroup from one of an ICJV case study project is shown in Figure 2.9.

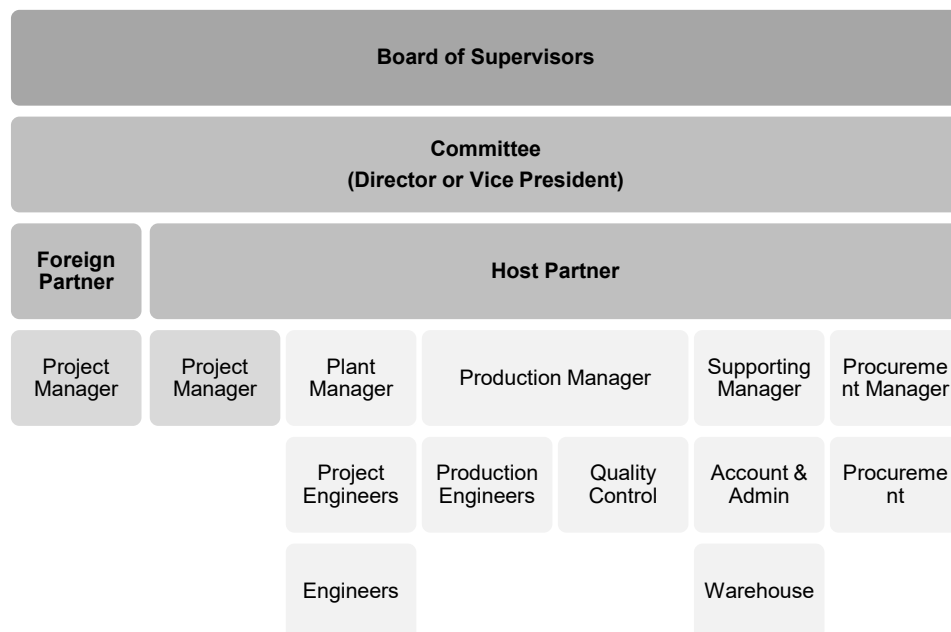


Figure 2.9 Possible subgroup of an ICJV project

2.7.3 Social Networks Models on Knowledge Transfer

The social network model for construction is focused on altering the construction project management from an efficient project to a high-performance project (Chinowsky, Diekmann and O'Brien, 2010). Some (2013) indicates that the common form of a matrix in an SNA is composed of rows and columns as there are actors in the data set. This type of matrix is the start of the network analysis and is known as 'adjacency matrix'.

		Affiliations			
Affiliations		A	B	C	D
	A	0	1	0	0
	B	1	0	0	1
	C	0	0	0	0
	D	0	1	0	0

Figure 2.10 Matrix diagram presenting affiliations in a network

The first appearance of social networks in sociology was when a Social Network Analysis (SNA) emerged as a set of methods to analyse social structures using methods that specifically enable an investigation of the relational aspects of those structures (Scott, 2000). An SNA is useful in this context because it offers a flexible set of methods that can be used with people who come from different backgrounds and it is a detailed way of evaluating the actors based on their positions. This is a powerful quantitative method that can represent the total complexity of ICJV projects and facilitates an examination of the network structure, and thus the relationships between entities and organisations in this study. UCINET, an SNA software package, and Net Draw will be respectively used for analysis and visualization. UCINET will be used to calculate the network density and actors' centrality values. Net Draw can help to graphically represent the communication structures in the project teams by using nodes to depict actors and ties between the nodes to depict channels of communication. The analysis of social network data also requires coding for the tie content and the application of graph theory to visualise the structure of a network in a sociogram. A sociogram of the knowledge network will be produced for each case study to establish the network structure, network size, tie characteristics, and actors' attributes. It is clear that the tie content will also be analysed to establish its influence on knowledge transfer.

An analysis of network data often produces maps of pictures that display the pattern of linkages between the nodes of the network and Sociogram' is a kind of graphical display that consists of nodes to represent actors and ties. A 'Sociogram' is considered to be a formal representation of the patterns of interpersonal relationships. A graph or 'Sociogram' is used to represent the relationships between actors in a group or community in terms of communication, information exchange and knowledge exchange (Chinowsky, Diekmann and Galotti, 2008 and Chinowsky, Diekmann and O'Brien, 2010). The sociogram shown in Figure 2.11 represents the relationship of tacit knowledge sharing between team members in a pilot case study.

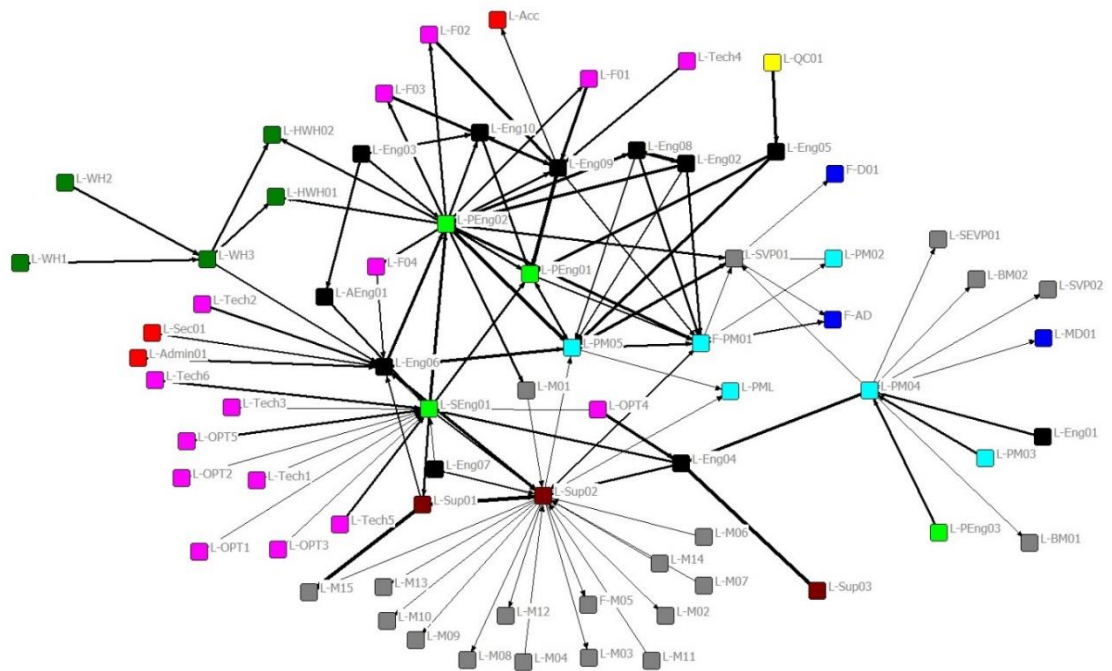


Figure 2.11 Sociogram showing the initial tacit knowledge sharing within the project team

The data of network relations collected from the questionnaire survey was calculated and analysed using the UCINET and NetDraw network analysis package software. Figure 2.11 represents an example of a social network, as a so-called sociogram. A matrix explains the relationships among various actors and converts it into a graph (Scott, 2000). The node represents the various actors in the network. Actor L-Eng07 on the top is isolated since he/she is not connected to the other actors. The largest subgroup can also be the main component of the network. L-HWH1, L-HWH2, and L-WH3 represent a triad. The middle of the triad has high actor centrality in this subgroup. How social network theory can be applied in the context of knowledge transfer is investigated in the next chapter.

2.8 THE GAP IN THE LITERATURE

Some important gaps in the literature were identified from the extensive review of relevant research on ICJV Projects and knowledge transfer processes.

The first gap in the literature concerns the absence of the factors that there is a lack of research offering an analysis of the key enabling and inhibiting factors that influence the knowledge transfer process. Prior research has only focused on the type of knowledge transferred, the source, the recipient or the relationship between the source and the recipient. The few exceptions (e.g. Gupta and Govindarajan, 2000; Szulanski, 1996) have only involved an examination Intra (within an organisation) knowledge transfer. Furthermore, there are relatively few studies based on the impact of cultural differences on knowledge transfer (van Wijk et al., 2008). According to Easterby-Smith et al. (2008) this may because cultural aspects are rarely visible within the quantitative methods that have dominated published studies, prompting future researchers to investigate cultural issues using qualitative methods and case studies. To the

best of the researchers' knowledge, there is no study that has examined all of these factors simultaneously in the context of inter-organisational knowledge transfer. Therefore, the current understanding of what contributes to knowledge transfer processes and the success of ICJV Projects is still limited.

Secondly, an extensive review of the literature indicates that, although a large number of previous researchers have examined knowledge transfer processes, little is known about how knowledge is transferred from a foreign partner to a local partner in the context of ICJVs. This dearth of research related to knowledge transfer constitutes a severe gap in the ICJV project field since the international construction markets seem to provide local organisations with access to more abundant and unique knowledge and skills that may not be available or are hard to develop in-house. Furthermore, as important as transferring knowledge and learning is believed to be, knowledge transfer from offshore or near-shore markets should be even more valuable to the foreign organisation since it may be more exclusive than the knowledge in the domestic market. This is especially true when local organisations suffer from a shortage of the technical and business knowledge and skills needed to develop and maintain highly sophisticated information systems, as is the case in developing countries.

Another important gap that has been identified is that, despite the growing number of studies relating to ICJV project, there is limited research conducted with regard to developing countries.

This study aims to close these gaps in the literature by examining and analysing how knowledge is transferred successfully between local and foreign actors in the context of ICJV Projects in a developing country.

2.9 CHAPTER SUMMARY

The purpose of this chapter was to build a theoretical foundation for the empirical research based on an in-depth review of existing related literature. The literature on the general background of JVs, IJVs, ICJVs and ICJV Projects in Thailand has been reviewed. Their performance and success factors have been highlighted. The overall background of ICJV Projects in Thailand and its market was also presented. A critical review of the existing literature on knowledge, knowledge management and knowledge transfer within and across organisational boundaries was then undertaken. The importance of KT in the context of ICJV Projects was highlighted. A discussion on how the KT problem could be explored from a social network perspective was presented in the final section. The influence of social networks on KT in ICJV Projects, and the potential they offer as an analytical tool were briefly considered.

Through this literature review, internationalisation emerged as an important research area in the construction industry. The social network characteristics that influence KT processes were identified as: Actors' Attributes, Size of the network, Network Structure, Network Density, Network Centrality, Cliques of the network, Tie Characteristics (e.g. Strengths and Weaknesses), and Tie content. Social Network Analysis was identified as an appropriate tool to

map the knowledge flow in an ICJV project team, and thus to rigorously evaluate the current KT practices. It is expected that this analysis will enable the researcher to make recommendations on improving the current practices. The ultimate aim is to close the knowledge gaps that have been identified by developing a conceptual framework to evaluate a knowledge transfer framework for ICJV projects in Thailand.

A conceptual framework that includes the key enabling and inhibiting factors that influence knowledge transfer in ICJV projects and knowledge transfer methods and mechanisms that facilitate a successful transfer of knowledge between a foreign company and a local company in ICJV Projects, is presented in the next chapter.

3. CONCEPTUAL FRAMEWORK FOR KNOWLEDGE TRANSFER IN ICJV PROJECTS

3.1 INTRODUCTION

The relevant literature related to in International Joint Ventures (IJVs), International Construction Joint Ventures (ICJVs), Knowledge Management (KM), Knowledge Transfer (KT) and the Social Network (SN) Theory was reviewed and discussed in the previous chapter. Internationalisation was identified as an important area of research in the construction industry. The importance of knowledge transfer in this international arena was also highlighted. It was shown that International Joint Ventures (IJVs), which involve a partnership between two organisations in developed or developing countries have been successfully utilised as a strategy for firms to benefit from international market opportunities in this globalised world ([Carrillo, 1996](#), [Gale and Luo, 2004](#), [Ozorhon et al., 2008](#), [V.V. et al., 2000](#)).

Knowledge Transfer (KT) is an important process by which an organisation learns from the specific knowledge that exists in the other organisation or its different parts. The successful transfer of knowledge between partners is not only the key factor of a successful IJV, but it is also an important objective of growing firms to attract foreign investment based on an IJV. Moreover, KT has also been defined as the successful transfer of knowledge between local and foreign partners. Therefore, local partners who wish to enter an emerging market and secure long-term competitiveness in this new environment needed to rapidly develop the required resources. As such, it is essential to better understand how knowledge is transferred and adopted in International Construction Joint Venture (ICJV) projects. Therefore, the purpose of this chapter is to identify the key factors that influence KT processes in ICJV Projects and develop a conceptual framework based on those factors. [Miles and Huberman \(1994\)](#) state that a conceptual framework contains the key construct related to the phenomenon being studied and the presumed relationships between them. Many researchers argue that the starting point for a case research is the research framework that underlies and provides the research constructs. The conceptual framework for this research represents the knowledge input, KT processes and knowledge output revealed in prior literature related to ICJV Projects. It will be used to explore how knowledge is transferred in selected ICJV Projects. The conceptual framework will be the key contribution of this research to existing knowledge since it will combine concepts from two domains of the literature, i.e. knowledge transfers and management, and international joint ventures. The framework will be refined later using the data collected from selected ICJV projects.

This chapter is divided into five main sections, including this introduction. The IDEF0 Functional Modelling method which is used as a basis for developing a framework is presented in the second section, while the literature related to KT processes is examined in the third section with an explanation of how it was addressed in prior studies. A demonstration of the development of

a conceptual framework is provided in the fourth section, while the fifth section contains a brief summary of this chapter.

3.2 IDEF0 FUNCTIONAL MODEL

The IDEF0 (IACM Definition) Functional Modelling method is a structured representation model of the functions, actions, activities or processes and decisions within modelled systems and organisations (Grover and Kettinger, 2000). The IDEF0 was developed to represent activities or processes that are normally performed in an organised and standardised manner. This is a functional model that consists of a series of hierarchical schemes of functions, data, and objects that are interrelated. Input, Control, Output, and Mechanism are all referred to as concepts (ibid). Moreover, the IDEF0 is used to produce 'a functional model' that can and represent a wide range of businesses in the manufacturing industry. It is utilised to present the flow of data, the functional flow and system control in a life cycle process. The IDEF0 definition of a function is a set of activities that take certain inputs and transforms them into outputs using some mechanisms that are subject to certain controls. These inputs, controls, outputs, and mechanisms (ICOMS) can be used to model the relationship between various activities. The IDEF0 model is presented in Figure 3.1.

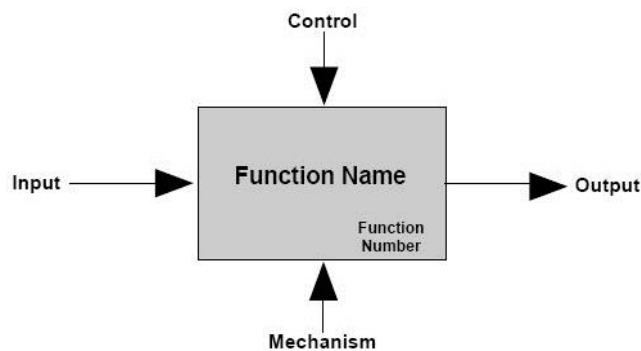


Figure 3.1 Input-process-output paradigm

Koskela (1992) describes the construction process as a combination of flow processes. The construction process consists of many stages and many parties. Furthermore, Grover and Kettinger (2000) observe that the information/knowledge contents and processes managed in the system can be identified using the IDEF0 function modelling approach. Therefore, it is argued that the IDEF0 functional model, for example, provides a flow of data related to activities and mechanisms that provide a learning opportunity and facilitates an understanding in order to access knowledge transfer processes in the context of construction projects. Since the purpose of this study is to examine the flows of knowledge and knowledge transfer processes in ICJV projects, IDEF0 functional modelling is deemed to be an ideal research method; therefore, the conceptual framework for the study will be designed based on the IDEF0 Functional Modelling method. The conceptual framework is also based on this model. The conceptual framework will also be based on a review of the literature of the key concepts related to the knowledge transfer process and the key enabling and inhibiting factors. Hence, the framework will act as a guide to determine possible explanations for the phenomenon of knowledge transfer in ICJV Projects.

The key concepts in the area of knowledge transfer, which were revealed in the review of the previous literature to have an effect on the knowledge transfer processes in ICJV Projects, are explained in the next sub-section.

3.3 KEY CONCEPTS OF KNOWLEDGE TRANSFER

A review of the state-of-the-art literature was conducted in order to determine the key factors that influence KT processes in ICJV projects and the conceptual framework is presented in Figure 3.2. The framework is divided into three main parts, namely, knowledge input, knowledge transfers processes, and possible output.

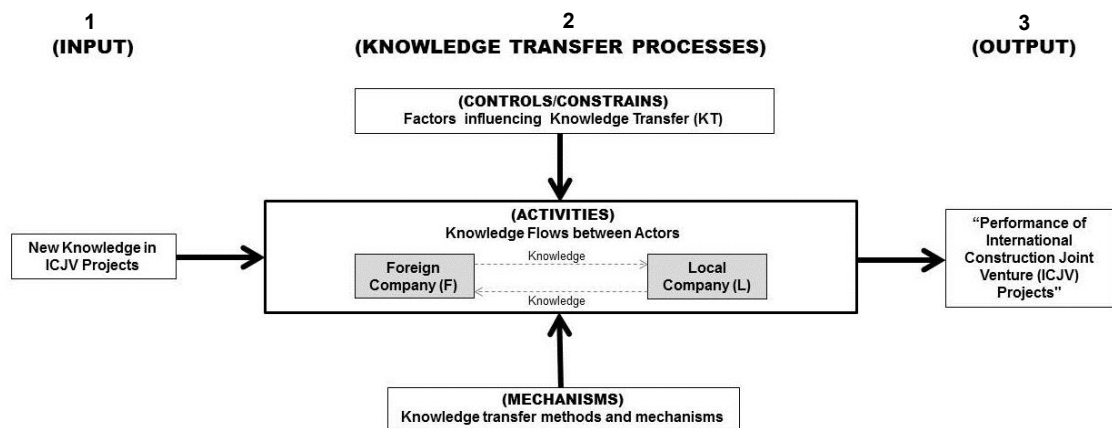


Figure 3.2 Conceptual framework of this study

3.3.1 Knowledge Input

Understanding knowledge characteristics are the key to understanding knowledge transfer. The knowledge input section of the conceptual framework was found to have a significant impact on the efficiency and effectiveness of the transfer of knowledge. Four different subject areas of this 'New knowledge' were identified; as 'New Construction Material', 'New Construction Technologies', 'New Construction Techniques', and 'New Construction Management'. Different kinds of knowledge input, such as tacit or explicit and know-what and know-how were assigned to these areas. The knowledge of 'New Construction Materials' is most explicit. 'Know-what' information can be gathered and accessed on Knowledge sharing boards, in Web-based discussions, Blogs, Websites, Personal intranets, Communities Of Practices (COPs), Information systems/ Information Technology (Computer-aided systems/ 3d-models) or Databases. 'New Construction Technologies' can be explained as a combination of tacit and explicit knowledge. Technologies require a combination of both 'Know-what' and 'Know-how', whereas, 'New Construction Techniques' and 'New Construction Management' are purely tacit knowledge and can be gathered from prior projects or knowledge experts using social knowledge, such as experience and knowledge sharing, mentoring and coaching, meetings or conferences and seminars, training or workshops, visiting other projects or visiting the foreign company or face-to-face communication. The key concepts in the area of knowledge transfer in this study that has been revealed in prior literature to have an effect on knowledge transfer processes in ICJV Projects are explained in the next section.

3.3.2 Knowledge Transfer Processes

The changing business environment has made organisational knowledge a critical factor of businesses' competitive advantage. International Joint Ventures (IJVs) are defined as a business partnership with at least one of the partners being headquartered outside the joint venture's country of operation (Ozorhon et al., 2008). IJVs between organisations in developed and developing countries are considered to be a successful strategy for firms to benefit from international market opportunities in the globalised World (Carrillo, 1996). Moreover, IJVs are a mechanism for transferring knowledge between partners and a way to improve the knowledge and skills of the local partner(s) (Hajidimitriou and Rotsios, 2009). As global competition continues to intensify, knowledge is increasingly becoming the crucial strategic resource and is regarded as a key factor, not only for successfully completing projects, but also as a critical asset of an organisation's competitive advantage (Wethyavivorn, Teerajetgul, and Charoenngam, 2009). The success of an organisation in today's competitive business environment is significantly related to its ability to utilise knowledge and build its capacity. Managing its knowledge and capacity effectively may help an organisation to sustain its competitive position in a constantly changing business environment. Knowledge is regarded as the most valuable resource and its transfer within and between organisations is a key factor of success and plays the most significant role for firms. Whether, or not IJV companies benefit from their new international relationship greatly depends on their ability to transfer knowledge (ibid).

Therefore, the transfer of knowledge is an extremely important factor in increasing an organisation's competitive advantage in the current rapidly changing business environment. KT, which refers to the transfer of global expertise between firms, plays a critical role in the long-term existence of organisations, as well as being recognised as one of the key factors of success in the implementation of any kind of project. It is strategically important to organisations for several reasons. KT's ability to provide social capital in construction management, knowledge creation, learning organisation, technology transfer and communities of practice has led to it being recognised as the way to significantly improve construction project management.

The concept of the knowledge transfer process is difficult to capture from the literature because there is no clear distinction between the transfers of knowledge the creation of new knowledge (Wende, and Haghirian, 2009). It is clear from a review inter-partner learning that cross-national alliances have engaged the attention of academic scholars in recent years and they have identified various issues with the knowledge transfer process the first of which it relates to the process of knowledge acquisition, i.e. how knowledge is acquired or transferred across partner firms and what factors facilitate or inhibit this process. The second issue is concerned with the type of knowledge being transferred (Hau and Evangelista, 2007). Knowledge flows and knowledge transfer refer to the transfer of expertise of global relevance. This is strategically important to organisations for several reasons. The conceptual framework in this section includes several samples of activities (knowledge flow between actors), controls/ constraints (performance and success factors, knowledge facilitators, and key enabling and inhibiting factors) and methods and mechanisms for transferring knowledge. As organisations increase

their presence in the international business field, they must develop the new knowledge and skills involved in international projects. [Lech \(2011\)](#) defines KT as “a process of exchange of tacit and explicit knowledge between two actors” and [Goh \(2002\)](#) posits that another important factor to consider is the basic process underlying KT. Previous researchers suggest that three sets of factors are likely to influence KT, namely, the source and the recipient, the type of knowledge, and the knowledge facilitators by which the transfer takes place ([Goh, 2002 and Hau and Evangelista, 2007](#)). Key concepts in the area of knowledge transfer are examined in the next sub-section, such as knowledge flows between actors (i.e. the source and the recipient, the type of knowledge), key factors that influence KT processes (i.e. ICJV Performance and Success Factors, Knowledge Facilitators, key enabling and inhibiting factors and knowledge transfer methods and mechanisms), which contribute to the development of the conceptual framework of this study.

(a) Source and recipient

The knowledge exchange between the source and the recipient enables organisations that want to increase their international business activities to develop the new knowledge and skills necessary for international projects. [Nonaka and Takeuchi's \(1995\)](#) ‘SECI Model’ includes four distinct modes that contribute to the success of companies and their effectiveness in term of creating knowledge. This spiral of knowledge (Exhibits in Figure 2.7) represents tacit and explicit knowledge and emphasises the importance of the interaction between different actors. The model not only explains knowledge creation but also describes the process of transferring knowledge.

Both the flow and transfer of knowledge are strategically important to organisations for several reasons. Knowledge flows along a channel between a source and a target. The process of transferring and acquiring knowledge certainly involves two key players, namely, the knowledge holder and the knowledge receiver ([Hau and Evangelista, 2007](#)). The distance of the knowledge flow also influences the methods chosen for KT. [Dobrai et.al., \(2012\)](#) propose that the pattern of interaction between local and foreign companies can be different, such as Foreign-Foreign (F-F), Foreign-Local (F-L) and Local-Local (L-L). [Li-Hua \(2007\)](#) represents the pattern of interaction between a local and a foreign company and can consist of in a different pattern, such as Foreign-Foreign (F-F), Foreign-Local (F-L) and Local-Local (L-L) (See Figure 3.3). [Mahnke and Pedersen \(2003\)](#) demonstrate four knowledge flow (See Figure 3.4).

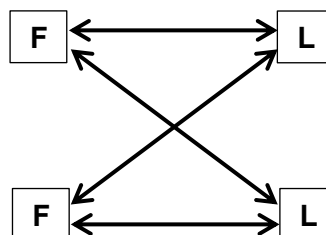


Figure 3.3 Patterns of interaction between a local and foreign company ([Li-Hua, 2007, p.3](#))

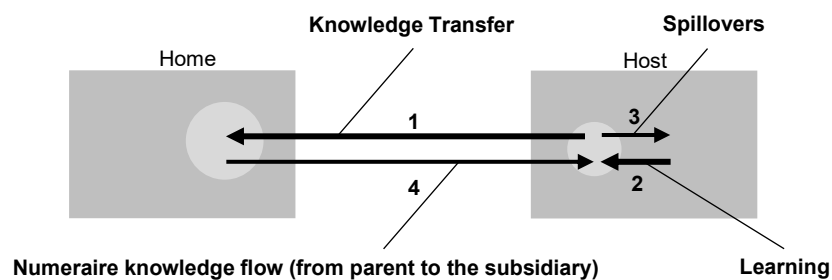


Figure 3.4 Knowledge flow between actors (Mahnke and Pedersen, 2003, p.45)

Flow 1: Flows from a subsidiary to a parent. These flows, which form the basis of the Multinational Enterprises' network (MNE's network) leverage may be called knowledge transfer and high levels of these flows enable MNE headquarters to exploit local competencies and act as a knowledge intermediary or knowledge integrator (or as a facilitator of such activities).

Flow 2: Flows from the location to the subsidiary. These flows consist of the subsidiary's learning, the exploitation of local competence, and the utilisation of the local resource.

Flow 3: Flows from the subsidiary to the location. These flows are part of what have been termed spill overs. Based on the literature, spill-overs refer to flows of knowledge both into and out of the firm.

Flow 4: Flow from the parent to the subsidiary. This is the traditional flow, whereby the subsidiary exploits a home-base knowledge advantage.

In the context of knowledge flows (Figure 3.4), the size of the knowledge flows from the subsidiary to parent (Flow 1) is strongly related to their potential to create value. Knowledge flows and knowledge transfer refer to the transfer of expertise of global relevance. These are strategically important to organisations for several reasons. The conceptual framework shown in this section includes several samples of activities (knowledge flow between actors), controls/constraints (success factors, knowledge facilitators, and key factors) and methods and mechanisms for transferring knowledge. The first set or activity of factors that influence knowledge transfer processes in this conceptual framework is 'Actors'. The flow of actors between a foreign company and a local company influence the social network characteristics in projects.

Therefore, the effectiveness of learning based on IJVs does not solely depend on the learning intent and learning capabilities of local members; it also relies on the source of the knowledge, since the process of transferring and acquiring knowledge involves two key players, namely, the knowledge holder (Foreign partner) and the knowledge receiver (Local partner) (Hua and Evangelista, 2007). Foreign personnel who work at contact points with a local partner must be sufficiently knowledgeable to plug a gap in the knowledge between the source and the recipient. This research is focused on exploring the theory that underpins the transfer of knowledge within ICJV projects in Thailand. Since the aim of the research is to identify and understand the processes of transferring knowledge in ICJV projects, the knowledge flow between actors from Foreign-Local (F-L) in selected projects will then be studied. Moreover,

Goh (2002) and Hau and Evangelista (2007) posit that Type of knowledge is another important factor to consider in the basic process underlying knowledge transfer.

(b) Types of knowledge transferred in ICJVs

In today's knowledge economy, the key to a sustained competitive advantage is the ability to deliver new products and services to market ahead of the competition (Yitmen, 2011). Joint ventures between actors of foreign and local companies are recognised mechanisms for KT and thus a way of acquiring skills that are lacking (Carrillo, 1996). Many organisations seize the opportunity to acquire new knowledge based on these collaborative arrangements. An International Joint Venture (IJV) is defined as a joint venture with at least one partner headquartered outside the joint venture's country of operation (Ozorhon et al., 2008). IJVs are also recognised as a latent method of enhancing construction firms' international competitiveness *ibid*). Moreover, they can be a mechanism for transferring knowledge between partners and a way of improving the knowledge and skills of the local partner(s) (Hajidimitriou and Rotsios, 2009). There has recently been growing interest in the acquisition of managerial knowledge, particularly by forming an international strategic alliance with partners from developing countries (Hau and Evangelista, 2007). The primary contribution of knowledge by foreign partners in transition economies consists of technology, management expertise, market knowledge, and global support, while the local partner provides knowledge of local institutions and an insight into the way to deal with various government bureaucracies and matter of local culture. According to Carrillo (1996), various kinds of knowledge and skills are necessary for international construction, including technical expertise, management expertise and skills, financial risks and financial backing, and more significantly, the transfer of knowledge.

Similarly, expertise in project management, project planning, expertise in high-speed grouting technology and high levels of quality control are also the main areas in which local companies lack expertise and need to learn from their foreign partners. Ofori (1996) also states that international companies can be most helpful in providing their local partners with human resource development skills, technical expertise, financial backing, etc. Furthermore, Ganesan and Kelsey (2006) posit that the primary knowledge transferred in construction is based on design knowledge and skills, embodied technologies in building materials and components, construction techniques and equipment, and organisation know-how and management systems. All the aforementioned types of knowledge were identified to flow between actors from local and foreign partners in international construction in the literature reviewed in this paper. Therefore, local partners who wish to enter the emerging market and secure long-term competitiveness in this new environment need to quickly develop the required resources. Thus, it is especially important to understand how new knowledge in ICJV projects can be transferred and adopted. All types of knowledge flow between actors from local and foreign partners in the context of international construction found in the literature review are presented in Tables 3.1 and 3.2.

Table 3.1 Knowledge flow between foreign and local company

Authors	Learning from foreign to local company	Learning from local to the foreign company
(Carrillo, 1996)	1. Technical expertise 2. Management expertise and skills 3. Financial risks and financial backing 4. Project planning skills 5. Ability to resource project 6. Expertise in the high-speed/ high levels of QC 7. Logistics 8. Vertical movement of materials and manpower 9. Expertise in project management 10. Specific natural gas technology 11. Quality assurance and control 12. Safety 13. Planning and project control	
(Ofori, 1996)	1. Strong financial backing 2. A disciplined and motivated workforce 3. Advanced technology 4. Structure organisation 5. Efficient project management 6. Accumulated experience and track record 7. Comprehensive support facilities 8. Human resource development 9. Good track record 10. Technical expertise 11. Financial backing 12. Corporate commitment and ability to assess 13. Risks	1. Practice under-pricing to win projects 2. Use transfer pricing to record losses on their local operation 3. Avoid paying local taxes 4. Knowledge of local situation 5. Local government policies 6. Knowledge of local customs 7. Resources 8. Administrative Procedures
(Ganesan and Kelsey, 2006)	1. Design knowledge and skills 2. Embodied technologies in building materials 3. Construction techniques and equipment 4. Organisation know-how and management systems 5. Conceptual and details design 6. Domestic production and imports of construction 7. Training of skilled workers 8. Execution of projects using new technologies 9. Project fully or partially funded from overseas 10. Business in overseas project 11. Investment in the construction sector 12. Increased equipment 13. Labour productivity 14. Financial support	
(Hau and Evangelista, 2007)	1. Marketing know-how 2. Managerial know-how/ Management know-how 3. Training programmes 4. Technology know-how	
(Ozorhon et.al, 2007)		1. Political stability 2. Macroeconomic conditions 3. Strong legal system
(Steensma et.al, 2008)	1. Technological expertise 2. Marketing expertise 3. Product development 4. Foreign cultures and tastes 5. Managerial techniques 6. Product processes	1. Knowledge of a local institution 2. Dealing with various government bureaucracies 3. Local culture 4. The knowledge of local market conditions
(Ozorhon. et al., 2008 and Ozorhon. et al., 2010)		1. Local Language 2. Local business practices 3. The political and legal system 4. Economic environment 5. Industry structure 6. National culture
(V.V. et al, 2000)	1. Technology, quality and safety standards 2. Know how modern site management is done 3. Marketing knowledge	1. Gaining working knowledge under local conditions 2. Bidding strategy incorporates the preferential margin scheme
(Devapriya and Ganesan, 2002)	1. Design skills 2. Construction techniques 3. Materials or equipment manufacturing techniques 4. IT systems 5. Advanced production systems 6. Employment in international projects 7. Manpower training programmes 8. Transfer of materials or equipment manufacturing capacity	

Table 3.2 Type of Knowledge flow between actors in ICJV projects (From analysis)

Type of Knowledge flow between actors	
<u>A. Design Knowledge and Skills</u>	1. Conceptual skills 2. Design skills and Details design
<u>B. Technical Expertise</u>	1. Construction techniques (such as high-speed grouting of piles, high grade of concrete specified, large concrete pours) 2. Construction knowledge 3. Product process and development 4. Transfer and movement of materials and manpower or equipment manufacturing capacity 5. Accumulated experience and track record/ good track record
<u>C. Management Expertise</u>	1. Project management 2. Project planning and control 3. Project resource management 4. Human resource management and development (such as disciplined and motivated workforce) 5. Organisational management 6. Procurement system 7. Subcontracting arrangement and management/ corporate commitment and ability to assess 8. Employment of subcontractors in international project 9. Risk management 10. Site management 11. Cost management
<u>D. Technological Expertise</u>	1. Technologies in building and components 2. Advanced production systems (such as prefabrication systems) 3. Specific technology (such as Natural gas technology) 4. IT systems 5. New technologies from overseas collaboration
<u>E. Economic, Marketing and Financial Expertise</u>	1. Investment in the construction sector 2. Marketing knowledge/ Marketing know-how 3. Financial risk 4. Financial backing/ strong financial backing/ financial support 5. Project fully and partially funded from overseas 6. Practicing under-pricing to win projects 7. Bidding strategy incorporates the preferential margin scheme 8. Avoid paying local taxes 9. Economic environment 10. Industry structure 11. Macroeconomic conditions
<u>F. Quality Assurance and Control Expertise</u>	1. Quality assurance and control 2. Quality standard
<u>G. Safety Expertise</u>	1. Safety standard
<u>H. Construction Resources</u>	1. Construction resources (such as materials, equipment, tools and etc.) 2. Construction equipment (such as Increased equipment, Materials or equipment manufacturing techniques and capacities) 3. Labour productivity 4. Local Resources 5. Comprehensive support facilities
<u>I. Training Programmes</u>	1. Training of skilled workers, their migration for overseas jobs and their re-employment in domestic construction 2. Manpower training programmes 3. Training programmed
<u>J. Local Condition and Culture</u>	1. Foreign/ Local culture and National culture 2. Local language 3. Knowledge of local situation/ institution 4. Knowledge of local market conditions 5. Local government policies/ dealing with various government bureaucracies 6. Knowledge of local customers 7. Administrative procedures 8. The strength of legal system/ legal system 9. Political stability/ political system 10. Gaining knowledge of local conditions 11. Local business practice

However, there are other factors that influence KT Processes, namely, 1) Performance and Success Factors of ICJVs, 2) Knowledge Facilitators, Key enabling and inhibiting factors that influence knowledge transfer in ICJVs and Knowledge transfers methods and mechanisms.

(c) Key factors that influence KT processes

1) Performance and Success Factors of ICJVs

There has been an unprecedented change in the nature of the global business environment over the past two decades. The number of ICJV projects has grown at an increasing pace on a global basis but, especially in developing countries, where ICJVs are regarded as one of the best instruments for attracting foreign investors based on national development and the domination of the local economy (Mohamed, 2003). The measurement of the performance of strategic alliances has long been an important research topic in the field of international management (Ozorhon et al., 2007). The key performance and success factors of ICJVs identified from the literature are presented in Table 3.3.

Table 3.3 Key Factors of Performance and Success of ICJVs

Authors	Performance and Success Factors of ICJVs
ADNAN, H. & MORLEDGE, R. (2003)	Mutual Understanding/ Inter-partner trust/ Agreement of Contract/ Commitment/ Cooperation/ Financial Stability/ Coordination/ Communication/Information/ Management Control/ Profit/ Partner Experience/ Criteria for Partner Selection/ Organisation Structure/ Compatibility of Objective/ Equity Control/ Effective Human Resource Management/ Motivation for forming IJV/ Knowledge Transfer/ Size Compatibility of Partner's firm/ Cultural Understanding/ Conflict
GALE, A. & LUO, J. (2004)	Selection of a suitable partner/ Clear statement of JV agreement/ Obtaining enough information about potential partners before negotiation/ Clear identification of partner's objectives/ Control of the majority ownership of the capital.
OZORHON, B., ARDITI, D., DIKMEN, I. & BIRGONUL, M. T. (2007)	Conditions of the host country/ Project-related factors/ Project performance/ Partner performance
OZORHON, B., ARDITI, D., DIKMEN, I. & BIRGONUL, M. T. (2008)	Culture
MO, X., OMRAN, A. & PAKIR, A. H. K. (2011)	Institutional/ Structural/ Task-related
Enshassi, Mohammed, and Abushaban (2009)	Cost factors, Time factors, Quality factors, Productivity factors, Client satisfaction factors, Regular and community satisfaction factors, People factors, Health and safety factors, Innovation and learning factors, and Environmental factors
ADNAN, H., KASSIM, A. N. & CHONG, H.-Y. (2012)	Preparation/ Financial/ JV Formation/ Social and Culture/ Technical and Technology/ Services/ Human and Employment
(Hong and Chan (2014)	Motivation behind ICJV formation, critical success factors, and risk analysis and management
Son, Han, and Rojas (2015).	Firms' partner choice
Taengkliang (2016)	Motivation, local's partner characteristic, foreign's partner characteristic, cultural distance
Mba and Agumba (2018)	Mutual understanding, Inter-partner Trust, Co-operation between the members, commitment, communication between partners, management control, partner experience

Performance is a complex and multidimensional phenomenon ([Ozorhon et al., 2011](#)). Figure 3.5 presents the performance of ICJVs which is defined in terms of 1) 'Project performance' or the extent to which predefined project objectives are realised; 2) 'Performance of the IJV management' or the effectiveness of the control of the IJV operation; 3) 'Partner performance' or the extent to which the current company objectives are realised as a result of undertaking a project based on an IJV; 4) 'A partner's satisfaction with the overall performance of the IJV' which is one of the most frequently-used subjective measures of an IJV performance; 5) 'Host country conditions' and 6) 'Project-related factors' which refer to the completeness of payments by the client, the relationship with other project parties to the project, the completeness of the project definition and the effectiveness of the project management functions, such as planning, monitoring, and control ([Ozorhon et al., 2007](#), [Ozorhon et al., 2008](#) and [Ozorhon et al., 2011](#)).

- 'Project performance' is defined as the extent to which the predefined project objectives are realized. IJVs in construction are essentially formed to execute project-based activities. Part of the operational success of an IJV in the construction industry can be defined in terms of project success.
- 'Performance of the IJV management' is defined by the effectiveness of control of the IJV operation. Control is defined as the influence exercised by the partners of the management of the venture.
- 'Partner performance' measures the extent to which present company objectives are realised as a result of a project undertaken through an IJV. The assessment of the IJV performance is to some extent related to the degree to which the objectives of the IJV partners are achieved to some extent.
- 'A partner's satisfaction with the overall performance of the IJV' is one of the most frequently used subjective measures of an IJV performance. The main advantage of this measure is its ability to provide information regarding the extent to which the IJV has achieved its overall objectives. Selection of ICJV partners has been identified as one of the critical success factors for ICJV projects (Hong and Chan (2014)).
- 'Host country conditions' were defined in this study by political stability, macroeconomic conditions, the strength of the legal system and the relationship with the host government.
- 'Project-related factors' include the completeness of payments by the client; the tolerance/flexibility of the client; relationship with other project parties; competence of other project parties; completeness of project definition; availability of resources; technical complexity of the project; impact of factors such as weather and soil conditions; completeness of the design; the completeness of the contract documents; handling the project requirements in terms of quality, environment, health and safety; penalty sanctions concerning duration; and the effectiveness of the project management functions, such as planning, coordination, monitoring, and controlling.

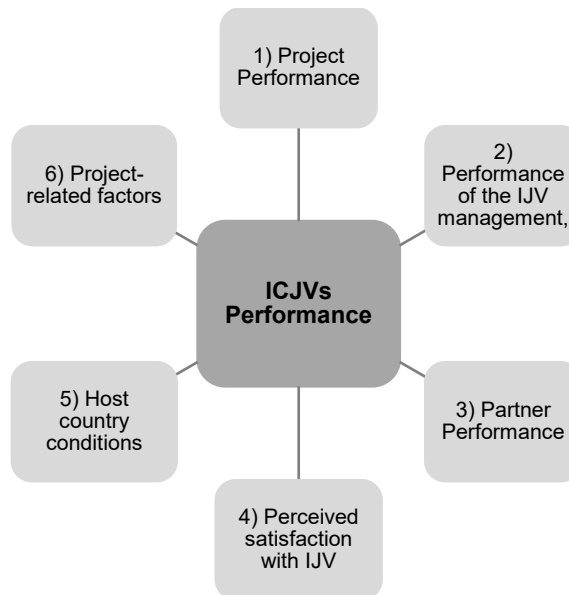


Figure 3.5 ICJVs Performance (Ozorhon et al., 2007, Ozorhon et al., 2008 and Ozorhon et al., 2011)

The number of construction joint ventures has developed and is growing rapidly. Adnan, Kassim and Chong (2012) reveals that partner-related factors are important for the successful management of a joint venture between firms from diverse cultures, while Adnan, (2005) maintains that the agreement of contract terms is critical to the successful implementation of joint venture projects. A good JV agreement is an essential success factor and can avoid a great deal of trouble and conflict in future joint venture operations if they are drafted in clear terms and conditions that can be easily understood by all partners as well as the worker. Additionally, Adnan, Kassim, and Chong (2012) identify seven success factors that influence knowledge transfer processes in joint venture projects: 1) Preparation, 2) Finance, 3) JV Formation, 4) Society and Culture, 5) Technical and Technological, 6) Services and 7) Human Resources and Employment. Hence, it is clear that the success factors of a construction project greatly depend on the quality of competent humans in the organisations, who are able to work as a team in a joint venture. Importantly, it is acknowledged that inter-company collaboration entails the requirement of mutual inter-organisational commitment and trust and willingness to cooperate in achieving targeted objectives. It seems clear that construction industries in developing countries need to urgently address these problems and the formation of a JV is recommended as the best option for managing large projects in developing the world. Successfully establishing a JV not only offers opportunities for expansion but also combines both parties' valuable skills to complete projects effectively and efficiently.

Therefore, based on the review of the literature gathered for this research, it is clear that a successful construction project greatly depends on the quality of competent humans in the organisations and their ability to work as a team in a joint venture. It seems that the most significant success factors are considered to be the preparation and formation of the ICJV, mutual understanding, agreement or contract, management and control, partner's experience, profit, technical and technology, human resources and services (Adnan and Morledge, 2003 and Adnan et al., 2012).

2) Knowledge Facilitators

The contextual conditions in which knowledge transfer takes place can strengthen, or weaken the flow of knowledge within projects (Hajidimitriou and Rotsios, 2009 and Everett, 2006). Here, these conditions are referred to as knowledge facilitators.

Firstly, Trust plays a major role in the success of an ICJV and has a huge impact on the way partners work together (Hajidimitriou and Rotsios, 2009). The factor of trust has also been specifically examined in the context of ICJVs (Hong and Chan (2014). Mutual trust among JV partners is a necessary precondition for successful cooperation (Picha, et.al, 2017). According to Everett (2006), trust among individuals (or organisational units) is an essential factor in establishing motivations favorable to KT; therefore, trust is an important motivator and facilitator of KT. Likewise, trust has a strong impact on the acquisition of knowledge, since it facilitates the exchange of information and resources and leads to common problem-solving techniques (Hajidimitriou and Rotsios, 2009). A high degree of trust between the members of a JV is vital for its' successful operation (Mba and Agumba, 2018). As a result, trust determines the degree of KT and the efficiency and effectiveness of the process. Therefore, it is important to note that trust is one of the most significant elements of an inter-partner relationship (Ozorhon et al., 2008).

Secondly, Ozorhon et al., (2008) and Mba and Agumba (2018) established that commitment is important facilitator for the success of ICJV project. Commitment as the willingness of IJV partners to exert an effort on behalf of the IJV. Committed partners are unlikely to be interested in creating and maintaining a good relationship with other partners and they are more likely to consider long-term gains than short-term advantages.

Thirdly, Adnan and Morledge (2003) identify Cultural Distance between partners as one of the distinctive contextual factors in the literature that plays an important role in IJV learning. Cultural distance can be defined as the trajectory that is the outcome of culture-based factors (i.e. language, values, norms or meanings), which impedes the flow of information between partners. However, the difference or distance between two cultures has little relevance until those cultures interact. In the case of an IJV, the cultural distance can produce friction when the parent firms interact with each other at various stages of the IJV's lifecycle (Hua and Evangelista, 2007). Moreover, Taengkliang (2016) states that the effect of cultural distance has significant relationship between knowledge transfer and IJV firms' performance.

Fourthly, The Prior Experience of engagement between the partners can serve as evidence to justify subsequent risky steps; moreover, a prior relationship indicates a history of repeated interaction, which may lead to relational advantages and stability (Ozorhon et al., 2008). Previous cooperation also fosters a climate of openness, which is essential for discussing any behavioral problems that may constitute a barrier to learning.

Fifthly, Mba and Agumba (2018) established that communication plays a major role in the success of any business. Effective communication between IJV partners is important for a good inter-partner relationship (Ozorhon et al., 2008). It also enables the partners to have a

mutual understanding of the goals of the alliance and the roles and responsibilities of all the actors. Similarly, it helps individuals to share and disseminate their experience.

3) Key enabling and inhibiting factors that influence knowledge transfer in ICJVs

In order to remain competitive, companies need to develop strategies to retain the knowledge of older workers and transfer it successfully to other employees (Stevens, 2010). The categories of key enabling and inhibiting factors in KT processes are illustrated in Table 3.4.

Table 3.4 Factors affecting knowledge transfer

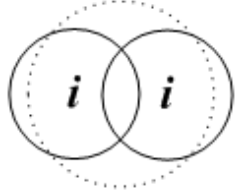
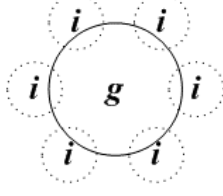
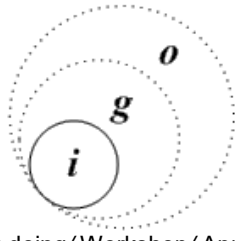
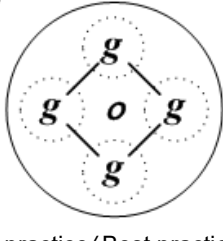
CARRILLO, P. (1996)	STRACH, P. AND EVERETT, A. (2006)	LANDAETA, R. E. (2008)	HAJIDIMITRIOU, Y. & ROTSIOS, K. (2009)	WENDE, E. A. D. H., PARISSA (2009)	ZAIDI, M. D. A. & DAVIES, H. (2011)
1. Training 2. Time 3. Finance 4. Commitment	Trust is an important knowledge transfer motivator.	- knowledge articulability and embeddedness - knowledge distance - knowledge transfer processes and tools - the perceived need for knowledge - organisational culture - cultural differences - size of the organisation - understanding of individuals' cognitive style - senior management involvement - politics - knowledge transfer leadership - lack of standard work processes - learning mandate - the geography - technical regulations	Factors that affect knowledge transfer mentioned in the literature. 1. Motive 2. Commitment 3. Characteristics of tasks and procedures 4. Organisational culture 5. Nature of social ties 6. Personal contacts and face-to-face communication 7. Communication, visits, and meetings 8. Size of the unit 9. Trust between partners 10. Equity ownership (control)	Cross-Cultural: Seven obstacles have been summarised and selected from cultural orientations based on casual expert interviews in preparation for this research initiative. 1. Power dimension 2. Relationship dimension 3. Time dimension 4. Uncertainty dimension 5. Future dimension 6. Communication dimension 7. Information processing dimension	1. Attitude 2. Communication 3. Skill 4. Poor commitment 5. Monitoring and supervision

(d) Knowledge transfers methods and mechanisms

Successful knowledge transfer is considered to be the key to the success of projects and organisations (Wende, and Haghirian, 2009). Steven (2010) defines KT as a systematic and integrative process of coordination within the organisation by using and implementing tools, systems, and processes to improve the activities of acquiring, creating, storing, sharing and using knowledge. Certainly, there are many methods and mechanisms to transfer knowledge. The 'SECI Model' of Nonaka and Takeuchi's (1995) represents the dimension of tacit and explicit knowledge and symbolises the number of people involved in the process. Four modes of knowledge conversion are identified: 1) Socialisation, 2) Externalisation, 3) Combination and 4) Internalisation. Various KT methods and mechanisms that can be used to transfer and adopt knowledge between local and foreign partners in ICJV projects are described in this section and these will be utilised to collect data to identify the methods and mechanisms that are currently used between the actors in the studied ICJV projects. The KT methods and mechanisms identified in the literature are illustrated in Table 3.5.

Table 3.5 Knowledge Transfer Methods and Mechanisms

(Carrillo, 1996, Goh, 2002, Wende, and Haghirian, 2009, Stevens, 2010, Lech, 2011, Park, 2011, Kale and Karaman, 2011, and Alashwal and Abdul-Rahman)

(S) Socialisation (Individual to Individual) (Sharing Knowledge and Experiences)  1. Face-to-face communication/ Face-to-face meetings 2. Socialising out-of-hours (Lunch or Coffee breaks) 3. Video or Telephonic communication 4. Storytelling 5. Visiting colleagues/ other projects/ companies 6. Visiting a foreign company 7. Visiting plants or manufacturers	(E) Externalisation (Individual to Group) (Codification and Documentation)  1. Brainstorming 2. Memoranda and letters 3. Project history/ Case Writing 4. Knowledge sharing board 5. Web-based discussion group 6. Chat rooms/ 'Toolbox' talks 7. Personal intranets 8. Blogs/ Websites 9. Team collaboration tools 10. Expert systems/ Information system/ Information Technology 11. Computer-aided systems/ 3d-models) 12. Simulation and games 13. Decision support systems 14. Problem-solving technology 15. Learning Materials (e-Learning) 16. Communities of Practices (COPs) 17. Group Meetings/ Team meetings 18. Ad hoc Meetings/ Minute Meetings 19. Regular meetings and continuous meetings
(I) Internalisation (Individual to Group and Organization) (Individualization of Experiences)  1. Learning-by-doing/ Workshop/ Apprenticeships 2. On-the-job training 3. Special Training/ Training in concentrated courses 4. Induction Training 5. Hand-on training/ Formal Training 6. Training with a foreign company 7. Mentoring and coaching 8. Lesson-learned Meetings	(C) Combination (Group and Organization) (Best Practice, Expansion of Knowledge)  1. Sharing best practice/ Best practice/ A share best practice database 2. Knowledge Databases 3. Web-based access to data 4. Intranet and internet pages 5. Lesson Learned Database

3.4 INTEGRATED CONCEPTUAL FRAMEWORK

The significance of knowledge transfer, specifically ICJV projects has been argued throughout the literature reviews. Since this process will help to develop and improve their knowledge and capacity to complete internationally, it is especially important to understand how knowledge in ICJV projects can be transferred and adopted. Therefore, given the foregoing discussion, a framework to explore KT processes in selected ICJV projects, has been developed. An IDEF0-type notation was employed to identify the three main parts of the framework, namely, knowledge input, knowledge transfer process, and possible output. The conceptual framework that contains the key factors discussed in this paper is shown in Figure 3.6.

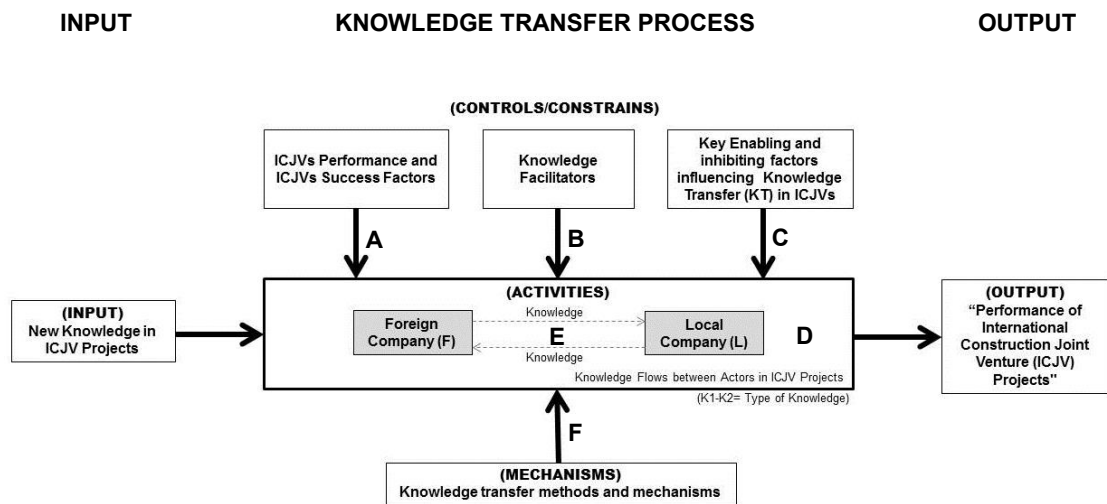


Figure 3.6 Integrated Conceptual Framework of the study

Figure 3.7 is a more detailed version of the conceptual framework since it illustrates the key enabling and inhibiting factors that influence KT processes in ICJV projects. This conceptual framework will be used to indicate the possible transfers of knowledge in the selected ICJV projects. The primary data will be collected and analysed to refine this framework to ensure that it is relevant for use in practice. The case studies will involve two joint venture companies in Thailand that are cooperating in joint-venture agreements with foreign companies and there will be one pilot case study and three main case studies of each company. One of the contributions of this research to knowledge is this conceptual framework, which facilitates an analysis of the key concepts and key factors that influence the KT processes in ICJV project.

3.5 CHAPTER SUMMARY

The purpose of this chapter was to develop a conceptual framework to represent the key factors that influence KT in ICJV Projects. The key finding from the literature consisted of the key enabling and key inhibiting factors that are related to and influence KT in ICJV projects. This conceptual framework also suggests that there are many factors involved in the KT processes in ICJV projects and the contribution of this chapter is to integrate the key enabling and inhibiting factors. This framework not only includes some of the key KT methods and mechanisms that influence KT processes in ICJV projects, but it also paves the way for future research on how to identify the key actors in ICJV projects. Furthermore, it also paves the way for validating the conceptual framework in practice and developing a knowledge transfer framework for ICJV projects.

Having presented and discussed the conceptual framework of this research in detail, the research methodology adopted for the empirical fieldwork will be explained in the next chapter, as well as, the means of collecting and analysing the data.

4. RESEARCH METHODOLOGY

4.1 INTRODUCTION

Having presented the overall background, context and conceptual framework of this study in the previous chapter, this chapter will contain an overview of the research approaches, methodology, and methods utilised to complete the research, which involved selecting an appropriate research methodology to validate the conceptual framework. The research paradigm, research approach, research strategy, data collection, and data analysis methods chosen for the study are explained in this chapter.

The chapter is divided into seven main sections including this introduction. An overview of the research paradigm based on the research context is presented in Section 4.2 with a description of two different epistemologies (Quantitative and Qualitative) a discussion of their relevance to the problem area. Section 4.3 contains a description of the overall research design and the reasonable methods for collecting and analysing the data, while the rationale for adopting a case study as the research strategy provided in Section 4.4. The various aspects of ethical approval are explained in Section 4.5, while issues related to methodological precision and how they are addressed in this study are discussed in Section 4.6. Finally, the chapter is briefly summarised in Section 4.7.

4.2 RESEARCH PARADIGM

There is a range of definitions of a paradigm. A research paradigm needs to be guided by a scientific method (Myers, 2008). A paradigm is a basic orientation to theory and research made by Thomas Kuhn in 1970. In essence, a scientific paradigm is an overall system of thinking (Neuman and Neuman, 2010) about how research should be undertaken. Fellows and Liu (2008) note that a paradigm is a theoretical framework that includes a system by which events can be viewed. The choice of paradigm is important because it not only determines what views are adopted but also establishes the approach to questioning and discovery. Bryman (2015) emphasises that understanding the research paradigm will lead to the choice of a suitable research strategy and research design. The purpose of this section is to establish the context of the research based on the epistemological approach followed in this study. The key considerations related to different philosophical approaches within the research context are highlighted below.

This research is based on two underlying paradigms, namely; positivist and interpretive, as shown in Table 4.1.

Table 4.1 Research paradigm (Source: Compiled from Fellows and Liu (2008) and Bailey (2007))

Basic Beliefs	Continuum	Research Paradigm		Assumptions
		Positivist	Interpretive	
Ontology	Nominalism-Realism	A single objective reality exist	Multiple realities, socially constructed	Whether the object of investigation is the product of consciousness (Nominalism) or whether it exists independently (Realism)
Epistemology	Anti-Positivism-Positivism	What can be learned about the social world exists independently of the researcher	What is learned in research does not exist independently of the researcher	What are the grounds of knowledge are?
Methodology	Ideographic-Nomothetic	Survey questionnaire Simulation Experiment	Action Research Case study	Ideographic or nomothetic ('concrete') approaches to evidence (abstract) collection.

4.2.1 Positivist Paradigm

According to Fellows and Liu (2008), positivism was originally conceived by Auguste Comte (1798-1857). Neuman and Neuman (2010) describe that positivism as a notable paradigm that is widely used and broadly defined in social science research. The positivist approach is a philosophical concept that refers to the study of the social world, which continues to be influential in sociological studies. Positivists regard reliability as the most important characteristic of a scientific method, which is recognised as being closely related to rationalism, empiricism, and objectivity. Positivism is associated with several social theories and structural-functional, rational choice, and exchange theory frameworks (ibid). Moreover, positivists have developed random sampling techniques, rules of questionnaire design and the measurement of outcomes (Myers and Avison, 2002 and McNeill and Chapman, 2005). Positivism researchers prefer to collect precise quantitative data and often use experiments, surveys, and statistics (ibid). In this sense, it seems that positivist research is strongly related to quantitative research (ibid). A quantitative approach was taken in this study with a questionnaire survey and a Social Network Analysis (SNA) in order to identify key actors, network density, network centrality and a clique of the network. Section 4.3 contains a discussion of the quantitative research implemented in this study.

4.2.2 Interpretive Paradigm

Interpretive social science is related to a theory of meaning that originated in the nineteenth century. Interpretive can be traced to the German sociologist, Max Weber (1864-1920) and Wilhelm Dilthey (1833-1911), a German philosopher, but it became even more popular with the emergence and growth of phenomenological sociology in the 1960s (ibid). There are several varieties of interpretive social science; for example, hermeneutics, constructionism, ethnomethodology, cognition, subjective and qualitative sociology (ibid). The interpretive paradigm is particularly valuable for research in management and other social arenas for indicating that reality is constructed by the people involved (ibid). Furthermore, Neuman and Neuman (2010) maintain that this approach concerns how people interact and get along with

each other. An interpretive approach also involves a systematic analysis of socially meaningful actions through a direct observation of people and an interpretation of how people create and maintain their knowledge in the social world.

Positivists perceive that common sense is inferior to science, whereas interpretive social science believes that ordinary people use common sense to guide them in daily life (ibid). Additionally, the interpretive approach is the basis of social research techniques that are sensitive to contexts, able to see the world the way others see it and are more concerned with achieving an empathic understanding. The most likely explanation for this is that social research has traditionally given rise to ethnographic studies; particularly the technique of participant observation and data collected in this way is qualitative in form rather than quantitative. The interpretive paradigm constitutes an important part of today's construction management context (Fellows and Liu, 2008). This research is based on a multiple case study. Qualitative interviews with an interview schedule were conducted to identify and capture the key concepts and factors from the key actors in the related projects. The way the qualitative research was conducted in this study is discussed in Section 4.3.

4.2.3 Justification for the Adoption of Positivist and Interpretive Philosophy

Knowledge Transfer (KT) has been recognised as one of the key factors of success of any type of project and it is also recognised as an important success factor in establishing the new organisation. Positivist and interpretive paradigms are deemed to be the most appropriate to address the aim of this study, which is to investigate how knowledge is transferred successfully in ICJV projects. The rationale for the adoption of positivist and interpretive sociology in this study is presented in Table 4.2.

Table 4.2 A Summary of Differences among Positivist and Interpretive Approach

(Neuman and Neuman, 2010, pp.100-119)

	Positivist Paradigm	Interpretive Paradigm
The nature of the research	Quantitative Research	Qualitative Research
The relationship of theory	Deductive	Inductive
Literacy	Theoretical assumptions	Education Support
Concept	Objective	Subjective
Research Design	Focusing on the structure, system and research process	Without format, opened-system and created by research
Determination	Statistics	Case study
Tools	Standard	Non-standard
Nature of information	Physical	Sensitive information
The purpose of the analysis	Explanatory variables	Understanding
Analysis	Variables	Individual
Statistical techniques	Yes	No
Presentation	Tables	Describing
Generalization	Relationships, self-caused, the rule of reason and logic	Classification and concept
The framework of the study	Generalisation	Specification

In sum, there are substantive differences between positivist paradigm and the interpretivist research. Positivist research devotes its efforts to using the paradigms of mathematics and the natural sciences to construct an ideal and highly detailed science of educational administration. It seems that the positivist paradigm is better for appreciating the richness of the social networks, which is another reason for utilising it to examine the social network context in this research, whereas, interpretivist research places emphasis on the construction of theories and systems. Field research with case study attaches importance to the use of understanding and experience to manifest the feelings and sensations of this study. Field research with case study pays attention to the value of individuality, particularity, difference, and multiplicity. As a result, an interpretive paradigm is a suitable basis for this study because it facilitates a deep exploration that enables the acquisition of a rich description and holistic understanding of the key enabling and inhibiting factors that influence knowledge transfer processes in ICJV projects. The advantage of using field research to explore the issues of this study lies in its ability to better comprehend the origin and development of an issue, and improves the ability and sagacity in the study of issues. Having chosen and explained the research paradigm for the study, the research approach will be described in the next section.

4.3 RESEARCH DESIGN

Research consists of a learning process of gathering data, testing a stated idea and engaging in planned or unplanned interaction with interference. The mixed-methods approach has been widespread in sociology for many years. It has generally been used in two broad ways (McNeill and Chapman, 2005). A triangulation method was used in this study, which involved using a combination of quantitative and qualitative methodologies as a powerful solution to strengthen the research design (ibid). Similarly, triangulations refer to the use of multiple methods to cross-check and verify the reliability of a particular research tool and the validity of the collected data. Hence, triangulation generally entails combining quantitative and qualitative methods in order to check the accuracy of the data gathered by each method (ibid). Both quantitative and qualitative approaches were adopted in this study. The relevance of these two forms of triangulation to the study is discussed in the next two sections to explain why it is the most suitable approach for this research. How to analyse, test, explain and conclude the data using triangulation is shown in Figure 4.1.

transfer processes in ICJV projects in Thailand and to test potential interview questions. Then, a conceptual framework was developed using the literature review and a pilot case study.

4.3.1 Literature Sources

A review of the literature was essential to provide the background of the gap in knowledge in order to identify the key concepts in the areas of knowledge transfer and social networks. The literature review was conducted to demonstrate and identify the existing knowledge in order to bridge this knowledge gap. Furthermore, the literature review helped to select a suitable methodology and methods to be used in this study. The literature review was updated in December 2018.

4.3.2 Data Collection

The data was collected from two case studies in Thailand with one pilot case study and three main case studies of each company. A multiple case study approach was adopted to facilitate the investigation within the context of the projects. The data was collected in Bangkok, Thailand between March 2016 and August 2017. A pilot case study helped to refine the data collection and design the questionnaire with appropriate questions. Furthermore, a pilot case study was proved to be useful to obtain feedback from the participants to revise the form of the questionnaire survey. A combination of quantitative and qualitative data was utilised in this study and the selected research methods are described below.

Quantitative research methods were originally utilised within the natural sciences ([Saunders et al., 2009](#)). This approach to research is mainly related to positivism and is designed to gather concrete data to study the relationship between facts and emphasise the use of measuring quantified data. The quantitative approach essentially involves measuring the collected data ([Fellows and Liu, 2008](#)). In contrast to quantitative research, it is based on words or pictures rather than numbers and graphs. Moreover, it is designed to acquire insights and understand the perceptions of both individuals and groups. The objectivity of qualitative data is often questioned, especially by people with a scientific background in the quantitative, positivist tradition ([Fellows and Liu, 2008](#)). The techniques for analysing qualitative research data may involve transcribing interviews and analysing the content of conversations ([Fellows and Liu, 2008](#)). Likewise, [Creswell \(2013\)](#) states that qualitative research enables the researcher to explore and understand the meaning individuals give to a social phenomenon. In contrast, many social scientists also adopt a qualitative approach in their social research in order to expand the understanding of the social world and have an indirect impact on broad public knowledge. Social science research is designed to develop advanced knowledge of the social world ([Neuman, 2010](#)). The main advantage of qualitative research is the ability to produce rich knowledge, especially in the social context.

As noted above, since the aim of this study is to examine knowledge transfer processes in the context of ICJV projects, it was considered to be appropriate to conduct the research based on a combination of quantitative and qualitative approaches. Quantitative research was used to

collect demographic details and map the social network within the projects, while qualitative research was used to obtain more in-depth information in order to better understand the participants' current perspectives, as well as explore any new ideas. Likewise, qualitative research could be especially useful in examining the processes used to transfer knowledge and identifying the key factors that facilitate or inhibit the success of those processes. Furthermore, the use of the qualitative method can facilitate an understanding of the social and cultural contexts within which the participants work and how they approach them from different job positions in order to compare, contrast and understand their perspectives. On the contrary, a survey or questionnaire based on the quantitative method could generally not provide detailed and rich information needed to deeply understand a complex phenomenon, such as the transfer of knowledge. Since the research is not so much concerned with knowing the objective truth, but rather the truth as it is perceived by the participants, the use of the qualitative method can produce a more complete portrayal than the quantitative approach. Therefore, this study is based on an interpretive paradigm with the use of a qualitative mode of inquiry.

Several qualitative research strategies could be useful in a study of "Knowledge Transfer on International Joint Venture Construction Projects in Thailand". There is an increasing awareness that some qualitative research strategies, such as case studies, grounded theory, and action research are especially useful for examining social phenomena. Therefore, a qualitative research strategy based on a case study was deemed to be the most suitable approach for this particular research, since an in-depth case study is the most appropriate strategy for conducting research directed by an interpretive paradigm. A combination of quantitative and qualitative data was collected and a multiple case study approach was adopted to undertake the investigation within the context of the selected projects.

Quantitative data

A quantitative questionnaire was developed for use during the pilot study. [Wasserman and Faust \(2009\)](#) state that questionnaires are most commonly used collection method and they usually contain questions that can identify and measure the relationships between actors. This questionnaire was tested during the pilot case study and revised based on feedback from the respondents and the researcher's observations. The data collection began when the questionnaire was finalised and key management experts, such as general managers, project managers and key construction workers from the two case studies in Thailand were invited to complete it. The distribution of the questionnaire also facilitated the use of snowball sampling, since the respondents were asked to identify other key participants with the specific range of skills and attributes that have been determined to be critical for the transfer of knowledge. The questionnaire was also used to collect data on actors' attributes, and the respondents' knowledge transfer ties. Microsoft Excel and Social Network Analysis (SNA) software (UCINET) were used to analyse the results of the questionnaire survey and identify key participants/actors and experts involved knowledge transfer in ICJV projects.

The questionnaire was divided into three main sections, the first of which was designed to collect data regarding the 'actors' attributes', such as name (Q1), gender (Q2), age (Q3),

nationality (Q4), educational qualification (Q5), years of experience in the construction industry and in the ICJV project (Q6-7), position (Q8), primary discipline (Q9), and experience of delivering ICJV project (Q10). Hence, the questionnaire contained several questions related to experience in training and visiting local or foreign partners, and their job roles and responsibilities in this ICJV project (Q11-14). The second section of the questionnaire was designed to map the knowledge flow in the ICJV project by collecting the social network data. [Wasserman and Faust \(2009\)](#) indicate that a questionnaire usually contains questions about the respondents' ties and relationships with other actors. The questions can be used in three different ways, as explained below.

Roster vs. free recall – the issue of whether questionnaires should be presented with a complete list (roster) or whether the respondents should be allowed to generate lists of names (free recall)

- A roster can only be used if the researcher knows all the members of the group prior to gathering the data.
- Free recall can be used if not all the members of the group are known
- Ex. Friends in a class vs. community elites

Free choice vs. fixed choice

- Free choice – nominations or responses of actors are not constrained
- Fixed choice – the number of nominations or responses of actors is constrained
- Ex. Responses about the environment vs. top three people respondents interact with.

Ratings vs. complete rankings – used to reflect intensity;

- Ratings – respondents are required to apply a quantitative value to relationships
- Complete rankings –respondents are required to rank their ties to all other actors based on what is being measured
- Ratings and rankings with multiple responses that produce valued relationship; are dichotomous and directional

[illegible]

Figure 4.2 Example of a Social Network Question

The third section of the questionnaire was designed to identify the methods used by the participants to obtain and share knowledge within the project (question 20, 21, 22, 28, 29, and 30).

Person No.	Which type of METHODS DO YOU USE TO GET KNOWLEDGE of others within this project? (See details in Table 2)				How frequently do you use this tool?				
	(S) Socialization	(E) Externalization	(C) Combination	(I) Internalization	Less than once a week	Once a week	More than once a week	Once a day	More than once a day
0	1				1	2	X	4	5
		11			1	X	3	4	5
				4	X	2	3	4	5
					1	2	3	4	5
					1	2	3	4	5

Figure 4.3 Example of a Social Network Question to identify the methods used

Questions 31 to 34 gave the participants the opportunity to suggest some ways to improve the knowledge transfer processes in ICJV projects. The participant information sheet can be found in Appendix A, the consent form in Appendix B and the questionnaire survey in Appendix C.

Qualitative data (In-depth Interviews)

On the other hand, qualitative interviews based on an interview schedule were conducted with the key participants/actors and experts involved in transferring knowledge in the ICJV projects. An interview schedule with open-ended questions was designed in order to enrich the quantitative data related to the knowledge transfer methods and key factors. The knowledge transfers methods, the key enabling and inhibiting factors that influence the process of transferring knowledge in the ICJVs projects were identified. Furthermore, the key participants/actors and experts were invited to suggest ways in which the transfer of knowledge in the ICJV projects can be improved. The NVivo software package was used to analyse the qualitative data. The interview schedule can be found in Appendix D.

Documents

Gathering documents has long been regarded as an important means to collect data in qualitative studies (Creswell, 2013), and it plays a particularly crucial role in case study research (Blumberg et al., 2011). Case study researchers often supplement interviews with the gathering and analysing of relevant documents produced in the course of everyday events (Gibson and Brown, 2009). Yin (2008) points out that document are important to corroborate and augment evidence from other sources. In this study, the necessary information of each case study and each case study was collected from the company's website, annual reports, and organisation chart to verify particular issues and dates of projects. This documentary evidence enabled the researcher to build a richer picture of the phenomenon being studied.

4.3.3 Data Analysis

A data analysis is defined as a systematic process of searching and arranging the data in order to gain understanding and find useful meaning (Boeije, 2010 and Burns, 2000). According to Bogdan and Biklen (2006), a qualitative data analysis involves working with qualitative data (interview transcripts, field notes, and other materials), organising them, breaking them into manageable units, synthesising them, searching for patterns, discovering what is important and what can be learned from them, and deciding the findings. The data display refers to the organised assembly of information to facilitate the drawing of conclusions. It includes narratives, matrices, graphs, tables and various charts. Research methodology books and articles offer various general approaches to analysing qualitative data, including a content analysis, grounded theory, narrative analysis, conversational analysis, discourse analysis, hermeneutics, and semiotics. The qualitative content analysis technique was found to be the most appropriate method for use in this study and the rationale for choosing it will be justified in the next section.

Descriptive Statistics

Descriptive statistics consists of a statistical summary that quantitatively describes or summarises features of a data collection. Descriptive statistics are used to describe the basic features of the data in a research. Descriptive statistics provide simple summaries about the measures and the sample. In this study, descriptive statistics is found to be important to analyse the data regarding the actor attributes such as gender, age, nationality, educational qualification, years of experience in the construction industry and in the ICJV project, position, primary discipline, experience of delivering projects in ICJV project, and experience in training and visiting with local or foreign partner, and their job role and responsibilities in this ICJV project. Moreover, descriptive statistics are found to be important to analyse the data regarding the type of methods used to receive and share knowledge and also the frequency of these knowledge transfer processes.

Qualitative Content Analysis

A content analysis is one of the techniques widely used to analyse qualitative data. There are generally two types of content analysis, namely, quantitative analysis and qualitative analysis. The results of a quantitative content analysis are presented as frequency counts (Wilkinson, 2011), whereas a qualitative content analysis is used to interpret meaning from the content of the text (Mayring, 2000). Similarly, researchers who use a qualitative content analysis mainly focus on 'the contextual meaning of the text'. A qualitative content analysis technique was used in this study in order to understand the nature of the phenomenon in the context of the literature review. The contents of the questionnaires required the participants to elaborate on the following points;

- Please briefly describe your job role and responsibilities in this ICJV project (Q13)
- Who do you report to during this project and how often? (Q14)
- Which METHODS do you use most to RECEIVE knowledge from others within this project? (Please Specify) (Q31)

- Which METHODS do you use most to SHARE your knowledge with others in this project? (Please Specify) (Q32)
- Do you have any suggestions on how to share experience within JV projects? (Q33)
- Do you have any other comments and/or recommendations? (Q34)

Social Network Analysis using UCINET and NetDraw Software Package

A social network is a pattern of ties that exist between different entities (People, organisation, and countries). A social network analysis is important to synthesise and represent the results. In this study, it was used to generate a series of social networks to transfer knowledge within ICJV projects. The establishment of effective social networks with partner firms is essential to capture the full potential of knowledge transfer. UCINET is a software programme developed by a group of a student at the University of California, Irvine (UCI) for the purpose of analysing social network data. This programme is easy to use and covers a basic graph of theoretical concepts, a positional analysis, and multidimensional scaling. The principal social network analysis procedures are found under the NETWORK menu and there is sub-menu for COHESION, COMPONENTS, CENTRALITY, SUB-GROUP, and ROLES&POSITIONS (Scott, 2007, Scott, 2012 and Borgatti, Everett, and Freeman, 2002). As mentioned in the previous section, a multiple case study was used in this research project to examine the associated social network of the different trades involved in ICJV projects in Thailand. The case study was used to address two primary objectives associated with this research: 1) To analyse the Social Network that exists among different trades involved in ICJV projects by creating an adjacent matrix, and 2) To analyse the social network to identify the key enabling and inhibiting factors that influence the knowledge transfer in ICJV projects. A Social Network Analysis (SNA) software (UCINET) and NetDraw were used to analyse the results of the questionnaire survey in this study and to identify key participants/actors and experts involved in transferring knowledge in ICJV projects.

Use of NVivo Software Package

The significant advantage of using computer software for a qualitative data analysis has been the subject of much discussion. Qualitative methods are chosen when the aim is to achieve a detailed understanding of a process or experience. Many qualitative researchers suggest the use of software such as NVivo to conduct qualitative data analysis. NVivo was first introduced by Tom Richards at La Trobe University in Melbourne, Australia in 1981, and has continued to be developed to support researchers in various ways based on extensive feedback. NVivo is intended to help users to organise and analyse non-numerical or unstructured data by enabling them to classify and arrange information, examine relationships between the data; and combine analysis with linking, shaping, searching and modelling. The use of NVivo for a qualitative analysis helped researchers to manage data, manage ideas, query data, visualise data and make a report from the data. The benefits of using NVivo computer software for analysing qualitative data are speed, enhanced research quality and an improved of data representation (Al-Salti, 2011).

- **Speed:** qualitative software enables researchers to handle, manage and search data in a shorter time than with a manual process.
- **Enhanced research quality:** qualitative software enables researchers to be consistent in the analytical procedures, which improves the validity of the research.
- **Improved data representation:** qualitative software enables researchers to display the data in a graphical format, which facilitates a better interpretation and discussion from different perspectives.

NVivo 10 was used to conduct a qualitative content analysis of the transcript of the interviews with key knowledge transfer actors within ICJV projects in Thailand in order to simplify and accelerate the data analysis. NVivo 10 was found to be a useful tool for coding such large quantities of unstructured text. It enabled the development of themes inductively while simultaneously facilitating a more systematic analysis of the data by allowing an opportunity to re-visit the data should new insights or new information become available, thereby improving the accuracy of the results. Additionally, NVivo 10 proved to be useful for creating memos linked to specific sections of text or recording the relationships among themes. In this way, it provided an efficient and transparent mean to code, search for and locate relevant segments of text within and between cases.

4.4 RESEARCH STRATEGY

Social studies come in many shapes and sizes. Research can be organised in several ways, such as experiments, case studies, cross-case research, qualitative or quantitative (Neuman and Neuman, 2010). Case study research is used to examine many features of few cases. The cases can be individuals, groups, organisations or events. Most case study research is qualitative research. The purpose of almost all qualitative research is to construct representations based on in-depth and detailed knowledge of cases (ibid). A case study can be used to intensively investigate one or a small number of cases by examining many details in each case and context. Moreover, case study research can also incorporate multiple perspectives of one situation or event (ibid). Therefore, since the use of case study can be said to facilitate an in-depth investigation of particular instances of a phenomenon (Fellows and Liu, 2008), a multiple case study approach was adopted in this study to facilitate an in-depth investigation of the transfer of knowledge with these ICJV construction projects.

4.4.1 Multiple Case Study Approach

Case study research continues to be an essential form of social science inquiry (Yin, 2008). Case studies have been widely used as a research strategy in many situations to contribute to the knowledge of individuals, groups, organisation and related phenomena (Yin, 2014). The use of a case study as a research strategy has several advantages (Al-Salti, 2011). As a research method, a case study is also used to find the answer to the research question, fulfil the research objectives and identify the purpose of the research (Greenhill, 2002). A case study allows the

researchers to focus on a “case” such as the behaviour of a small group, organisational and managerial processes, and international relations (ibid).

Case study research can be designed as either a single case or multiple cases. The study of a single case enables the researcher to get close to the phenomenon being investigated and thus, obtain rich descriptions and a complete analysis of the primary data. A single case approach is often selected because the studied case is both exemplary since it pertains to extreme and/or unique circumstances, and revelatory, being one of the first examinations of the phenomenon for scientific purposes. On the other hand, a multiple case study approach facilitates a cross-case analysis and comparison, and the particular phenomenon can be investigated in diverse settings (ibid). Furthermore, multiple case studies yield more general results than a single case and they are the most useful for extending descriptions and theories. However, multiple case study research tends to be more time consuming than a single case study and results in much more data to be analysed (Oates, 2006). Therefore, in view of its advantages and despite being time-consuming, a multiple case study approach was used in this study to investigate the selected projects. This is referred to as a “within-case analysis” (ibid). According to Eisenhardt (1989), the use of a within-case analysis helps the researcher to overcome the problem of coping with massive amounts of data by putting more focus on each case and the producing a detailed write-up. Eisenhardt (1989) further states that a within-case analysis “allows the unique patterns of each case to emerge before investigators push to generalise patterns across cases”. Moreover, Miles and Huberman (1994) define a within-case analysis as involving a detailed case study write-up for each site in order to become intimately familiar with the contextual elements of each case as a stand-alone entity. Therefore, the organisations’ names remain anonymous and pseudonyms are used instead of the participants’ real names.

4.4.2 Number of Case Studies

This research was based on a multiple case study design. Another issue that researchers should consider when using multiple case studies is the number of cases (Yin, 2008). Various researchers suggest using a different number of cases to enable the findings to be extracted (Paré, 2004). Voss et al. (2002) argue that the fewer the number of cases, the greater the opportunity for an in-depth observation. Moreover, Eisenhardt (1989) suggests that case study research should consist of 4-10 cases in order to capture the complexity of the phenomenon being investigated. The selection of the number of cases is necessarily influenced by the research aim and question. In the same vein, Romano (1989) clearly states that the decision of the number of cases to be included is left to the researcher. In order to fulfill the research aim and objectives, the data for this study was collected from two case studies with three main ICJV projects of each case study. These two case studies have an excellent performance record in infrastructure construction projects in Thailand and have joint-venture agreements in Thailand with foreign companies from countries such as France, Germany, and Japan. The data for these six ICJV projects were collected from a sample of managerial and professional staff from

July 2016 until August 2017 in Bangkok, Thailand. The following selection criteria were developed in order to select ICJV companies with comparable features:

- Construction contractors in Thailand that are listed on the Stock Exchange Thailand (SET) and reported their annual revenue between 2010 and 2014.
- Professional members of Thailand's Construction Industry Board.
- Construction companies that cooperate/ have joint-venture agreements in Thailand with foreign companies from other countries, such as China, Taiwan, Korea, Japan or countries in Europe.
- Construction companies that are well established and have been operating continuously for more than 20 years.

The first case study in this research was the case study one, which was established on the 15th August 1958 with a registered capital of Baht 2,000,000. Case Study one registered as a Public Company Limited on the 24th March 1994 and was listed on the Stock Exchange of Thailand on the 9th August 1994. At year-end 2003, Case study one's turnover was 18,330 million Baht making it the largest infrastructure construction company in Thailand and one of the largest in the whole of Southeast Asia. Case study one has successfully completed the construction of many mass transit projects, the first of which was the 23.5 km Bangkok Transit System (BTS). Then, it entered into a joint venture business with two Japanese companies to complete the construction of the 10.5 km northern part of the underground Mass Rapid Transit (MRT) system. This contract comprised the construction of 10.5 km long, 5.7 m diameter, twin tunnels, 9 underground stations, and associated buildings (car parks, etc.). In addition to the domestic market, Case study one has expanded its business overseas to many countries, such as India, Bangladesh, Cambodia, Lao PDR, Indonesia, Maldives, Myanmar, the Philippines, Madagascar, Taiwan, Vietnam, Australia, Hong Kong, etc.

The second case study in this research was the case study two, which was incorporated as a limited company, with the initial registered capital of 1.4 million Thai Baht, on the 27th November 1972, to engage in the construction business in Thailand, e.g., construction of buildings and general civil works. In 1981, Case Study-Two entered into a joint venture business with Tokyu Construction Co., Ltd., one of Japan's top ten construction contractors to learning the construction technology and enlarge their business alliance. Case study two was converted into a public company, resulting in an increase in its registered capital to 1,050 million Thai Baht and listed on the Stock Exchange of Thailand (SET) on 19th April 1996. Case Study-Two had construction technology development through its joint venture with foreign companies which possess expertise, e.g., Bilfinger AG from Germany, Thames Water International Limited from England, Kumagai Gumi Limited and Tokyu Construction Co., Ltd. from Japan. This has enabled this company to expand its scope of engagements to the point it's become one of a few construction companies which are sufficiently well prepared to carry out sophisticated advanced construction technology in Thailand.

Despite the above-mentioned advantages of utilising a case study strategy, there are some weaknesses that are worth highlighting. Firstly, the availability of suitable case study sites may be difficult and even sometimes restricted, since many organisations are hesitant and unwilling to participate in a case study research (Walsham, 2006 and Myers, 2009). Oates (2006) argues that it is often relatively difficult to negotiate access to the necessary setting, people, and documentation required to investigate a particular phenomenon using a case study approach. Secondly, it is often difficult and daunting to design and scope a case study research project in order to ensure that the research inquiry can be appropriately and adequately addressed (Yin, 2008). The data collection process can be time-consuming and tedious, and often results in the accumulation of an enormous amount of data (Gray, 2009 and Cavaye, 1996). Another frequently-cited criticism of case study research is that its findings cannot be generalised (ibid). However, Yin (2008) refutes this criticism by stressing that the most scientific inquiries have to be replicated by multiple examples of the experiment, and case study research can be based upon multiple cases of the same phenomenon. Gummesson (2000) supports this view, by asserting that a complete understating of a phenomenon is often derived from the knowledge of many individual cases. In the same vein, Walsham (2006) argues that the validity of an extrapolation from an individual case or cases does not depend on the representativeness of such cases in a statistical sense, but the plausibility and cogency of the logical reasoning used in describing the results of the cases and drawing conclusions from them. A summary of these selected case studies and features of the studied projects can be found in Table 4.3.

Table 4.3 List of ICJV projects

No	ICJV projects	Company	Country	Number of participants	Project
1	ICJV Project-1A	Local company	Thailand	11	Track Rehabilitation Project (Phase 1 and 2) Completed in 2002
		Foreign company	France		
		Local company	Thailand		
2	ICJV Project-1B	Local company	Thailand	19	Track Rehabilitation Project (Phase 5) Completed in 2014
		Foreign company	France		
3	ICJV Project-1C	Local company	Thailand	15	Construction of the extra dosed 6-lane Chao Praya River Crossing Bridge Completed in 2016.
		Foreign company	Japan		
4	ICJV Project-2A	Local company	Thailand	9	Bang Na Expressway (BNE) Project Completed in 2000
		Foreign company	Germany		
5	ICJV Project-2B	Local company	Thailand	13	Chaloem Ratchamongkhon line (The first underground mass rapid transit project in Bangkok) Completed in 2004
		Foreign company	Germany		
		Foreign company	Japan		
		Foreign company	Japan		
6	ICJV Project-2C	Local company	Thailand	12	Construction of the Purple Line (Bangkok Metropolitan mass rapid transit railway) Completed in 2007
		Foreign company	Japan		

Questionnaires surveys were used to collect the data from key management experts, such as general managers, managing directors, senior engineers, project managers and key construction workers from both the local company and the foreign partner. The questions in the questionnaire were designed based on key knowledge, key concepts, and areas, etc. from the

conceptual framework mentioned in Chapter 3. Moreover, the participants were asked to nominate other potential respondents from their social networks based on snowball sampling to identify other key participants with the specific range of skills and attributes that have been determined as being critical for the transfer of knowledge. The number of participants present in Table 4.3. As a result, the number of participants depended on the number of key actors, their relationships, the network density and the extent of the network within which knowledge flowed and was transferred. The information retrieved from these key participants/actors was used to establish how knowledge is transferred between the ICJV partners during the interviews. Furthermore, these key participants/actors were also invited to suggest ways in which knowledge transfer in ICJV projects can be improved.

4.4.3 Access to the case organisations

[Al-Salti \(2011\)](#) points out that the availability of suitable cases to study may be difficult and restricted because many organisations feel unwilling and uncertain to participate in case study research. [Oates \(2006\)](#) also argues that it is often relatively difficult to negotiate access to the necessary setting, people and documentation required to investigate a particular phenomenon using a case study approach. In this study, the organisations and projects were accessed and the willingness of the participants was gained based on personal contacts with the executive director of each company. A principal informant was identified for each of the ICJV companies, and E-mails were sent to them, explaining the objectives stressing the importance of the research and requesting their participation. This ensured the maximum co-operation from these organisations and is consistent with the recommendation of [Lewis \(2003\)](#), who stresses the importance of having a single point of contact within the chosen organisations in order to avoid duplications or gaps in communication. Similarly, [Voss et al. \(2002\)](#) emphasise that a principle informant should be sufficiently senior to be able to open doors where necessary and to know who best to interview to gather the required data. Then, the informants were contacted by phone to ascertain their willingness to participate in the study and they all extended their full support to the fieldwork plans. [Zhang et al. \(2013\)](#) suggest that project managers are tasked with providing a list of key stakeholders to ensure that all the selected team members can adequately represent the whole team. Hence, in order to ensure access to the ICJV projects, an invitation e-mail was sent to a project manager in each project, who then indicated that he would assist in obtaining approval for access from the senior vice president of each firm and provide an organisation chart to identify the most suitable participants. [Zhang et al. \(2013\)](#) state that an organisation chart is designed to identify the senior members who are empowered to make decisions or ensure that the work is divided based on functionality. In this case, the participants included project directors, managers, senior engineers and those responsible for the day-to-day work routine.

Therefore, the participants in this research were recruited by the project manager using a project organisation chart and a participation information sheet and consent form was attached to this e-mail. Then, a follow- up phone call made after receiving a reply and obtaining approval from the senior vice president. An initial meeting was arranged between the researcher and the

project managers to discuss the best approach to increase the level of participation in each project. Key management experts and key participants were identified and the project manager helped to facilitate access to participants from the foreign companies. This approach was adopted to increase participation without putting pressure on potential respondents to take part in the study. An invitation e-mail was sent to the key participants and those with key management expertise in both the local and foreign partners firms of the JV. A participation information sheet and consent form were attached to the e-mail and the participants were advised to take at least 48 hours (or longer if they needed more time) to digest this information and decide whether, or not to take part in the research. After receiving a reply and obtaining the approval of key participants, a follow-up phone call was made to arrange a meeting with all the participants. A questionnaire survey was conducted. Moreover, they were asked to nominate other potential participants who were also key players in their ICJV project. Key participants/actors and experts were identified using a social network analysis and the researcher made a follow-up phone call to them. Finally, interviews were conducted with the key participants/actors and experts based on an interview schedule with open-ended questions. The data retrieved from these interviews were expected to enrich the information on the key enabling and inhibiting factors of knowledge transfer. The means of accessing the case organisations are shown in Figure 4.4.

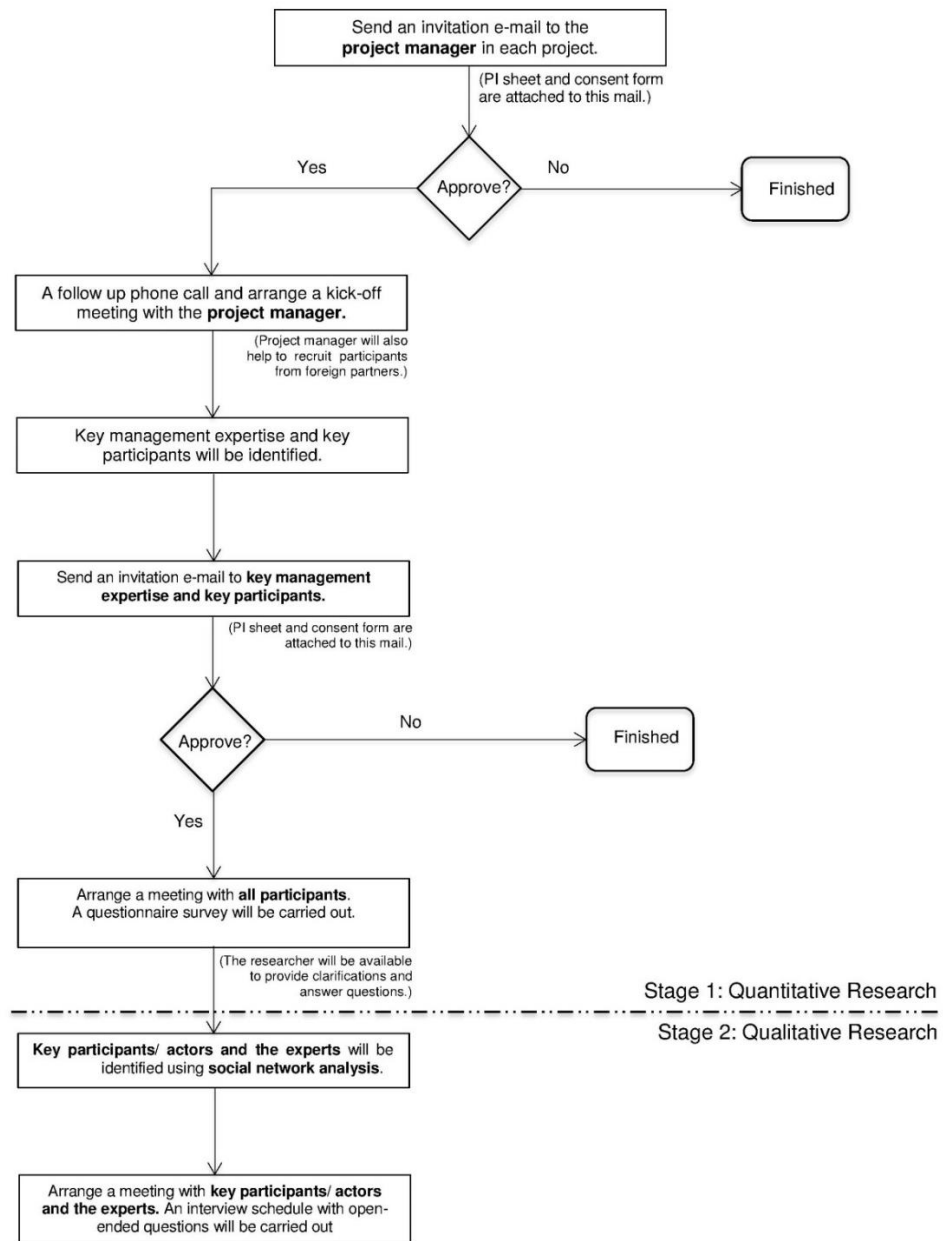


Figure 4.4 Means of accessing the case organisations.

The interviews were conducted with selected professionals and experts from a parent company and an IJV partner (subsidiary company). The interviewees were required to have experience of forming a JV with a foreign partner, either as general manager, managing director, senior engineer, or project manager, and those with key management expertise should have experienced at least one and, in the majority of cases several ICJVs. The criteria of experts to be interviewed including 1) Profile (Certificates and qualifications), 2) Position, 3) Past experience, 4) Experience of ICJV projects and 5) Experience and role in the knowledge domain which influences the transfer of knowledge in ICJV projects. The analysis of the interviewees depended on the number of professionals and experts to be interviewed and the number of knowledge domains that influence the knowledge transfer in ICJV projects to be evaluated.

4.4.4 Justification for the adoption of a case study research strategy

After defining and discussing the key characteristics of case study research, it is appropriate to highlight the rationale for choosing a case study strategy for this particular research. The main reason for selecting this type of strategy is that limited previous research has investigated knowledge transfer in the context of ICJV projects and a case study is an appropriate way to research an area in which few previous studies have been conducted. [Eisenhardt \(1989\)](#) suggests that a case study strategy is appropriate when conducting exploratory research of complex social phenomena in real-life contexts. Moreover, the aim of this research is to provide a holistic understanding of the key factors that impact the success of knowledge transfer in ICJV Projects and [Yin \(2009\)](#) suggests that a case study strategy is useful when a holistic, in-depth investigation is required. A case study facilitates a more detailed, varied and extensive understanding of the phenomenon being investigated using multiple sources of evidence. Additionally, the existing research of inter-organisational knowledge transfer is dominated by quantitative studies using survey questionnaires ([Salmi and Torkkeli, 2009](#)) and a questionnaire-based approach alone cannot fully capture the richness and social complexity of the inter-organisational knowledge transfer process ([Perez-Nordtvedt et al., 2008](#)). Therefore, a more detailed case analysis using in-depth interviews was needed for this research in order to better understand the complexity of the phenomenon, leading to a more compelling and robust explanation (Eisenhardt, 1989). Hence, it is argued that only a case study strategy is capable of holistically capturing the dynamic complexity involved in the transfer of knowledge from a foreign to a local actor in ICJV Projects.

4.5 ETHICAL APPROVAL

Ethical issues are critical in all social research. Researchers are responsible for ensuring that the participants are well-informed of the data collection process and, understand the purpose and the nature of the research. They must also ensure that they respect the participants' right to privacy. The data collection process for this study was given full unconditional approval by the University Research Ethics Committee at Oxford Brookes University.

In the questionnaire survey stage, an invitation e-mail was sent to the project managers of each project. This e-mail included the research title, overall background, purpose of the research, and a brief summary of the research design and methodology. A participation information sheet and consent form was also attached to this e-mail and a follow-up phone call was made after receiving a reply and obtaining the approval of the senior vice president. An initial meeting was then arranged with the project managers to discuss the best way to obtain permission to conduct the questionnaire inside the projects and identify key management expertise and key participants. Moreover, the project managers could help to recruit participants from foreign companies. Then, an invitation e-mail with a participation information sheet and consent form attached was sent to key management experts and key participants in both the local and foreign partners. The participants were advised to take at least 48 hours (or more if necessary) to digest the participant information sheet and decide whether or not to take part in the research. Follow-up phone calls were made after receiving a reply and obtaining approval from key

participants and another meeting was arranged with all participants. A questionnaire survey was then conducted in which the participants were asked to provide their names and contact details, background, position, experience, knowledge, skill and practices related to ICJV projects in Thailand. Moreover, they were asked to nominate other potential participants and also key participants in their ICJV project.

In the interview stage, follow-up phone calls were made to the key participants, actors, and experts, who were identified from the social network analysis. The interviews were based on an interview schedule with open-ended questions in order to gather rich information about the knowledge transfer methods, key enabling and inhibiting factors from these key participants, actors and experts. This approach enabled the participants to be open and frank about sharing their knowledge and experience.

4.6 METHODOLOGICAL PRECISION AND VALIDATION

Building precision into the research design is an issue that requires a response from the researcher (Gray, 2009, and Mayan, 2009) and this issue is even more important in case study research (Barratt et al., 2010; Yin, 2008; Voss et al., 2002), in which data is generated from either limited or particular samples or situations (ibid). Yin (2008) specifically defines the criteria for judging the quality of research in terms of construct validity, internal validity, external validity, and reliability. However, other researchers consider that trustworthiness is more important than being concerned about validity and reliability in an interpretive inquiry (ibid). For example, Guba and Lincoln (1994) argue that qualitative research demands different criteria for evaluation and quality judgment than those used for quantitative research, which they suggest are credibility, dependability, conformability, and transferability. Nevertheless, since the labels of these criteria have been revised several times (ibid), there is no agreement among researchers about the way of looking at the concept of precision in qualitative research (ibid).

Validity refers to the correlation between what is reported and the social phenomenon being studied (ibid). It is the extent to which the researcher investigated what was intended to be investigated or collected the correct data from the correct sources (ibid). Researchers achieve validity when they are able to produce an accurate representation of the setting (Bailey, 2007) and it has been argued that qualitative studies have a high level of validity because of their in-depth and contextualised nature (ibid). In this study, the validity was strengthened by the use of the following strategies;

- Prior to the fieldwork, a clear and detailed explanation of the aims of the investigation and the main objectives of the research was provided to the participants by e-mail when arranging the appointments and at the beginning of the interviews.
- Multiple methods (semi-structured interviews and documents, including the websites and annual reports of the two ICJV companies) were used to collect the data, which allowed the researcher to achieve triangulation. Data was also collected from the participants of two case studies with the six ICJV projects in the semi-structured interviews in order to encourage a

different line of inquiry and provide multiple measures of the phenomenon being studied; therefore, the findings and conclusions of this study are likely to be more accurate and convincing.

- Torrance (2012) states that respondent validation involves research participants responding activities of the research in order to check them for accuracy by the first draft of interpretive reports. Participants can be asked to check the accuracy of initial data and they have opportunity to reflect more comments (ibid). As the above discussion implies, respondent validation is usually associated with qualitative approaches to research. In the context of evaluation studies, the research will likely involve known experimental sites with key participants.

Moreover, Torrance (2012) mentions that respondent validation resides in the judgement of and “expert”, rather than in negotiation with participants. As a result, the initial drafts of each ICJV project reports and the integrated conceptual framework were e-mailed to some of the key participants of six ICJV projects in order to verify their accuracy and invite comments for amendments, and further feedback and clarification where necessary. Yin (2008) highlights the fact that a review of the draft of the case study report produces further evidence, since informants and participants may remember new materials they had forgotten during the initial data collection period. This approach is a very valuable means of guarding against researcher bias.

4.7 CHAPTER SUMMARY

This chapter contained an overview of the various methods and methodology utilised within the context of this research. The research paradigm was defined by two different epistemologies (Quantitative and Qualitative) and a mixed methodology was developed to identify the key actors, key concepts, and key factors in the area of this research. Two research paradigms (Positivist and Interpretivist) were chosen as the methodological basis of the study because this enables researchers to obtain a more holistic and comprehensive view of the phenomenon being studied. A combination of quantitative and qualitative data was collected to achieve the main aim of this study and a multiple case study approach was adopted as a research strategy to undertake an investigation within the context of the ICJV projects. The rationale for choosing the data collection and analysis methods provided in the overall research design. The various aspects of ethical approval were also mentioned. Since it was mentioned in this chapter that a multiple case study was adopted as an approach to conducting this research, the key findings or the empirical work from the two case studies with six ICJV projects will be presented and discussed in the next chapter.

5. ANALYSIS AND FINDINGS (CASE STUDY ONE)

5.1 INTRODUCTION

The research methodology adopted for this case study research was presented and discussed in the previous chapter. The purpose of this chapter is to present the findings from an analysis of the three ICJV projects from Case Study One. The projects are analysed following the case descriptions' strategy suggested by Yin (2009). The case background and the key findings of the actors' attributes, social network analysis and KT methods and mechanisms for each project are presented. The chapter is divided into four sections, including this introduction and each project analysis follows the format outlined in Table 5.1. Section 5.2 contains an overview of Case Study One and Section 5.3 contains a detailed analysis of each of three ICJV Projects, while Section 5.4 contains a summary of the case study.

Table 5.1 Case Analysis Format

No	Analysis of data
1)	Case Background
2)	Actors' Attributes a) Gender, Age, and Nationality b) Educational Background and job position c) Experience and primary discipline in a construction projects
3)	Social Network Characteristics a) Size of the Network, Network Structure and Network Density b) Degree of Centrality c) Betweenness Centrality d) Cliques of the network/ Cluster analysis
4)	Knowledge Source and Knowledge Transfer Mechanisms a) Source of Knowledge b) Knowledge Transfer Methods and Mechanisms c) Tie Characteristics and Tie Contents d) Relationships between Key Actors, Knowledge Transfer Methods and Mechanisms, and Tie Contents

5.2 OVERVIEW OF CASE STUDY ONE

This chapter contains an overview of the first case study. The case study company was initially established on the 15th August 1958 with a registered capital of 2,000,000 Thai Baht. It became a Public Company Limited on the 24th March 1994 and was listed on the Stock Exchange of Thailand on the 9th August 1994 of that same year. Its turnover was 18,330 million Baht at the year-end of 2003, making it one of the largest infrastructure construction companies, not only in Thailand, but also the whole of Southeast Asia. Case study one has successfully completed the construction of many mass transit projects, the first of which was the 23.5 km Bangkok Transit System (BTS) when it entered into a joint venture with two Japanese companies to complete the construction of the 10.5 km northern part of the underground Mass Rapid Transit (MRT) project. This contract comprised the construction of 10.5 km long and 5.7 m diameter twin tunnels, 9 underground stations, and associated buildings (car parks, etc.). In addition to the domestic market, case study one has expanded its business overseas to many countries, such as India,

Bangladesh, Cambodia, Lao PDR, Indonesia, Maldives, Myanmar, the Philippines, Madagascar, Taiwan, Vietnam, Australia, and Hong Kong.

5.3 CASE STUDY ANALYSIS

The first project, ICJV Project-1A, was a Track Rehabilitation Project (Phases 1 and 2), while the second one, ICJV Project-1B, was a Track Rehabilitation Project (Phase 5) and the third, ICJV Project-1C, was the Construction of the Extradoses 6-lane Chao Praya River Crossing Bridge with a 460-metres long and 200 metres wide (Maha Jessada Bodin Bridge) at Nonthaburi I Road. All three ICJV projects of Case Study One presented in this chapter are summarised in Table 5.2.

Table 5.2 Three ICJV Projects (CASE STUDY ONE)

No	ICJV Project	Role of Company	Country	Type of Project
1	ICJV Project-1A	(LC01)-Infrastructure Construction Contractor	Thailand	Track Rehabilitation Project (Phase 1 and 2) Completed in 2002
		(LC02)-Tracklaying, rehabilitation and maintenance of track	Thailand	
		(F1)-Transport Infrastructure Construction Contractor	France	
2	ICJV Project-1B	(LC01)-Infrastructure Construction Contractor	Thailand	Track Rehabilitation Project (Phase 5) Completed in 2014
		(F1)-Transport Infrastructure Construction Contractor	France	
3	ICJV Project-1C	(LC03)-Infrastructure Construction Contractor	Thailand	Construction of the Extradoses 6-lane Chao Praya River Crossing Bridge Completed in 2016.
		(F2)-General construction company	Japan	

The case study involved and its ICJV projects are described in the background of each case in the first section and the actors' attributes of the participants in this research are illustrated in the second section. The third section contains the key findings of the social network analysis, while the fourth section is devoted to an analysis of the KT methods and mechanisms that influenced the knowledge transfer processes within the ICJV projects.

5.3.1 ICJV PROJECT-1A

1) Background of Case

This ICJV project involved three partner firms; a French firm with a 35 percent share, a Local Company-01 (LC01) with a 55 percent share (the ICJV project leader), and another Local Company-02 (LC02) with a 10 percent share. This was a Track Rehabilitation Project (Phases 1 and 2) and the contract sum was £180 million. It was completed in August 2002. The stated objectives of this ICJV were to combine the resources of the joint venture companies in order to win the contract and share the risk using the expertise of each of them. Local Company-01 (LC01) is one of the largest firms in Thailand. Its major activities range from general

construction to infrastructure construction. Local Company-02 is an independently operated company which has provided project management and construction services to the railway industry in a number of countries throughout Asia, including Thailand, India, Indonesia, Malaysia, the Philippines, and Taiwan. Foreign Company (F1) is the leader in France's light-rail market, having constructed new rails (particularly high-speed lines) and upgraded and maintained national lines and industrial sidings, as well as installed and maintained catenary wires, with systems already implemented in approximately 20 cities in France. Foreign Company (F1) is one of the three leading companies in this sector.

2) Actors' Attributes

Many organisations have successfully shared and transferred expertise between individuals and groups in this era of globalisation (Argote, 1999) and the form of sharing knowledge is based on the learning process of those individuals and groups. Knowledge is shared among individuals (actors) for the purpose of generating new knowledge (Ackerman et al., 2013). Additionally, the attributes and interpersonal relationships among individuals (actors) represent the individuals and the links between them. These interpersonal relationships affect the exchange of information and knowledge in construction projects (Ehrlich and Carboni, 2008 and Zhang et al., 2013). Actors' attributes influence other actors through their network ties and/or actors adjust their ties to the characteristics of their peers and to their ties with them. Moreover, actors' general attributes, such as gender, age, cultural background, and hierarchy (job level/education) can also influence KT (Schröpfer, Tah, and Kurul, 2017). Hence, it was considered to be important to collect data on the actors' attributes of the participants, such as their age, gender, nationality, qualifications, job position, work experience, and attitude of the participants before gathering other data, such as their nationality, educational background, and expertise (ibid) to explore the influence of the structure of the team on the KT processes in the ICJV projects.

a) Gender, Age, and Nationality

All the participants in this case study (100.00%) were male. Managerial and professional staffs came from three different countries. 9.09% of them were Filipino, 27.27% were French and 63.64% were Thais (see Table 5.3). Moreover, the findings revealed that 37% of the participants were aged between 31 and 40, 27% between 51 and 60, and the remainder were between 26 and 30 and 41 and 50 years old. Therefore, most of the respondents in this ICJV project could be said to be aged between 31 and 40.

Table 5.3 Nationality of research participants (ICJV Project-1A)

Nationality	Local Company-01 (LC01)	Local Company-02 (LC02)	Foreign Company (F)	Total	%
Thai	7	0	0	7	63.64%
French	0	0	3	3	27.27%
Filipino	0	1	0	1	9.09%
Grand Total	7	1	3	11	100.00%
	37.58%	9.09%	53.33%	100.00%	

b) Educational Background and job position

Many researchers have found that individuals' educational background and job position reflect their perception of knowledge and experience. The educational background and expertise of different stakeholders in various positions are presented in table 5.4, in which it is shown that 9% of the research participants had a certificate, 9% had a diploma, 36% had a postgraduate degree and 46% an undergraduate degree. Therefore, most of the participants in this ICJV project described themselves as project managers.

Table 5.4 Cross Tabulation between educational background and job position (ICJV Project-1A)

Educational Background	Job position							Total	%
	Asian Director	Cost Estimate/ Procurement Engineer	Project Engineer	Project Manager	Quality Surveyor	Supervisor	Senior Vice President		
Certificate	0	0	0	0	0	1	0	1	9
Diploma	0	1	0	0	0	0	0	1	9
Undergraduate	1	0	1	2	0	0	1	5	45
Postgraduate	0	1	0	2	1	0	0	4	36
Total	1	2	1	4	1	1	1	11	100

The cross tabulation in Table 5.4 shows that most of the participants had graduated as undergraduates and held the position of project manager in this project. However, it can be seen from the table that one of the procurement engineer, two project managers and one quality surveyor had a postgraduate degree. Therefore, it seems that their 'educational background' was not related to their 'job position' in this ICJV project.

c) Experience and primary discipline in construction projects

According to Table 5.5, the respondents in this case study had a range of <5 to >20 years of experience. The results revealed that most of them had >20 years' experience in the construction industry and ICJV projects. The majority of respondents in this case study (72.7%) had received construction training (e.g. Supervisor, Business Unit Manager, Engineer, Supervisor, Project Manager, Asian Director, and Quality Surveyor). These findings indicate that three of the 11 respondents lacked construction training (e.g. two project managers and an engineer).

Table 5.5 Cross Tabulation between experience in construction and job position (ICJV Project-1A)

Experience in the construction industry	Job position							Total	%
	Asian Director	Cost Estimate/ Procurement Engineer	Project Engineer	Project Manager	Quality Surveyor	Supervisor	Senior Vice President		
< 5	0	1	0	0	0	0	0	1	9
6-15	0	0	1	2	0	0	0	3	27
16-20	0	1	0	2	0	0	0	3	27
> 20	1	0	0	0	1	1	1	4	37
Total	1	2	1	4	1	0	0	11	100

Based on Table 5.5, different stakeholders had experienced ranging from 5 to 20 years in various fields. The cross-tabulation in Table 5.5 confirms that there is a strong relationship between 'experience in construction' and 'job position'. It is evident that most of the managerial staff in this case study had more than 20 years' experience in the construction industry, e.g.

Asian Director, Quality Surveyor, Supervisor, and Senior Vice President. Since, the data for this case study was collected from an ICJV project: A Track Rehabilitation Project (Phases 1 and 2), the highest percentage of disciplines in this project were Mechanical Engineering (45%) and Civil Engineering (45%), thereby reflecting the knowledge, skills, and experience required in the project. The second highest discipline was Electrical Engineering (10%). Therefore, it may be considered that a Track rehabilitation works would include the replacement of rails and sleepers, reinforcement of ballasts, improvement of the railway bed, purchasing machinery for track rehabilitation, and repairing automatic signal facilities. Hence, the civil engineers and mechanical engineers would be responsible for the inspection and operation of the tracks, as well as the maintenance and repair of the tracks, together with support from technical personnel as their subordinates. The social network characteristics, their relationships and the extent to which they influenced KT in the ICJV projects are examined in the next section.

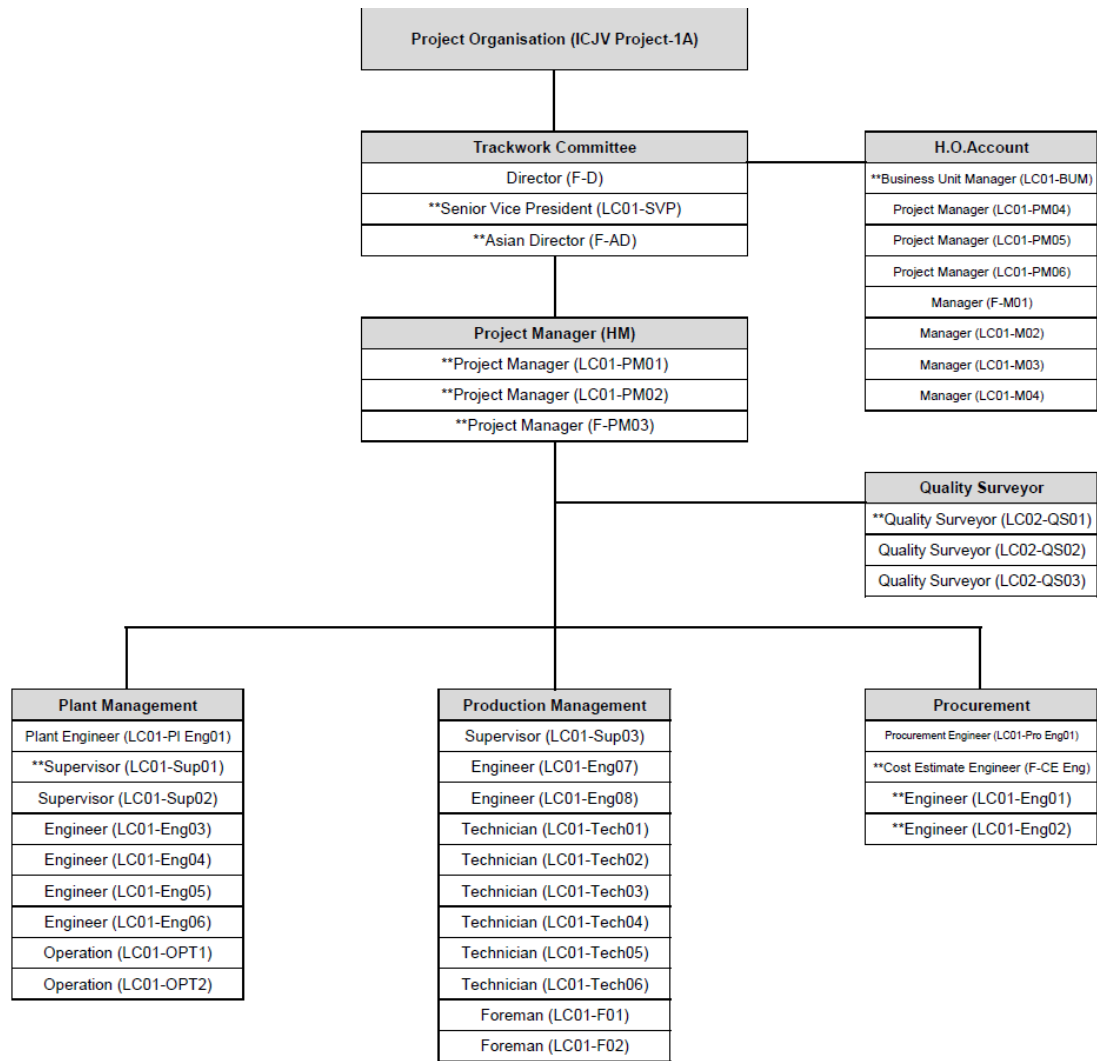
3) Social Network Characteristics

A Social Network Analysis (SNA) was conducted in this study in order to map the ties that exist between the parent company and the partner(s), and analyse them to understand how knowledge is transferred within ICJV projects and identify the experts involved in the transfer. This is linked to the significance of the relationship among social actors to their behaviour, opinions, and attitudes. Actors' attributes influence other actors through their network ties or they adjust their ties to the characteristics of their peers and to their ties with them. The characteristics of the social actors, for instance, people in the network and the intensity, frequency, valence, or type of social relationships are represented by line weights, line values, line signs, or line types (Wasserman and Faust, 1994). The size of the network, network structure, network density, degree centrality, betweenness centrality and network cliques were selected as the core indicators in this study (Zhang, He and Zhou, 2013). The data collection and data analysis in this section are divided into the following three main categories;

- Size of the Network, Network Structure, and Network Density
- Degree Centrality and Betweenness Centrality
- Network Cliques/ Cluster analysis

a) Size of the Network, Network Structure, and Network Density

This section contains the results of the social network analysis, i.e. the size of the network, network structure, and network density. This network is comprised of 42 nodes, which is rather small compared to ICJV Project-1B and rather large compared to ICJV Project-1C, which are also examined in this case study. This network consists of 11 research respondents and 31 other project participants who were named by them. The network boundary is defined as all the participants from the organisation chart of this project; as a result, there are 11 participants in this case study. The code denotes their position. The participants' code and their relationship to the project organisation in this network are presented in Figure 5.1 and Table 5.6.



** Respondents

Figure 5.1 Job position of participants and their code (ICJV Project-1A)

Table 5.6 SNA internal restriction with a position (ICJV Project-1A)

Respondents	This person shares information with you	How often do you exchange knowledge with this person?	You share information with this person	How often do you share knowledge with this person?
LC01-SVP	F-D	1	LC01-PM01	3
	F-AD	1	F-PM03	1
			LC01-PM02	3
LC01-BUM	LC01-SVP	1	F-PM03	1
LC01-PM01	LC01-PM02	3	LC01-PM02	3
	F-PM03	3		
LC01-PM02	LC01-PM01	4	LC01-Eng01	3
	F-PM03	3		
F-PM03	F-AD	1	LC01-Eng01	1
	LC01-PM02	3	LC01-Eng02	3
	LC01-SVP	1	LC01-Eng08	3
LC01-Eng01	LC01-Eng04	3	LC01-Eng03	5
	LC01-PM02	2		
	F-PM03	2		
	LC01-PM04	2		
LC01-Eng02	F-PM03	3	LC01-Pro Eng01	3
	LC01-PM02	3		
LC01-Sup01	LC01-SVP	1	LC01-PM06	3
	LC01-PM05	1	LC01-Eng05	3
	LC01-PI Eng01	1	LC01-Eng06	3
	F-M01	3	LC01-Eng07	3
	LC02-QS01	4	LC01-Tech01	4
	F-PM03	3	LC01-Tech02	4
	LC01-PM01	3	LC01-Tech03	4
	LC01-M02	3	LC01-F01	4
	LC02-QS02	4	LC01-Tech04	4
	LC02-QS01	3	LC01-Tech05	4
	LC01-M03	1	LC01-F02	4
	LC01-M04	1	LC01-Tech06	4
	LC01-Sup02	1	LC01-F03	4
	LC01-Sup03	1	LC01-OPT01	4
			LC01-OPT02	4
F-AD	LC01-SVP	1	F-PM03	3
F-CE Eng	F-AD	1	LC01-Eng01	1
	F-PM03	3		
LC02-QS01	LC01-SVP	1	F-PM03	3
	LC01-BUM	3	LC01-PM01	3
	F-PM03	3	LC01-PM02	3
	LC01-PM02	3		

F = Foreign Actor

LC01 = Local Company-01

LC02 = Local Company-02

How often to exchange and share knowledge?

1=Less than once a week 2=Once a week 3=More than once a week 4=Once a day 5=More than once a day

The collaborative networks, network structure and the strength of the ties between nodes developed in the collected ICJV project-1A are shown in Figure 5.2 and different stakeholders' expertise in various positions in the collaborative networks is shown in Figures 5.3. The arrow represents the existence of collaboration between the three firms (Foreign Company, Local Company-01, and Local Company-02). The direction of the link is from the recipient of the knowledge to the source and the weight of the links between the nodes indicates the frequency with which knowledge is transferred between two actors. It can be seen that the stronger the tie is, the more often they exchange knowledge.

The aim of this study is to identify and understand the processes by which knowledge is transferred knowledge in ICJV Projects; hence, the processes of transferring knowledge between local and foreign partners in this ICJV Projects were examined. It was found that this collaborative networks consisted of four foreign actors (F-D, F-AD, F-PM03, and F-CE-Eng) from a Foreign Company (F) and there is another one foreign actor (LC02-QS01) employed by the Local Company-02 involved in this ICJV Project. As can be seen from Figures 5.4, the findings revealed that there was a strong connection between foreign and local actors, e.g. Supervisor (LC01-Sup01), Project Managers (F-PM03, LC01-PM01, and LC01-PM02), Quality Surveyor (LC02-QS01), and Senior Vice President (LC01-SVP). They interlinked with other actors from various disciplines within this international project once a day or more than once a day.

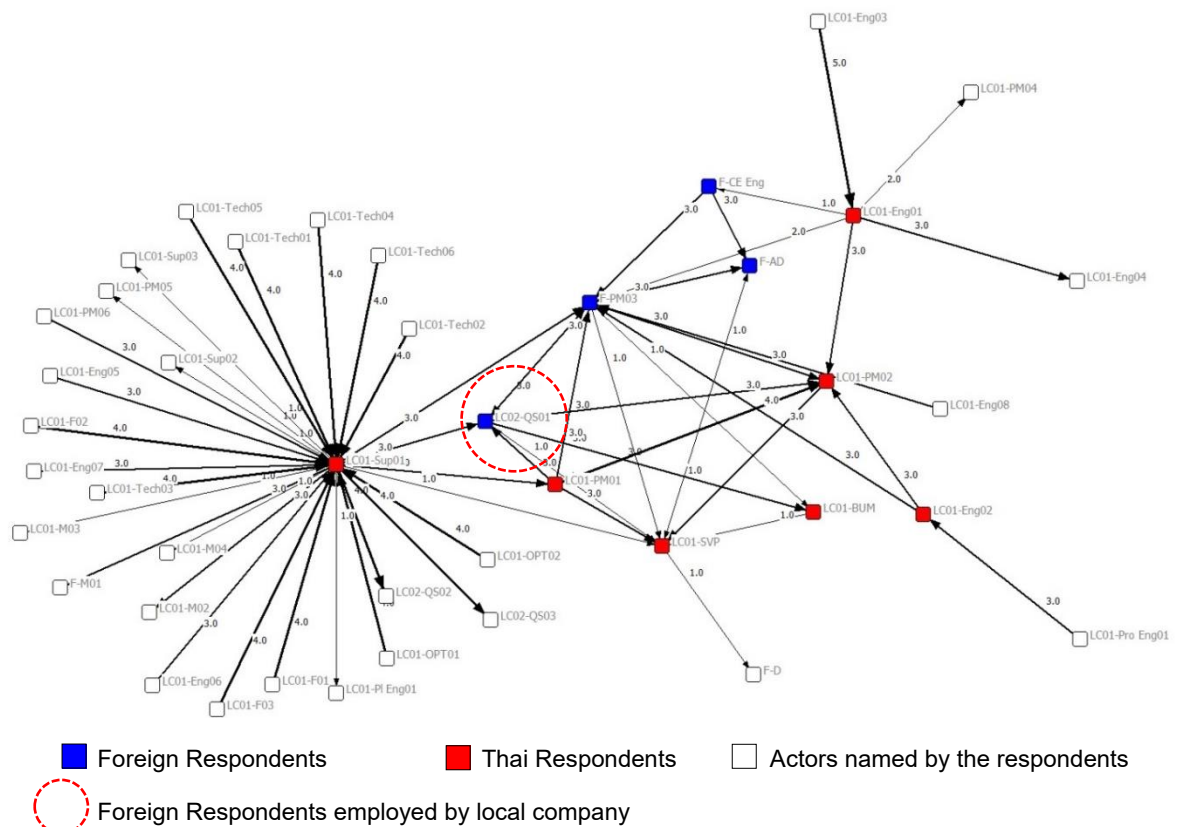


Figure 5.2 Sociogram showing knowledge sharing between actors and their nationality (ICJV Project-1A)

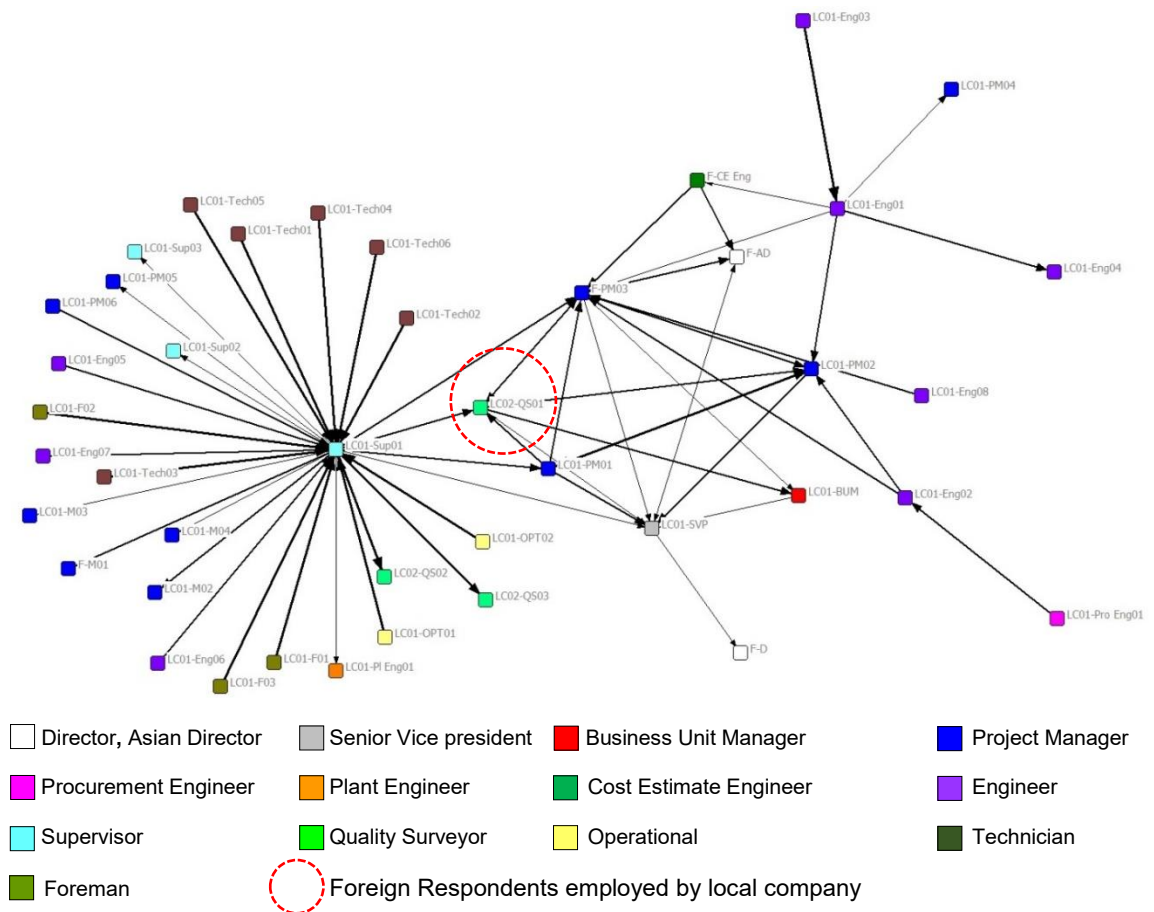


Figure 5.3 Sociogram showing knowledge sharing according to position (ICJV Project-1A)

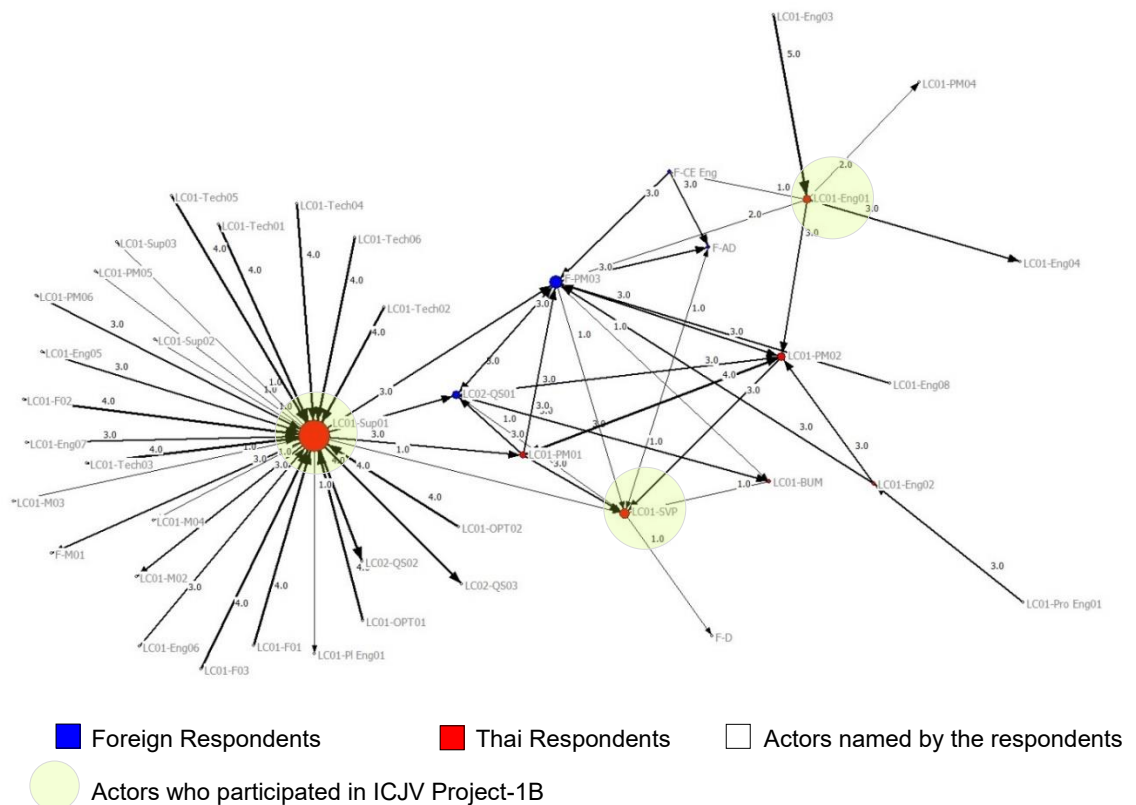


Figure 5.4 Sociogram showing network density (ICJV Project-1A)

LC01-Sup01 held a supervisory position, F-PM03 took a project manager from a foreign partner, LC01-PM01 and LC01-PM02 took a project manager from a local partner, LC02-QS01 was a quality surveyor position in Local Company-02 which provided the railway construction services in a number of countries throughout Asia, and LC01-SVP was the senior vice president who managed this ICJV Project with the F-AD from a foreign partner. Moreover, the collaboration networks in Figures 5.4 indicates that most of the local staffs in the collaborative network preferred to seek advice from LC01-Sup01, whereas, LC01-Sup01 preferred to acquire knowledge and benefit from the experience of LC02-QS01, F-PM03, LC01-PM01, and LC01-SVP. He was seen to exchange knowledge and experience with the team members once a day or more than once a day. It seems clear that he was well connected with the other local staffs and he actually improved the KT processes within in this project. This outcome indicates that LC01-Sup01 was a highly active actor, who collaborated with the colleagues from both local and foreign companies and then shared his knowledge and experience with local colleagues.

F-PM03 exchanged his knowledge and experience with his colleagues from his company e.g. F-AD and F-CE Eng and also with other colleagues from local partners, e.g. LC02-QS01, LC01-SVP, LC01-PM01, LC01-PM02, and LC01-BUM. It seems clear that F-PM03 was well connected with other companies and he actually improved the KT processes in this project by being a source of knowledge for the team to deliver the Track rehabilitation project in the team. Moreover, it was also shown that some of the local partners in this collaborative network, e.g. LC01-Sup01, LC02-QS01, LC01-PM01, LC01-Eng02, and LC01-Eng08, acquired knowledge and experience from F-PM03. This outcome could indicate that F-PM03 possessed specialised knowledge of railway construction and international track rehabilitation projects. Another interesting aspect of this network is that F-D was a director from a foreign partner and LC01-SVP was the only actor who received knowledge from him and named him as a source of knowledge in this ICJV collaboration. A possible explanation for this may be that the Senior Vice President (LC01-SVP), the Director (F-D) and the Asian Director of a foreign partner (F-AD) were responsible for cooperating in this joint venture and the management of the construction in this ICJV project together.

LC01-PM01, LC01-PM02, and F-PM03 were project managers, who relied on potential links between them to manage this ICJV Project. It was shown that they preferred to exchanged knowledge between themselves and also with F-PM03 once a day or more than once a day, whereas, LC01-PM02 preferred to share his knowledge with LC01-Eng01. This outcome could indicate the existence of KT processes between local and foreign managers in this network. As a result, it is vital to examine the kind of knowledge these actors exchanged.

LC02-QS01 exchanged his knowledge and experience with LC01-SVP, LC01-BUM, F-PM03, LC01-PM01 and LC01-PM02, and LC01-Eng01 exchanged his knowledge and experience with F-PM03, LC01-PM02, LC01-PM04, LC01-Eng03, and LC01-Eng04. The reason for this is likely to be that this ICJV Project requires knowledge and skills related to international railway construction services, especially in term of quality control, and LC02-QS01 appears to possess specialised knowledge of international railway construction and track rehabilitation projects. Moreover, Figure 5.4 indicates that LC02-QS01 is the focal point in this network; hence, it can be assumed that it is organised around him. He is a civil engineer and holds the

position of quality surveyor of Local Company-02 with more than 20 years' experience. He exchanged his knowledge and experience with Project Manager (F-PM03 and LC01-PM02) and he also shared his knowledge and experience with Supervisor (LC01-Sup01), Project Manager (LC01-PM01), and Engineers (LC01-Eng02 and LC01-Eng08), whereas, he sought advice from Senior Vice President (LC01-SVP), Business Unit Manager (LC01-BUM), and Asian Director (F-AD). In this network, LC02-QS01, LC02-QS02, and LC02-QS03 occupied the position of quality surveyor position in the project, while LC02-QS02 and LC02-QS03 is not acting as LC02-QS01. In contrast, LC02-QS02 and LC02-QS03 did not act as LC01-Sup01. In contrast, LC02-QS02 and LC02-QS03 were well connected with LC01-Sup01 and shared their knowledge and experience with him every day. Based on this outcome, it seems clear that LC02-QS01 was well connected with Project Managers from both local firms and foreign partners and also with the supervisor of this project. Hence, it can be assumed that LC02-QS01 relied on knowledge being transferred between the local and foreign actors in this ICJV Project.

LC01-SVP was regarded as the senior vice president who was responsible for managing this ICJV Project with F-AD from a foreign partner. It is indicated in Figures 5.4 that his main dissions were with F-D, F-AD, LC01-PM01, LC01-PM02, and F-PM03 in this collaborative network; moreover, LC01-SVP was the only one actor named by F-D and who asked for advice from F-D. Hence, it could be claimed that LC01-SVP occupied a position in which he not only relied on working and coordinating with the director of a foreign partner, but also depended on the Asian director and the project managers to manage the construction in this ICJV Project. As a result, it is essential to further explore the kind of knowledge that was exchanged between these actors.

This finding confirms that knowledge was transferred between LC01-Sup01, F-PM03, LC01-PM01, LC01-PM02, LC02-QS01, and LC01-SVP and they are identified as experts in this ICJV project. As a result, it could be argued that LC01-Sup01, F-PM03, LC01-PM01, LC01-PM02, LC02-QS01, and LC01-SVP can be said to be the key actors in receiving and providing knowledge related to the construction of Track rehabilitation. Hence, supervisors, project managers, the quality supervisor, and senior vice president were the potential links between the team members in this ICJV project.

According to the data collected from the UCINET 6.0, the network density was 0.099 with a standard deviation of 0.552. This illustrates that 9.90% of the potential links exist between the actors. [Scott \(2012\)](#) argues that the network density would be 1.00 (100%) if every actor in the team was connected. Since the network density is 0.099, which is a low value, it can be deducted that this is a sparse network in which not all possible connections were made. Nevertheless, the network density in this network was rather small compared to that of ICJV Project-1B and ICJV Project-1C. Therefore, it could be claimed that the KT processes were not made in this network compared to ICJV Project-1B and ICJV Project-1C. Another interesting aspect of in this network was the existence of 9.9% of the potential links between the actors. While, it could be asserted that this is a sparse network and it is rarely possible for a node to have ties with the remaining actors. However, it is important to analyses the centrality measures in this study in order to identify the key actor who is more central and more strongly linked than the others with regard to knowledge transfer in the ICJV project. Therefore, the degree of

centrality will be used to further explore the inter connectedness between LC02-QS01, F-PM03, LC01-Sup01 and other colleagues in the next section.

b) Degree of Centrality and Betweenness Centrality

Since it is essential to explore the kind of knowledge exchanged between these actors, it is important to firstly analyse the degree of centrality to determine which actor was more central and more strongly linked than the others with regard to the transfer of knowledge in this ICJV project. The degree of centrality immediately links the distance from each actor to all the others in the network, while, betweenness centrality indicates how often a given node falls along the shortest path between two others nodes (Borgatti, Everett and Johnson, 2013). Betweenness typically plays the role of a gatekeeper or toll taker with the potential to control the flow through the network. A node with high betweenness can threaten the network by disrupting the operations. Additionally, high betweenness nodes can filter information and colour or distort it as they pass it along. In principle, these nodes are powerful because they can threaten to stop transmitting by using less efficient paths to reach one another. It is useful to note that, the variance of betweenness tends to be quite high, effectively discriminating between nodes. The calculations that help to determine the most central actors are presented below. Actors' centrality measures, both the degree of centrality and betweenness centrality, were used to identify the sources of knowledge. Moreover, actor centrality can also influence KT (Schröpfer, Tah, and Kurul, 2017).

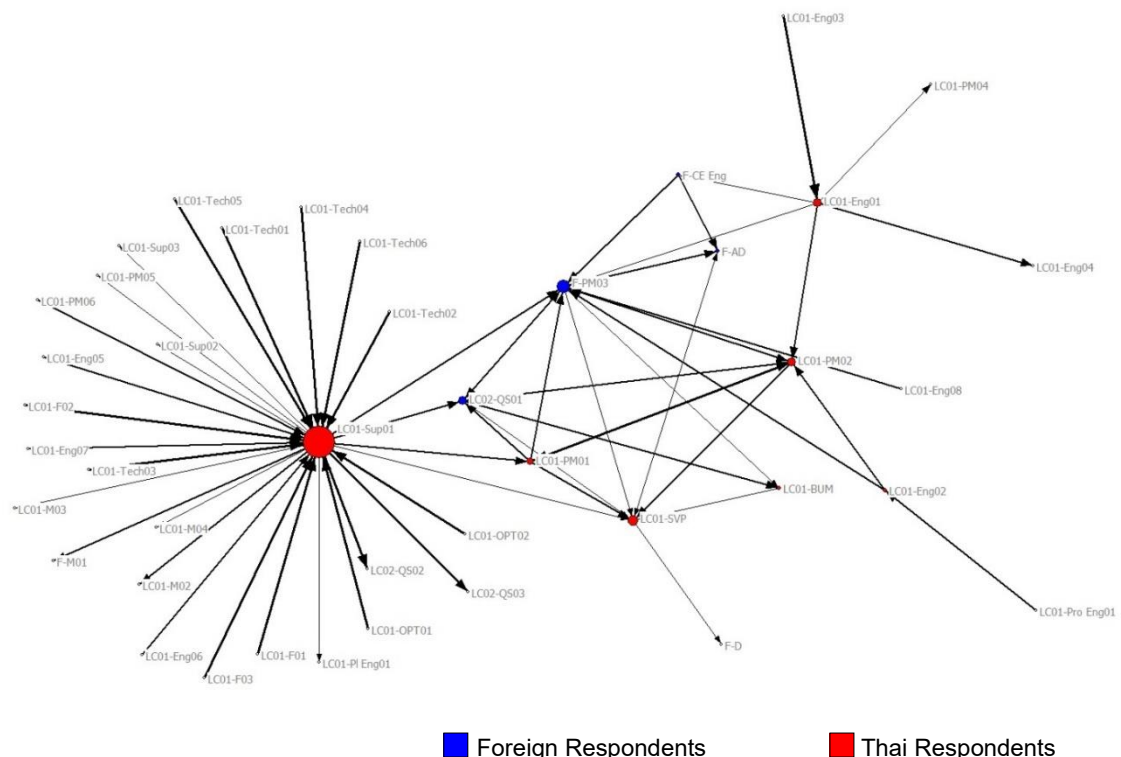


Figure 5.5 Knowledge transfer network (ICJV Project-1A)

The network map with different-sized nodes is shown in Figure 5.5. The node sizes are in accordance with the average degree of centrality of the actors. The larger nodes are the more central ones in terms of knowledge transfer within the team. The most central actors for out-degree and in-degree of centrality are shown in Table 5.7, which illustrates the average degree

of centrality. The in-degree and out-degree values of this case study are shown in Table 5.7. The measure of centrality is important to determine which actor is more central in the network (Hanneman and Riddle, 2005). The degree of centrality measures is divided into in-degree and out-degree, which can be used to divide actors into experts and consumers of knowledge (Müller-Prothmann, 2007). According to Schröpfer, Tah, and Kurul (2017) a high in-degree centrality value identifies experts or knowledgeable people, whereas a high out-degree value identifies knowledge consumers. The in-degree value represents the number of people who ask a particular actor for advice, while the out-degree indicates how many other actors or node seek knowledge from this ICJV project. An actor's in-degree of centrality is the total number of other nodes that have ties to it, while out-degree centrality is the total number of other nodes to which a node is directly tied. A combination of a high in-degree and out-degree of centrality implies that the actor is a knowledge broker (Schröpfer, Tah, and Kurul, 2017). Actors with a high in-degree value are identified as experts in this project and those with a high out-degree value are regarded as knowledge consumers, while those with a high in-degree and out-degree of centralities are considered to be knowledge brokers. Actors with a high in-degree value are regarded as experts and those with a high out-degree value are regarded as knowledge consumers in this project. Moreover, actors with a high in-degree and out-degree of centralities are considered to be knowledge brokers.

Table 5.7 Degree of Centrality (ICJV Project-1A)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
LC01-Sup01	Supervisor	> 20	51-60	30 (1)	56 (1)
LC01-PM02	Project Manager	6-15	31-40	13 (2)	15 (3)
LC01-PM01	Project Manager	6-15	41-50	12 (3)	7
F-PM03	Project Manager	6-15	31-40	11	23 (2)
LC01-Eng01	Engineer	6-15	26-30	11	5
LC02-QS01	Quality Surveyor	> 20	41-50	10	12
LC01-Eng02	Engineer	< 5	31-40	6	3
F-CE Eng	Cost Estimate Engineer	15-20	41-50	6	1
LC01-SVP	Senior Vice President	> 20	51-60	2	11
F-AD	Asian Director	> 20	51-60	1	7
LC01-BUM	Business Unit Manager	15-20	41-50	1	4

This outcome could indicate that the experts and knowledge consumers in this ICJV project were aged between 31 and 60 and had 6-20 years' experience. Therefore, it seems that their 'job position', 'years of experience' and 'age group' did not influence the knowledge transfer processes in this ICJV project. Based on the data in Table 5.7, it could be assumed that LC01-Sup01 was the supervisor of this project and definitely the most central actor in this network with an in-degree of centrality of 56. The in-degree of centrality of LC01-Sup01 was slightly more than twice that of the next person, F-PM03. This difference classifies LC01-Sup01 as a perceived expert who can answer any queries raised throughout the whole network, i.e. the most knowledgeable actor in the ICJV project. This is followed by F-PM03 (Project Manager from a foreign partner), LC01-PM02 (Project Manager), LC02-QS01 (Quality Surveyor) and

LC01-SVP (Senior Vice President). LC01-Sup01 (Supervisor) had both a high in-degree and out-degree of centrality. LC01-Sup01's out-degree of centrality was more than twice that of the next actors, LC01-PM02 and LC01-PM02. This difference classifies LC01-Sup01 as the knowledge consumer in this whole network; therefore, LC01-Sup01 (Supervisor) can be considered to be a knowledge broker in this project.

Table 5.8 Betweenness Centrality Measures (ICJV Project-1A)

Actor	Betweenness
LC01-Sup01	270.000
F-PM03	48.833
LC01-SVP	38.500
LC02-QS01	14.333
LC01-PM02	14.000

It can be seen from Table 5.8 that LC01-Sup01 (Supervisor) had the highest betweenness centrality score, which was more than five times that of the next person, who is F-PM03. This difference classifies LC01-Sup01 (Supervisor) as a gatekeeper who seeks knowledge and skills from within the team. This was followed by F-PM03 (Project Manager from a foreign partner) and LC01-SVP (Senior Vice President). This indicates that LC01-Sup01 (Supervisor) is regarded as the main gatekeeper in this network. Similarly, LC01-Sup01 (Supervisor) also occupies high in-degree and out-degree centrality values in the network. Hence, it may be asserted that LC01-Sup01 (Supervisor) is not only an expert but this actor is also regarded as a gatekeeper in this project. This finding corresponds with that of [Borgatti, Everett, and Johnson \(2013\)](#), who found that betweenness plays the role of a gatekeeping in this context. Nodes with high-betweenness are in a position to filter information and threaten the network with the disruption of operations. The most likely explanation for this result is that LC01-Sup01 (Supervisor) plays a broker role, since many nodes need LC01-Sup01 (Supervisor) to reach other nodes via an efficient path. LC01-Sup01 (Supervisor) has power because he can threaten to stop transmitting, forcing nodes to use less efficient paths to reach one another. It is useful to note that, LC01-Sup01 (Supervisor) effectively discriminates between nodes and potentially correlates well with other nodes.

c) Cliques of the network/ Cluster analysis

A clique is a subset of actors in the network whereby every actor is close to another in the subset and it is defined as a maximum complete subgraph ([Borgatti, Everett and Freeman, 2002](#)). Moreover, the clique co-membership matrix is a proximity matrix in which larger values indicate a stronger link ([ibid](#)). In addition to analysing the factions, a clique analysis was conducted to identify the informal subgroups that exist in the team ([Zhang, He and Zhou, 2013](#)). However, cliques can overlap so that individual actors can belong to more than one clique. A clique of the network or cluster analysis is a coefficient of SNA to explore the feature of knowledge flows within the subgroup ([Tang, 2012](#)). The results of the data analysis shown in Table 5.9 indicate that this network contained 8 clusters, each of which consists of a mixture of

three or more local and foreign members. Therefore, it seems clear that knowledge was transferred between a foreign and a local partner in this ICJV Project.

Table 5.9 Cluster Analysis (ICJV Project-1A)

N	Clusters
1*	LC02-QS01 LC01-PM01 F-PM03 LC01-Sup01 LC01-SVP
2*	LC01-BUM LC02-QS01 F-PM03 LC01-SVP
3*	F-CE Eng LC01-Eng01 F-PM03
4*	F-AD F-CE Eng F-PM03
5*	LC01-Eng02 LC01-PM02 F-PM03
6*	LC01-Eng01 LC01-PM02 F-PM03
7*	LC02-QS01 LC01-PM01 LC01-PM02 F-PM03 LC01-SVP
8*	F-AD F-PM03 LC01-SVP

* = Mixture of local and foreign partners

 = Most active cliques

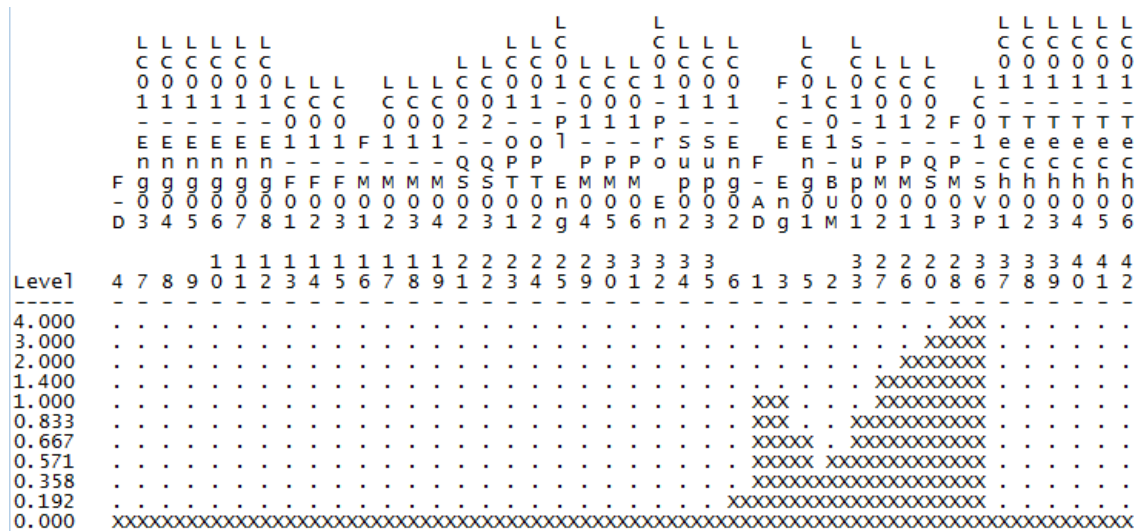


Figure 5.6 Hierarchical Clustering of Overlap Matrix (ICJV Project-1A)

Tang (2012) defines co-members as those who are responsible for maintaining the structure of several clusters. High co-membership qualifications mean that they occupy key positions in maintaining many clusters. According to Table 5.9 and Figure 5.6, actors F-PM03 and LC01-SVP were the most active actors in the first highest number of cliques, LC02-QS01 was the most active in the second highest and LC01-PM01 and LC01-PM02 were the most active at the third highest level. F-PM03 was a project manager of a foreign partner (with 6-15 years of experience) and LC01-SVP (with more than 20 years of experience). Borgatti, Everett, and Johnson (2013) observe that the larger values in the clique's co-membership matrix indicate a stronger link. Moreover, it can clearly be seen from Table 5.9 that actors F-PM03 and LC01-SVP were in 4 different cliques together (clique 1, 2, 7, 8), indicating that these actors were important within the group and are possibly occupied some kind of a leadership role in this project. It should be noted that cliques 1, 2, 7 and 8 contained a mixture of local and foreign partners in terms of acquiring and transferring knowledge. F-PM03 was active in all the cliques, indicating that this actor was regarded as playing a key role within the group and is possibly

occupied some kind of leadership role. He must also have been sufficiently knowledgeable to close a knowledge gap between the partners. As a result, it can be assumed that F-PM03 was regarded as a gatekeeper in term of receiving and disseminating knowledge from and to foreign partners.

This result is not in line with the in-degree and out-degree of centrality but it is in line with the betweenness centrality. The betweenness centrality presented in the last section score illustrated that F-PM03 (Project manager of a foreign partner) was regarded as a gatekeeper in this project, followed by LC01-SVP. Actor F-PM03 was similarly highly active and also occupied some kind of leadership role. As a result, it should be noted that F-PM03 and LC01-SVP were able to close knowledge gaps between the partners. F-PM03 was the only actor who was regarded as a representative actor by a foreign partner; hence, he was involved in different cliques. It appears from the data analysis that F-PM03 usually received knowledge from LC01-SVP by face-to-face communication less than once a week, whereas LC01-SVP usually shared his knowledge and experienced with F-PM03 more than once a week by telephone, e-mail, and face-to-face communication. LC01-SVP was the key actor in this project, since F-PM03 mentioned that he was the decision maker from whom he acquired knowledge. Moreover, LC01-SVP indicated that coaching was the most prominent reason for sharing knowledge and experienced with F-PM03, who mainly received knowledge from him in the areas of project management, investment in the construction sector, financial risk, a bidding strategy incorporated with a preferential margin scheme, knowledge of local market conditions and administrative procedures from LC01-SVP. On the other hand, LC01-SVP mainly shared knowledge of construction techniques, construction knowledge, product process and development, the transfer and movement of materials and manpower or equipment manufacturing capacity, accumulated experience and track record/ a good track record and cost management with F-PM03.

4) Relationship between Key Actors, Knowledge Transfer Methods and Mechanisms, and Tie contents

a) Source of Knowledge

The factors that underpinned the actors' roles and the relationship between the source and the receiver of knowledge were further explored in this section, as well as why this particular actor was chosen to seek and share knowledge in this ICJV project. The results were analysed using a content analysis and they are presented in Table 5.10 to Table 5.12.

Table 5.10 Knowledge Sources and Receivers (ICJV Project-1A)

No	Knowledge Source and Receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Boss	14	0	14	20.29
2	Partner	11	5	16	23.19
3	Boss and partner	0	0	0	0.00
4	Working colleague	11	18	29	42.03
5	Consultant	0	0	0	0.00
6	Supervisor	1	0	1	1.45
7	Subordinate	0	9	9	13.04
8	Father	0	0	0	0.00
	Total	37	32	69	100

Table 5.11 Communications between Knowledge Sources and Receivers (ICJV Project-1A)

No	Communications between Knowledge Source and Receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	0	21	21	15.67
2	E-mail	9	16	25	18.66
3	Face-to-Face	32	30	62	46.27
4	Social Network	7	19	26	19.40
5	Telephone and F2F	0	0	0	0.00
6	E-mail and F2F	0	0	0	0.00
7	F2F and Social Network	0	0	0	0.00
8	All types of communication	0	0	0	0.00
9	Others	0	0	0	0.00
	Total	48	86	134	100

Table 5.12 Why this person was chosen to seek and share knowledge (ICJV Project-1A)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Business situation in order to adapt to the project	0	1	1	1.27
2	Coaching and sharing knowledge	1	3	4	5.06
3	He is a partner so he really has the local knowledge	5	1	6	7.59
4	Increasing the performance	0	1	1	1.27
5	Need approval/ Need to agree together	7	0	7	8.86
6	Policy/ Procedure	1	0	1	1.27
7	Problem-solving	1	0	1	1.27
8	Provide directions on how to manage the project	1	2	3	3.80
9	Responsibility	0	9	9	11.39
10	Sharing knowledge and experience	0	18	18	22.78
11	Their knowledge and experience/ Experience and skill	14	0	14	17.72
12	Their vision	5	0	5	6.33
13	Trust and their experience	9	0	9	11.39
	Total	44	35	79	100

According to the data in Tables 5.10-5.12, knowledge can be stored in many different repositories, depending on its type. As shown in Table 5.10, the research participants provided these findings for 69 knowledge transfers. The most common knowledge source and receiver of knowledge in the project with 29 counts (42.03%) was a working colleague in this project, while the second most common was a partner with 16 counts (23.19%), followed by a boss with 14 counts (20.29%) and a subordinate with 9 counts (13.04%). Most of the participants stated that they considered their colleagues as reliable sources of knowledge, which corresponds to the research of Kivrak et.al. (2008), who found that colleagues were the most important source of knowledge for firms. Moreover, it is indicated in Table 5.11 that face-to-face communication (46.27%) was seen to be the most essential means of communication between the actors in this project, followed by social networking (19.40%), e-mail (18.66%), and telephone (15.67%).

Additionally, the most important reasons for communicating with colleagues was found to be sharing knowledge and experience (22.78%), followed by their knowledge and experience (17.72%), and trust and their experience (11.39%) (See more details in Table 5.12). This may be due to the fact that sharing knowledge and experience may be a proper reason or that some of the participants may have thought that they were likely to capture and convert tacit knowledge into explicit knowledge by sharing any kind of knowledge and experience, especially the knowledge and experience of a partner as a source of knowledge for the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within their project.

b) Knowledge Transfer Methods and Mechanisms

Knowledge transfer methods and mechanisms are an important for a successful transfer of knowledge within a project. Various mechanisms can be used to seek and share the required knowledge and those uses for each KT in this project were identified by the participants, as shown below.

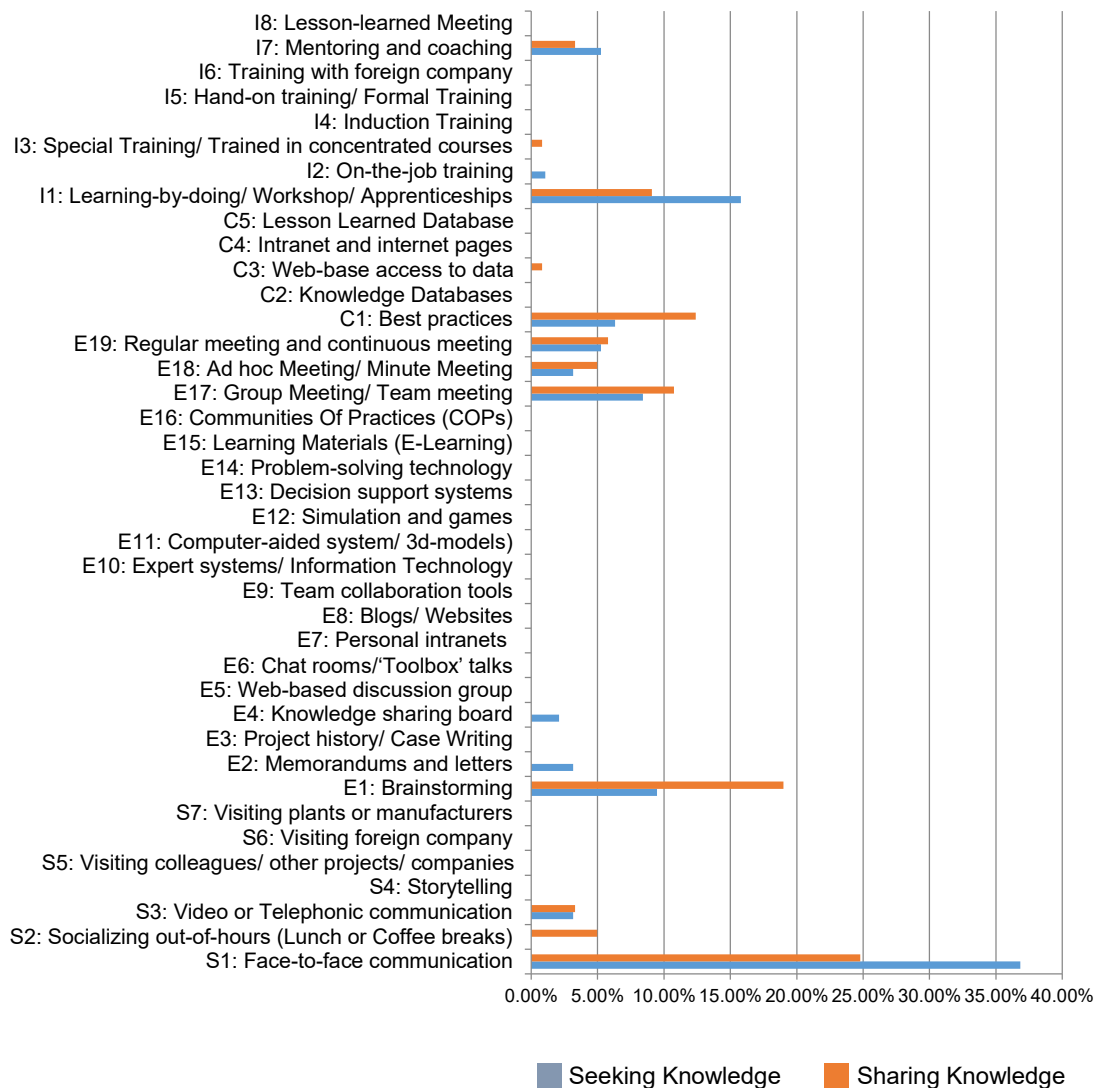


Figure 5.7 KT Methods and Mechanisms when seeking and receiving knowledge (ICJV Project-1A)

Figure 5.7 show that the research participants mainly used (S1) face-to-face communication as a mechanism to acquire their knowledge of the ICJV projects. This was followed by (I1) learning-by-doing/ workshop/ apprenticeships, (E1) brainstorming, and (E17) group Meetings/ team meetings. In terms of sharing knowledge, the methods most used to share knowledge in this ICJV project were (S1) face-to-face communication, (E1) brainstorming, (C1) best practice, and (E17) group meetings/ team meetings. The findings show that several of the participants preferred to use socialisation as a means of sharing tacit knowledge, including skills and ideas, through (S1) face-to-face communication, externalisation to articulate tacit knowledge and convert it into new explicit knowledge through (E1) brainstorming, (E17) group meetings/team meetings and (E19) regular meetings and continuous meetings, a combination of converting explicit knowledge from a foreign partner into a more systematic report through (C1) best practice and internalisation for the creation of new tacit knowledge from explicit knowledge (e.g. (I1) learning-by-doing and (I7) mentoring and coaching) local staff of the local company at different stages of the ICJV project. The type of knowledge flow between actors is presented in the next section.

c) Tie Characteristics and Tie Contents

The strength of a tie defines the type of knowledge that is transferred through it. The content and type of knowledge in ICJV projects are defined as a combination of both tacit and explicit knowledge. It is important to subdivide the type of knowledge into different categories in order to better examine the flow between the key actors in the project team; therefore, different categories of knowledge e.g. A) design knowledge and skills, B) technical expertise, C) management expertise, D) technological expertise, E) economic, marketing and financial expertise, F) quality assurance and control expertise, G) safety expertise, H) construction resources, I) training programmes, and J) local conditions and culture were determined and the results are shown below.

The tie contents between actors in the KT processes when seeking and sharing knowledge in this ICJV project are shown in Figure 5.8. The survey results revealed that management expertise was the most important knowledge exchanged among actors. The second most common types of knowledge were technical expertise and local conditions and culture. In contrast, actors rarely exchanged knowledge and experience of training programmes and quality assurance and control expertise. It seems that there was no knowledge of training programmes, quality assurance and control expertise in this ICJV project.

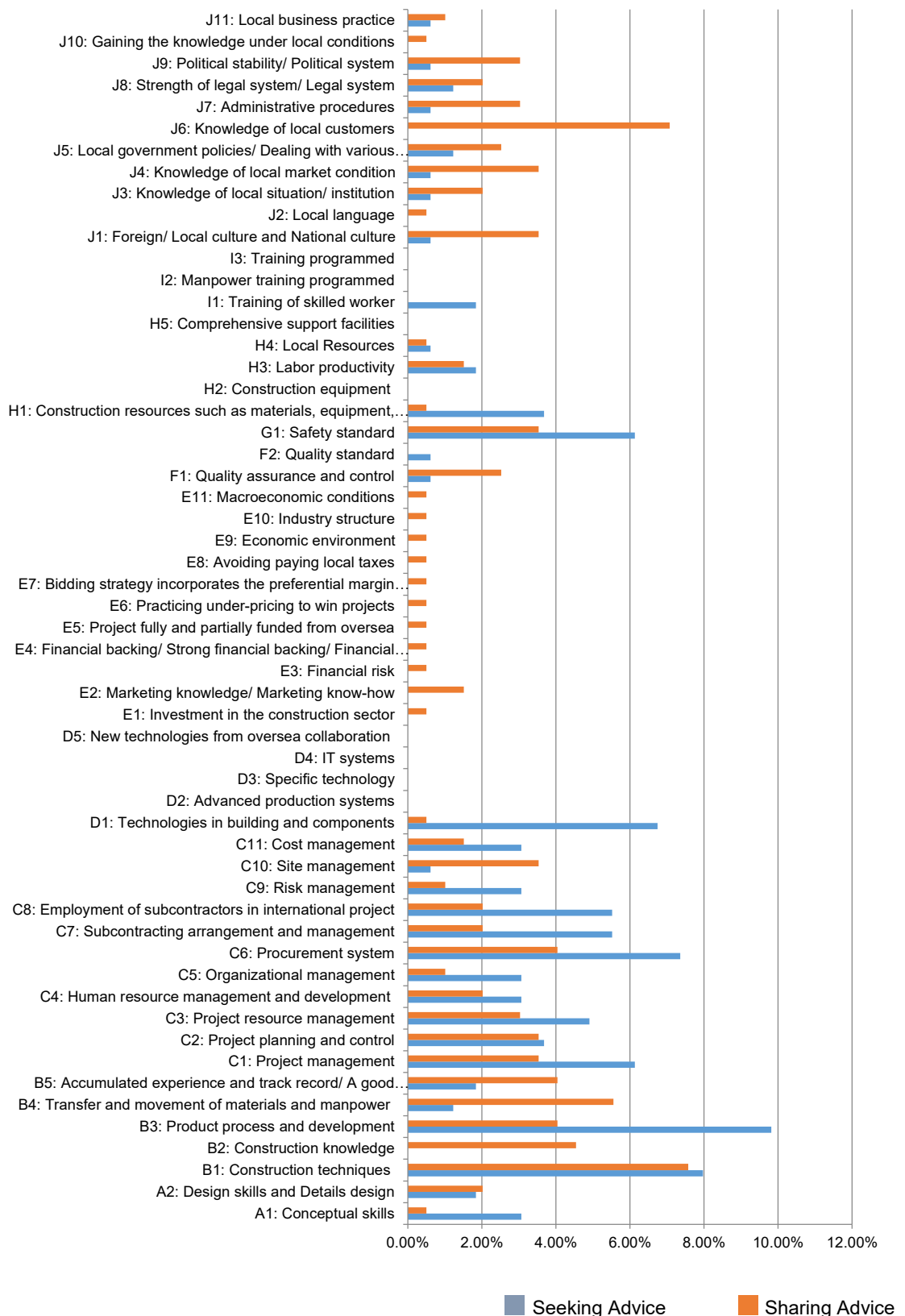


Figure 5.8 Tie contents of Knowledge Transfer when exchanging knowledge (ICJV Project-1A)

Moreover, Figure 5.8 shows the type of knowledge that was mainly exchanged in this ICJV project. The practitioners in this case study considered that the most significant factor for which they needed advice was the product process and development (B3), followed by construction techniques (B1), procurement system (C6) and technologies in building and components (D1). Conversely, the participants preferred to share their knowledge of construction techniques (B1), knowledge of local customers (J6) and the transfer and movement of materials and manpower or equipment manufacturing capacity (B4).

These results indicate that several of the participants preferred to discuss and exchange knowledge in the areas of construction techniques (B1), product process and development (B3) and the procurement system (C6) within this ICJV project.

Since the aim of this research is to identify and understand the processes of transferring knowledge in ICJV projects, the most significant knowledge between a key actor or a local and a foreign actor was examined to determine whether knowledge (tie contents) is more in demand by particular actors. Six actors were identified as the key actors in this ICJV project in the previous section. Three actors were identified as being perceived as experts with the highest in-degree centrality in this ICJV project. Hence, it was considered to be important to examine their choice of knowledge transfer methods and mechanisms and the flow of knowledge between them.

As argued in the previous section, LC01-Sup01 (Supervisor) was perceived to be an expert, as well as a knowledge consumer, knowledge broker and gatekeeper in this project. Moreover, the results of a previous analysis indicated that this network was organised around LC02-QS01. This clique co-membership matrix indicates that F-PM03 (Project Manager of foreign partner) and LC01-SVP (Senior Vice President of local partner) can be regarded as key actors at the highest level, indicating a stronger link to a leadership role in this ICJV project. Moreover, since LC01-PM01 and LC01-PM02 (Project Managers of local partner) were the most active at the second level of the clique co-membership matrix, it may be assumed that they could be regarded as the key actors in this network, as well as F-PM03 and LC01-SVP. As a result, it was essential to analyse the KT processes of this group of key actors and the relationship between them is indicated in Table 5.13.

Table 5.13 SNA between key actors (ICJV Project-1A)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gate Keeper	Focal point	Co-membership Of cliques
LC01-Sup01	Supervisor	X(1)	X(1)	X(1)	X		
F-PM03	Project Manager	X(2)					X(1)
LC01-PM02	Project Manager	X(3)	X(2)	X(2)			X(2)
LC02-QS01	Quality Surveyor					X	X(2)
LC01-SVP	Senior Vice President						X(1)
LC01-PM01	Project Manager		X(3)				X(2)

Expert	=	a high in-degree of centrality value
Knowledge Consumer	=	a high out-degree of centrality value
Knowledge Broker	=	a high in- and out-degree of centrality value
Gate Keeper	=	a high betweenness centrality value
Focal point	=	This network is organised around this actor
Co-membership of cliques	=	The most active actor in the first highest number of cliques

Table 5.14 Knowledge sharing between key actors (ICJV Project-1A)

Actors		LC01-Sup01	F-PM3	LC01-PM02	LC02-QS01	LC01-SVP	AD	LC01-PM01
LC01-Sup01	Received		X		X	X		X
	Shared							
F-PM3	Received			X		X	X	
	Shared							
LC01-PM02	Received		X					X
	Shared							
LC02-QS01	Received		X	X		X		
	Shared		X	X				X
LC01-SVP	Received						X	
	Shared		X	X				X
LC01-PM01	Received		X	X				
	Shared			X				

Table 5.15 Knowledge exchange between key actors (ICJV Project-1A)

Actors	Position	Received			
		From	Relationship	How often	Why
LC01-Sup01	Supervisor	LC01-SVP	Boss	Less than once a week	Trust and their experience
		F-PM3	Partner	More than once a week	As a partner
		LC01-PM01	Boss	More than once a week	Need approval
		LC02-QC01	Boss	More than once a week	Need approval
F-PM3	Project Manager	F-AD	Boss	Less than once a week	Their vision
		LC01-PM2	Colleague	More than once a week	Their knowledge and experience
		LC01-SVP	Boss	Less than once a week	Decision maker
LC01-PM2	Project Manager	LC01-PM01	Boss	Once a day	Trust
		F-PM3	Partner	More than once a week	As a partner
		LC01-SVP	Boss	Less than once a week	Their vision
LC02-QC01	Project Manager	LC01-SVP	Boss	Less than once a week	Their vision
		F-PM3	Partner	More than once a week	Their knowledge and experience
		LC01-PM2	Colleague	More than once a week	Their knowledge and experience
LC01-SVP	Senior Vice President	F-AD	Colleague	Less than once a week	As a partner
LC01-PM01	Project Manager	LC01-PM2	Colleague	More than once a week	Trust
		F-PM3	Partner	More than once a week	As a partner

Actors	Position	Shared			
		To	Relationship	How often	Why
LC02-QC01	Project Manager	F-PM3	Partner	More than once a week	Responsibility
		LC01-PM2	Partner	More than once a week	Responsibility
		LC01-PM01	Partner	More than once a week	Responsibility
LC01-SVP	Senior Vice President	F-PM3	Subordinate	More than once a week	Coaching and sharing knowledge
		LC01-PM2	Partner	Less than once a week	Coaching and sharing knowledge
		LC01-PM01	Subordinate	More than once a week	Coaching and sharing knowledge
LC01-PM01	Project Manager	LC01-PM2	Colleague	More than once a week	Provide directions on how to manage the project

F = Foreign actor

LC-01 = Local company-01

LC-02 = Local company-02

Based on the data in Table 5.14 and Table 5.15, most of the key actors usually sought advice from the boss (7 counts), partner (4 counts) and colleagues (4 counts) respectively, whereas they usually shared their knowledge and experience with a partner (4 counts), subordinate (2 counts) and colleague (1 count). The majority of them preferred to ask for advice from their boss because they needed approval and their boss was the decision maker in the project; moreover, they trusted his knowledge experience. The reasons for sharing their knowledge and skills were responsibility, coaching and providing directions on how to manage the project.

Table 5.16 KT methods and mechanisms and tie contents received by key actors (ICJV Project-1A)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
LC01-Sup01	LC01-SVP	S1	E1	C1	I1			C1 C4 C5							
	**F-PM03	S1	E1	C1	I1			C1 C2 C3							
	LC01-PM01	S1	E1		I1			C1							
	LC02-QS01	S1	E1		I1			C1			F1 F2				
**F-PM03	**F-AD	S1						C1 C5 C7							
	LC01-PM02	S1	E17				B1 B4	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10			F1		H1 H2 H3 H4 H5		J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11
	LC01-SVP	S1						C1		E1 E3 E7					J4 J6
LC01-PM02	LC01-PM01	S1						C1							
	**F-PM03		E2					C1 C2 C3							
LC02-QS01	LC01-SVP	S1						C1		E1 E3 E7					J4 J6
	F-PM03	S1	E1			A1		C6	D1						
	LC01-PM02	S1	E2 E17 E18 E19			A1	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10		E1					
LC01-SVP	**F-AD	S1 S3	E17 E18 E19					C1 C2 C3							
LC01-PM01	LC01-PM02	S1						C1							
	**F-PM03		E2					C1 C2 C3							

Table 5.17 KT methods and mechanisms and tie contents shared by key actors (ICJV Project-1A)

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
LC02-QS01	**F-PM03	S1	E17 E18 E19		I7			C2 C6 C7 C8 C11							
	LC01-PM01	S1	E17 E18 E19		I7			C6 C7 C8							
	LC01-PM02	S1	E17 E18 E19		I7			C6 C7 C8							
LC01-SVP	LC01-PM01	S1 S3	E17 E18 E19				B1 B2 B3 B4 B5	C11							
	**F-PM03	S1 S3	E17 E18 E19				B1 B2 B3 B4 B5	C11							
	LC01-PM02	S1 S3	E17 E18 E19				B1 B2 B3 B4 B5	C11							
LC01-PM01	LC01-PM02	S1	E17 E18 E19		I1	A1 A2	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11	D1	E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11					

Based on the data gathered in the previous section about the perceived experts in this project, it was considered to be important to examine the KT methods and mechanisms, as well as the type of knowledge exchanged between these key actors. Therefore, the KT methods and mechanisms and knowledge flow between the key actors in this ICJV project are shown in

Tables 5.16 and Table 5.17. The details of the methods and mechanisms and types of knowledge are shown in Appendix E.

The KT methods and mechanisms and type of knowledge that influence KT processes between the key actors in this ICJV project are shown in Table 5.16 and Table 5.17. In terms of the KT methods and mechanisms, the findings indicated that the majority of the key actors in this ICJV project preferred to use (S1) face-to-face communication, (S3) telephonic communication, (E1) brainstorming, (E2) memoranda and letters (E17) group Meetings/ team meetings, (E18) minutes of meeting, (E19) regular meetings and continuous meetings, (C1) best practice, (I1) learning-by-doing, and (I7) mentoring and coaching as methods and mechanisms to transfer knowledge between them.

Moreover, the findings revealed the most used KT methods and mechanisms to exchange knowledge in this ICJV project. Based on the data gathered in this case study, it is clear that (S1) face-to-face communication was the most important method and mechanism to transfer knowledge and experience, followed by (E17) group Meetings/ Team meetings, (E18) minutes of meetings, (E19) regular meetings and continuous meetings, (E1) brainstorming, and (I1) learning-by-doing. However, there are only some of the key actors preferred to use (S3) telephonic communication, (E2) memoranda and letters, and (C1) best practice to acquire knowledge in this ICJV project, whereas use (I7) mentoring and coaching to share their knowledge. It would appear that some KT methods and mechanisms (i.e. socialising out-of-hours (lunch or coffee breaks), storytelling, visiting other projects or foreign companies, project history/ case writing, knowledge- sharing boards, knowledge databases, on-the-job training or training with foreign companies were not used by these key actors.

Most of these methods correspond with those found by many authors in the literature, e.g. Carrillo (1996), Goh (2002), Wende and Haghirian (2009), and Stevens (2010). As a result, the choice of these KT methods and mechanisms gives a further indication of the tie contents in the development of the conceptual framework. This argument is also supported by a statement from LC01-Sup01, the supervisor who was perceived to be an expert, knowledge consumer, knowledge broker and gatekeeper for enhancing the KT processes in this project, which reads as follows;

[...] “we had a discussion almost every day. The supervisor of the foreign partner came to the site construction to consult the team and interaction on a face-to-face basis. We also sometimes used the telephone or email to ask for advice and share knowledge.

[...] The weekly meeting consisted of a group discussion about the tasks that occur in the project, and the learning by doing that was needed to help and needed the ICJV project. This was because learning was important to the work. Moreover, I recommend that training from both local and foreign suppliers of engine oil, machinery, etc. is necessary. Everything must have a method to work before the project starts. Therefore, everyone must start training before working, both those at the headquarters and the workers on each project. Then, they should receive general training from the supervisor in each project again.

The most likely explanation for these findings is that Training from both local and foreign suppliers is needed to improve the transfer of knowledge between partners in an ICJV project.

In terms the knowledge flow between these key actors, the most useful types of knowledge exchanged in this ICJV project are shown in Tables 5.16 and Table 5.17. Based on the data gathered in this case study, it is clear that (C1) project management was the most important knowledge flow in this project, followed by (C2) project planning and control, (C3) project resource management, (C6) procurement system and (C7) subcontracting arrangement and management/corporate commitment and ability to assess, (B1) construction techniques, (B4) transfer and movement of materials and manpower or equipment manufacturing capacity, (C8) employment of subcontractors in international projects and (C11) cost management, (B2) construction knowledge, (B3) product process and development, (B5) accumulated experience and track record/ good track record and (C5) organisational management (5 counts), (C4) human resource management and development and (E1) investment in the construction sector and (A1) conceptual skills, (C9) risk management, (D3) specific technology (such as natural gas technology), (D5) new technologies from overseas collaboration, (E3) financial risk, (E7) bidding strategy incorporating a preferential margin scheme, (J4) knowledge of local market conditions and (J6) knowledge of local customers.

Therefore, it would appear that there was a lack of sharing knowledge of (F) quality assurance and control expertise, (G) safety expertise, (H) construction resources, (I) training programmes and (J) local conditions and culture between these key actors. As a result, it seems that (G) safety expertise and (I) training programmes did not exist in this ICJV project.

Most of these methods correspond with those of many authors in the literature, e.g. [Carrillo \(1996\)](#), [Ofori \(1996\)](#), [Ganesan and Kelsey \(2006\)](#). As a result, the choice of these types of knowledge further indicates the tie contents in the development of the conceptual framework. This argument is supported by the following statement made by LC01-Sup01, the supervisor;

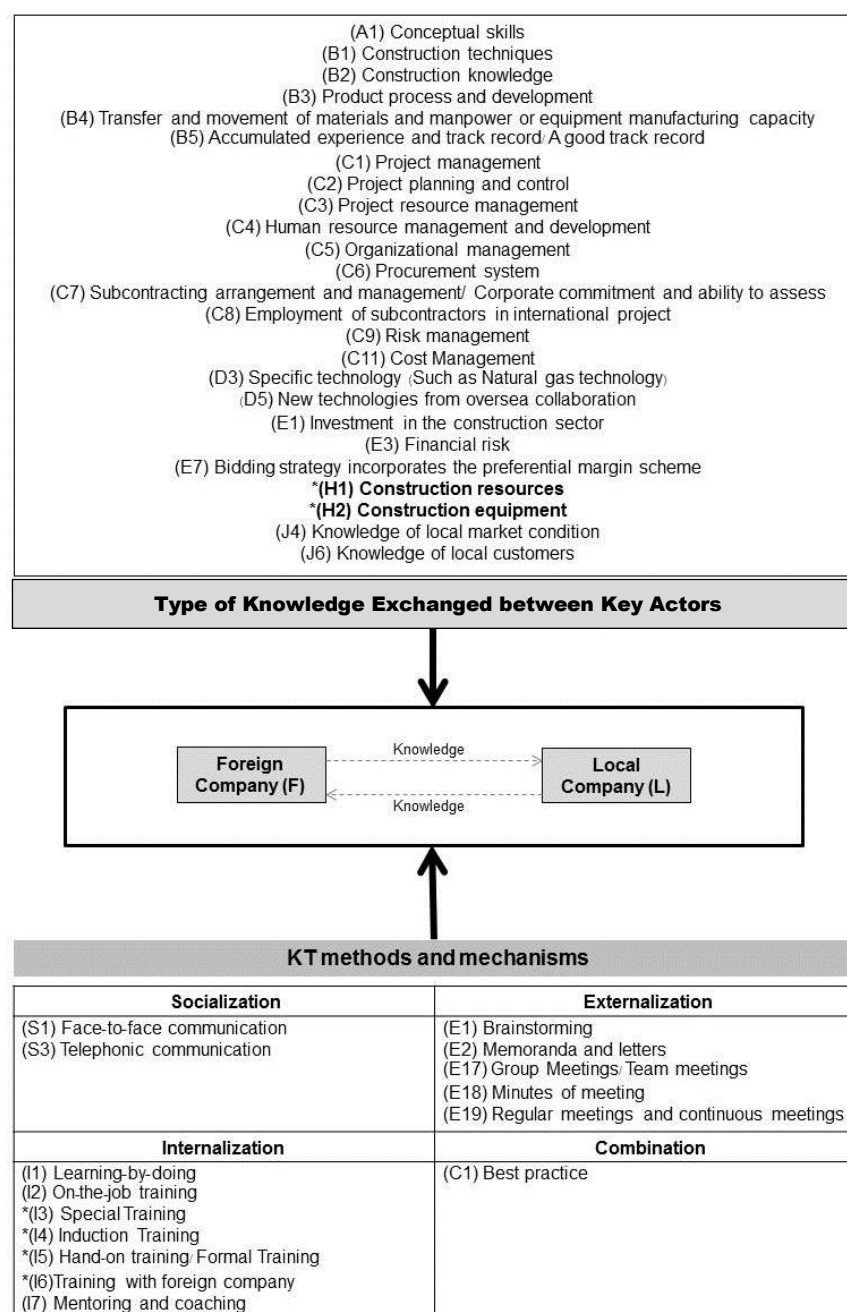
[...] “we not only exchanged knowledge of management expertise but we also discussed all types of knowledge, especially how to maintain the tools and machines used in the project, how to implement the new technology of railway systems which included how to repair, maintain and store tools and machines used in the project.”

Moreover, according to F-PM3 (Project Manager of foreign partner) who was regarded as the most active actor in the subgroups;

[...] “we mostly discussed technical expertise (construction knowledge and the transfer and movement of materials and manpower), especially the machinery which is owned by JV. Therefore, we needed to understand how it worked and how to use it. Since we have more experience, we tried to share our knowledge and experience of how the machinery works and how to use it, but most of the Thai staff were not sufficiently motivated to learn and had little interest in it. This may have been because they wanted to learn by themselves so they did not show any interest in being trained. As a result, we were just a reference for them.

[...] In terms of management expertise (project planning and control, risk management, site management), young engineers need to make a schedule based on careful consideration of the cost. However, they were focused on protecting the work schedule and working fast without considering the cost at the same time. So I tried to make them always think about the cost of each action because there was no point in losing money. I tried to teach them to control the budget, as well as quality assurance and control expertise.

The most likely explanation for these findings is that the project manager of the foreign partner aimed to share his knowledge and experience of machinery, project planning, control and cost management with local staff, but they had no motivation to change and take advantage of this training. Therefore, the will and lack of interest of the local staff are considered to have been the main barriers to transfer this knowledge in this ICJV project. As a result, the policy and management of the local partner should have been to convince its staff to change and take advantage of this training to improve the knowledge transfer within the ICJV project. The most used KT methods and mechanisms to exchange knowledge and experience in this ICJV project are illustrated in Figure 5.9.



*Results of interviews with key actors

Figure 5.9 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-1A)

It was shown in the previous section that the transfer of knowledge is the most important component of an ICJV Project. This section contains a summary of the key findings of this ICJV project and a discussion of the enabling and inhibiting factors found to influence the knowledge transfer process from foreign and local partners as a result of interviewing the main actors. The following is an analysis of those interviews.

The supervisor (LC01-Sup01) described the key enabling and inhibiting factors that influence the KT processes in the ICJV as follows;

[...] "Language is considered to be the main barrier to the transfer of knowledge between local and foreign staff. Some local workers find it difficult to communicate with foreign staff. Therefore, foreigners need to adjust to Thai people."

[...] "Culture is also considered to be a main barrier. We have a very different styles, methods and ways of thinking. Foreigners are very good at thinking systematically and we try to benefit from their advice in terms of following up the project and estimating the costs. Foreign partners have good experience of auctioning, purchasing and price comparison. Theirs is a more comprehensive concept, which is better than the Thai."

When asked about the ICJV performance and the success factors of ICJV projects, the supervisor (LC01-Sup01) gave the following response;

[...] "Commitment and internal rules are the most important indicators of successful ICJV projects, as well as the agreement of the contract."

He also suggested that;

[...] "Since we currently have no large projects in Thailand, we do not require high levels of technology"

[...] "Today, Thailand is facing the problem of political instability. This is the main obstacle for the company to acquire large new projects. Investment has been disrupted in Thailand and we cannot launch mega projects while we still have to deal with political instability and problems with the political system."

Additionally, the project manager of a foreign partner (F-PM03) described the key enabling and inhibiting factors that influence the KT processes in the ICJV, as follows;

[...] "One of the most prominent issues that influence the KT processes between partners is the lack of local staff's openness and willingness to learn. They have no motivation to train and change the way they work. The support of the management of the local partner in encouraging and motivating staff to be trained and change is vital to KT processes. We tried to change things, but they didn't support us."

When asked about the ICJV performance and success factors of ICJV projects, the project engineer (F-PM03) gave the following response;

[...] Agreement of the contract is considered to be the most important indicator of a successful ICJV performance. He is also suggested that;

[...] "It is important to send local staff to our country so that they can see the benefit for themselves. The local partner should budget for site visits and training by foreign companies or suppliers"

The data was collected from a number of interviews with key knowledge actors from this ICJV project using open-ended questions. The interviewees were briefed on the research background and topic, as well as the framework used to analyse the transfer of knowledge in this ICJV project. The key actors described the main factors that enabled and inhibited the KT processes in the project. They stated that language and culture were considered to be the main barriers to transferring knowledge between local and foreign staff as well as the lack of openness and willingness to learn of local staff. Hence, it seems that the two learning cultures were incompatible. Moreover, the key actors indicated that commitment and agreement of the contract were considered to be the most important indicators of a successful ICJV performance and the project manager from a foreign partner in this project also added that it was important to send local staff to his country so that they could see the benefit for themselves. A site visit and training programme for local ICJV staff would have helped them to acquire knowledge related to the construction methods. Therefore, the local partner should have budgeted for site visits and training by foreign companies or suppliers.

The next section contains an analysis of the second ICJV Project in this case study.

5.3.2 ICJV PROJECT-1B

1) Case Background

This ICJV project was undertaken by a French firm (F) and a Local Company (L) with an equity share of a 35 percent and a 65 percent respectively. This was a Track Rehabilitation Project (Phase 5), which was completed in August 2014 and the contract sum was £170 million. The stated objectives of this ICJV were to share the commercial risk, to fulfil the client's wish for a local firm to be involved in the project, complement the foreign partner's lack of local knowledge, and to share each other's expertise. Local Company-01 (LC01) is one of the largest firms in Thailand with major activities from general construction to infrastructure construction. Foreign Company (F) is a leader in the light-rail market in France, responsible for the construction of new rail construction (particularly high-speed lines), upgrading and maintaining national lines and industrial sidings, and installing and maintaining catenary wires in approximately 20 French cities.

2) Actors' Attributes

a) Gender, Age, and Nationality

The survey results indicated that all the participants (100.00%) were male. The managerial and professional staffs came from two different countries. 5.26% of them were French and 94.74% were Thais (see Table 5.18). Moreover, 42.11% of them were aged between 26 and 30, 15.79% were aged between 31 and 50 and the remainder were between 51 and 60 years old. Therefore, most of the respondents in this ICJV project could be said to be aged between 26 and 30.

Table 5.18 Nationality of research participants (ICJV Project-1B)

Nationality	Local Company (L)	Foreign Company (F)	Total	%
Thai	18	0	18	94.74
French	0	1	1	5.26
Grand Total	18	1	19	100
	94.74%	5.26%	100.00%	

b) Educational Background and job position

Many researchers have found that individuals' educational background and job position affect their perception of knowledge and experience. The research participants' educational background and the expertise of different stakeholders in various fields are illustrated in Table 5.19. The educational background of the research participants fluctuated. 10.53% of them had a certificate, 15.79% had a postgraduate degree and 73.68% had an undergraduate degree. Therefore, most of the respondents in this ICJV project described themselves as engineers.

Table 5.19 Cross Tabulation between educational background and job position (ICJV Project-1B)

Educational Background	Job position							Total	%
	Engineer	Project Engineer	Project Manager	Senior Engineer	Head of Warehouse	Supervisor	Vice President		
Certificate	-	-	-	-	1	1	-	2	10.53
Undergraduate	7	2	2	1	-	1	1	14	73.68
Postgraduate	1	-	2	-	-	-	-	3	15.79
Total	8	2	4	1	1	2	1	19	100.00

The cross tabulation in Table 5.19 indicates that most of the participants had graduated as undergraduates to hold the position of engineer in this project, but one engineer and two project managers had a postgraduate degree. Therefore, it seems that their 'educational background' of the participants in this ICJV projects was not related to their 'job position'.

c) Experience and primary discipline in a construction projects

According to Table 5.20, the respondents in this case study had a range of >5 to >20 years of experience in the construction industry i.e. <5 years (36.84%), 6-15 years (15.79%), 16-20 years (10.53%) and >20 years (36.84%). Therefore, most of them were seen to have <5 years and 6-15 years of experience in the construction industry and ICJV projects.

Table 5.20 Cross Tabulation between experience in construction and job position (ICJV Project-1B)

Experience in the construction industry	Job position							Total	%
	Engineer	Project Engineer	Project Manager	Senior Engineer	Head of Warehouse	Supervisor	Vice President		
< 5	7	-	-	-	-	-	-	7	36.84
6-15	1	1	1	-	-	-	-	3	15.79
16-20	-	-	2	-	-	-	-	2	10.53
> 20	-	1	1	1	1	2	1	7	36.84
Total	8	2	4	1	1	2	1	19	100.00

Based on Table 5.20, different stakeholders were experienced in various fields and have experience ranging from <5 to >20 years. The cross-tabulation in Table 5.20 confirms that there is a strong relationship between 'experience in construction' and 'job position'. It can be seen that most of the managerial staff in this case study had <5 and more than 20 years' experience in the construction industry i.e. Engineers, Project Engineer, Project Manager, Senior Engineer, Head of Warehouse, Supervisor and Vice President. Since the data for this case study was collected from an ICJV project: A Track Rehabilitation Project (Phase 5), the disciplines with the highest percentage in this project was Mechanical engineering (52.63%), reflecting the knowledge, skills, and experience required in this kind of project. The second highest was Civil engineering (26.32%) and the third was Electrical engineering (10.53%). Since Track rehabilitation works were likely to involve replacing rails and sleepers, reinforcing ballasts, improving the railway bed, purchasing machinery for Track rehabilitation, and repairing automatic signal facilities, mechanical engineers and civil engineers were required to inspect and operate the tracks, as well as maintain and repair them with support from technical personnel.

3) Social Network Characteristics

a) Size of the Network, Network Structure, and Network Density

This section contains the results of the social network analysis, i.e. the size, structure, and density of the network. This network consisted of 71 nodes, made up of 19 research respondents and 52 other project participants who were named by them. The network boundary is defined as all the participants from the organisation chart of this project; as a result, there were 19 participants in this case study. The codes that denote the participants, their position and their relation to the network are presented in Figure 5.10 and Table 5.21.

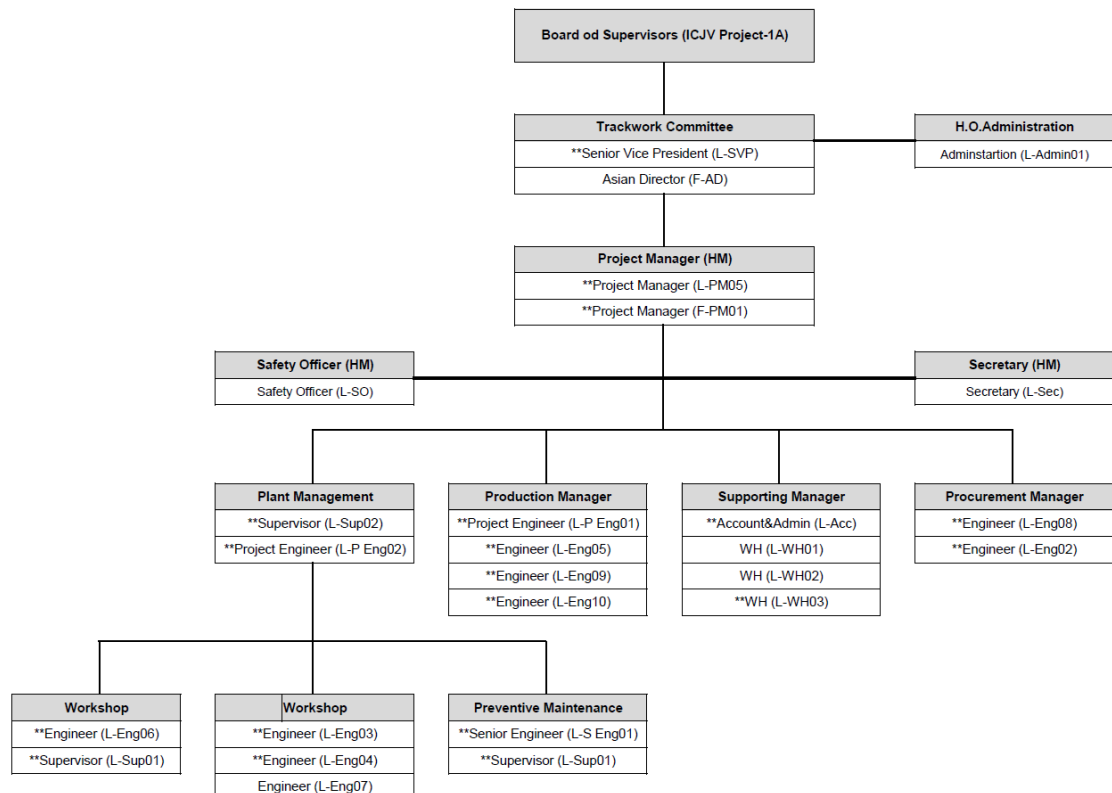


Figure 5.10 Job position and code of participants and their code (ICJV Project-1B)

Table 5.21 SNA internal restricted with a position (ICJV Project-1B)

Respondents	This person shares information with you	How often do you exchange knowledge with this person?	You share information with this person	How often do you share knowledge with this person?
L-Eng02	L-PEng2	4	L-Eng08	5
	L-PM01	3		
	L-PM05	2		
L-Eng03	L-AEng01	3	L-Eng10	3
	L-PEng2	3		
L-Eng04	L-Sup02	3	L-OPT4	4
	L-Sup03	5	L-PM04	4
L-Eng05	L-Peng01	4	L-QC1	4
	L-PM05	4	L-Admin01	3
L-Eng06	L-Peng02	4	L-F04	2
	L-Sup02	4	L-Sec01	2
			L-Seng01	1
			L-Sup01	2
			L-Tech02	3
			L-WH03	2
L-Eng08	L-Eng02	5	L-Peng02	3
	L-PEng2	4		
	L-PM01	3		
	L-PM05	2		
L-Eng09	L-Acc	2	L-Eng10	1
	L-Eng10	1	L-F01	4
	L-Peng01	5	L-F02	4
	PM01	2	L-F03	4
			L-Tech04	3
L-Eng10	L-Peng01	3	L-Eng03	3
L-PEng1	L-PM05	3	L-PM05	3
L-PEng2	L-Peng01	3	L-Eng06	5
	L-PM01	4	L-Seng01	4
	L-PM05	5		
F-PM01	F-AD	2	L-Eng08	3
	L-Sup02	2	L-PEng01	2
	L-SVP01	1	L-PEng02	3
			L-PM05	3
L-PM02	L-SVP01	1	L-PM01	1
L-PM04	L-BM01	1	L-Eng01	3
	L-BM02	1	L-PEng03	3
	L-MD01	1	L-PM03	3
	L-SEVP01	1		
	L-SVP1	1		
	L-SVP02	1		

Respondents	This person shares information with you	How often do you exchange knowledge with this person?	You share information with this person	How often do you share knowledge with this person?
L-PM05	L-PEng01	4	L-Eng05	3
	L-PEng02	4	L-Eng06	4
	L-PML	1	L-PEng02	4
	L-SVP01	4		
L-Seng01	L-PEng02	3	L-AEng01	3
	L-Sup02	2	L-Eng04	3
			L-Eng07	1
			L-OPT1	1
			L-OPT2	1
			L-OPT3	1
			L-OPT4	1
			L-OPT5	3
			L-Tech1	1
			L-Tech3	1
			L-Tech5	3
			L-Tech6	3
L-Sup01	L-M15	5	L-SEng01	3
	L-Sup02	5		
L-Sup02	L-M02	1	L-Eng04	2
	L-M03	1	L-Eng06	2
	F-M05	1	L-Eng07	2
	L-M08	1	L-M01	1
	L-M09	1	L-M04	1
	L-M10	1	L-M06	1
	L-M12	1	L-M07	1
	L-M13	1	L-M11	1
	L-M15	1	L-M14	1
	L-PM1	1	L-SEng01	2
	L-PM5	1		
	L-PML	1		
L-SVP01	F-AD	1	L-PEng02	3
	F-D01	1	F-PM01	1
			L-PM05	3
L-WH03	L-WH1	3	L-WH1	3
	L-WH2	3	L-WH2	3

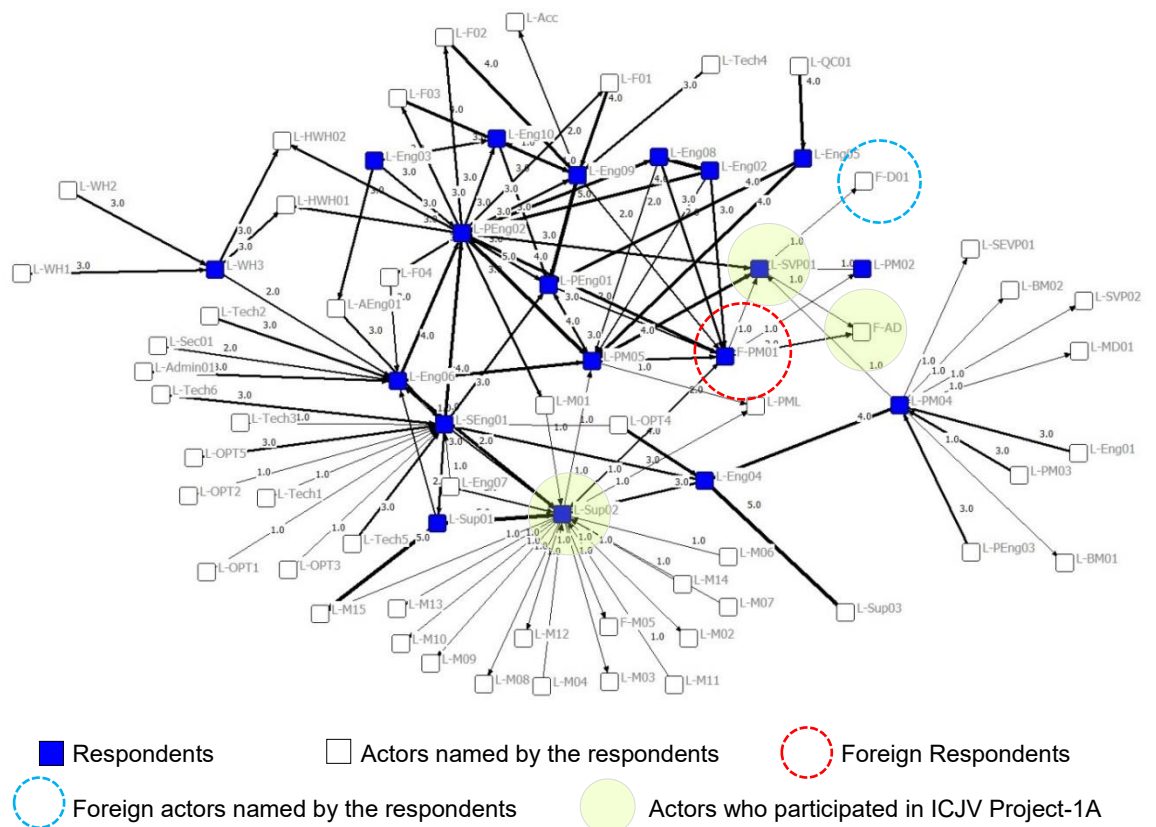


Figure 5.11 Sociogram showing knowledge sharing between respondents (ICJV Project-1B)

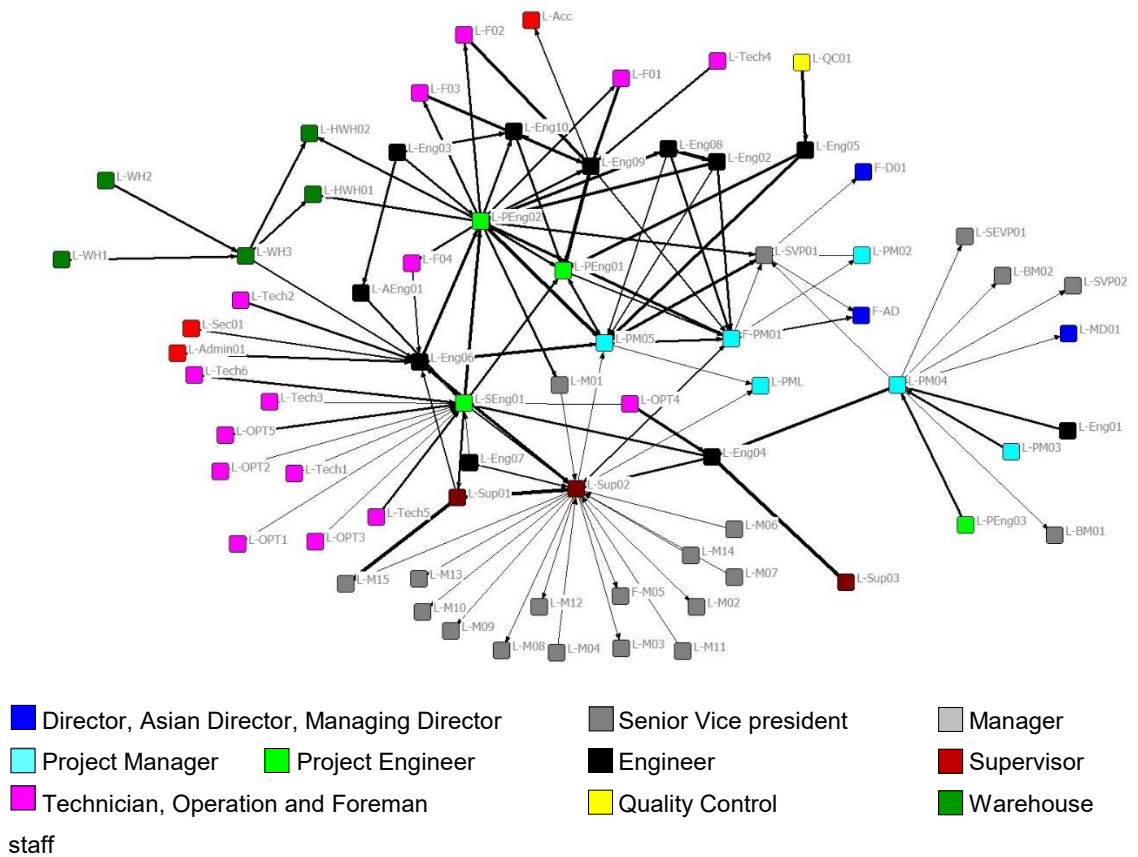


Figure 5.12 Sociogram showing knowledge sharing according to position (ICJV Project-1B)

The collaboration networks, network structure and the strength of the ties between nodes developed by the collected ICJV project-1B are shown in Figure 5.11 and the expertise of different stakeholders in various positions in the collaborative network is shown Figures 5.12. An arrow represents the existence of collaboration between two firms. The direction of the link is from the recipient to the knowledge source and the weight of the links between nodes indicates the frequency with which knowledge was transferred between two actors. It can be seen that the stronger the tie is, the more often they exchanged knowledge.

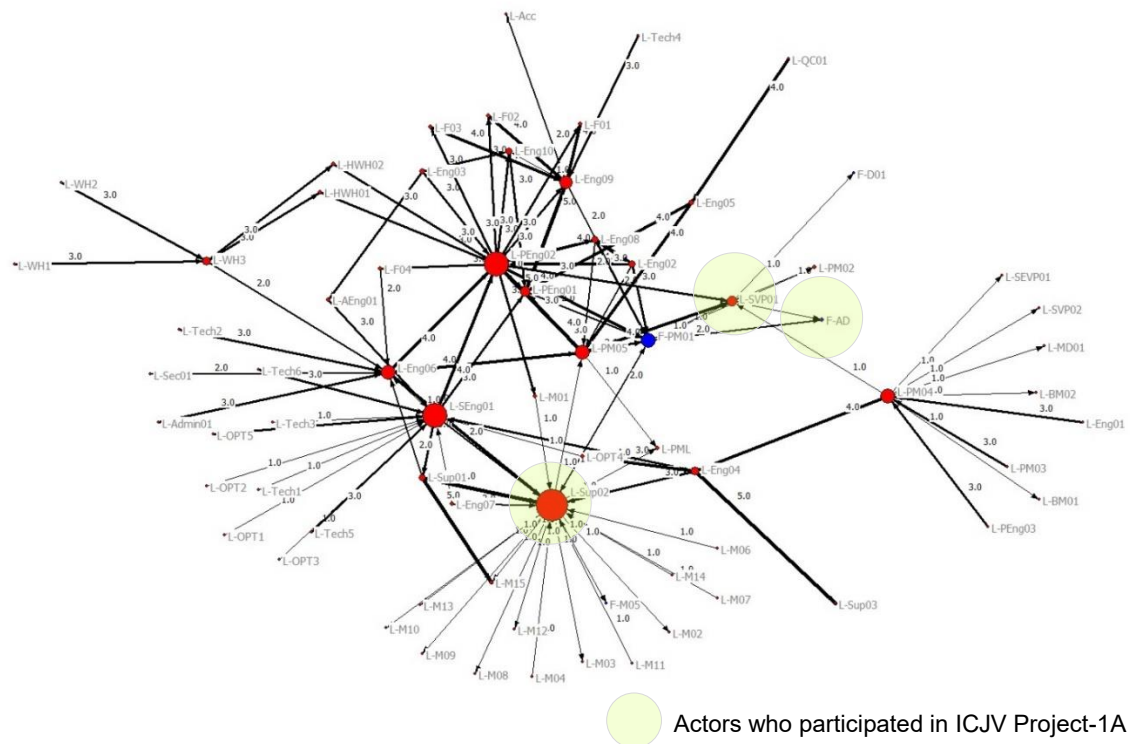


Figure 5.13 Sociogram showing network density (ICJV Project-1B)

In this collaborative networks, it is shown that there are three actors participated and were involved in the ICJV Project-1A in 2002, e.g. F-AD, L-SVP01, and L-Sup02. It could be said that these were the key actors in the KT processes between ICJV Project-1A and ICJV Project-1B. In this study, this collaborative networks shows that only two foreign actors (F-AD and F-PM01) from a Foreign Company (F) participated in this ICJV Project. F-PM01 from the Foreign Company (F) was employed as a Project Manager.

As illustrated in Figure 5.13, there was a good connection between foreign and local actors, e.g. Supervisor (L-Sup02), Senior Engineer (L-SEng01), Project Engineer (L-PEng02), Project Manager (F-PM01 and L-PM05). They interlinked with other actors from various disciplines within this international project once a day or more than once every day. L-Sup02 had a supervisory position, L-SEng01 was a senior engineer position, L-PEng02 was a project engineer position, F-PM01 was a project manager from the foreign partner and L-PM05 was a project manager from the local partner.

The collaborative network shown in Figures 5.13 indicates that most of the local staffs preferred to ask for advice from the Supervisor (L-Sup02), Senior Engineer (L-SEng01), and

Project Engineer (L-PEng02). They usually exchanged their knowledge and experience with the team members once a day or more than once a day. It seems clear that they were well connected with the other local staffs and the foreign manager (F-PM01) in terms of the KT processes in this project. Furthermore, the collaborative network in Figures 5.13 also shows that L-Sup02, L-PEng02, and L-SEng01 were the most central actors who shared their knowledge and experience within the team members. It seems clear that they were well connected with other companies and he actually improved the KT processes in this project by being a source of knowledge for the team to deliver this Track rehabilitation project.

F-PM01 was another actor with gets knowledge and experience on how to managing the ICJV Project from F-AD and he exchanged his knowledge and experience with L-PM05 (project manager from the local partner). It seems clear that F-PM01 connected well with L-PM05 as they exchanged their knowledge and experience more than once a week. F-PM01 asked L-PM05 for advice on how to manage and construct the ICJV Project in Thailand because he trusted him. Moreover, the result indicates that F-PM01 received knowledge from L-Sup02 who had participated in ICJV Project-1A in 2002. It could be said that the KT processes in the ICJV Project were between L-Sup02 and F-PM01.

Moreover, it is indicated in Figure 5.13 that Project Manager (L-PM05) was the focal point in this network; hence, it can be assumed that this network was organised around him. He was a mechanical engineer with 16-20 years of experience and held the position of project manager of the local partner. L-PM05 sought advice from Project Engineer (L-PEng01) once a day and Logistics Manager (L-PML) less than once a week, whereas, he shared his experience with Engineer (L-Eng05) more than once a week and Engineer (L-Eng06) and Project Engineer (L-PEng02) once a week. He also exchanged his experience with Project Engineer (L-PEng02) once a day. Hence, it can be assumed that Project Manager (L-PM05) was responsible for coordinating the construction process in this project with the Engineer and Project Engineer.

This confirms that KT processes took place between L-Sup02, L-SEng01, L-PEng02, F-PM01 and L-PM05 and they were the experts in this ICJV project. As a result, it could be said that L-Sup02, L-SEng01, L-PEng02, F-PM01 and L-PM05 were the key actors in receiving and providing knowledge related to the Track rehabilitation. Therefore, this finding confirms that the supervisors, senior engineer, project engineer, and project managers were the potential links between the team members in this ICJV project. As mentioned above, three actors participated and were involved in the ICJV Project-1A in 2002, e.g. F-AD, L-SVP01, and L-Sup02. Another interesting finding is that only L-Sup02 could be said to be a key actor in receiving and providing knowledge related to the Track rehabilitation from ICJV Project-1A to ICJV Project-1B, whereas F-AD and L-SVP01 only seemed to exchange knowledge. It seems that the success of KT processes does not depend on actors' job position, but their motivation to transfer the knowledge.

According to the data gathered from the UCINET 6.0, a network density of 0.005 has a standard deviation of 0.068; hence, there is a potential of 0.5% links between actors in the team were connected. [Scott \(2012\)](#) observes that the network density would be 1.00 (100%) if all the actors in the team were connected. Since the network density in this ICJV Project was 0.005, which is a very low value, the analysis indicates that it is rather small compared to ICJV Project-

1A. Hence, it can be assumed that not all the connections possible in this network of 71 nodes were made. Therefore, the density of this network was rather small compared to ICJV Project-1A and ICJV Project-1C. Another interesting aspect of this network is that 0.5% of the potential links existed between actors. Hence, it could be asserted that this network was sparse because it is rare for a node to have ties with the remaining actors.

However, it is important to analyse the centrality measures in this study in order to identify the key actor who is more central and more strongly linked than others with regard to the transfer of knowledge in this ICJV project. The centrality measures are analysed in the next section and it is also vital to identify the kind of knowledge that was exchanged throughout this ICJV Project.

b) Degree of Centrality and Betweenness Centrality

As stated above, it is important to analyse the degree of centrality measures in order to determine which actor is more central and more strongly linked than others in terms of transferring knowledge in an ICJV project because the degree of centrality immediately shows the distance between each actor and all the others in the network. Actors' centrality measures, both the degree of centrality and betweenness centrality, can be used to identify the sources of knowledge, as well as influencing KT (Schröpfer, Tah, and Kurul, 2017).

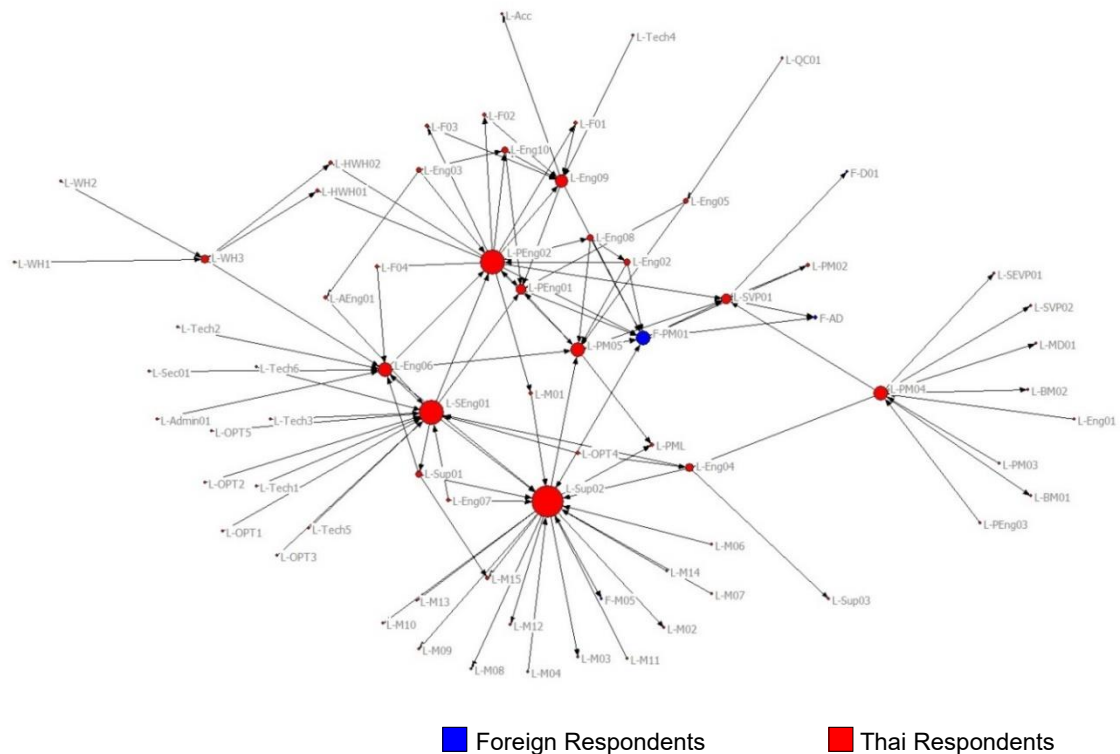


Figure 5.14 Sociogram showing network density (ICJV Project-1B)

The network map with different node sizes is shown in Figure 5.14. The node sizes correspond with the average degree of centrality of the actor. The larger nodes are more central in terms of the knowledge transferred within the team. The most central actors for out-degree and in-degree centrality are shown in Table 5.22, in which the average degree of centrality is illustrated. The in-degree and out-degree values of this case study are shown in Table 5.22.

Table 5.22 Degree of Centrality in the pilot case study (ICJV Project-1B)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
L-P Eng02	Project Engineer	6-15	31-40	45 (1)	23 (2)
L-PM05	Project Manager	15-20	41-50	15 (2)	21 (4)
L-Eng08	Engineer	6-15	26-30	14 (3)	3
L-S Eng01	Senior Engineer	15-20	41-50	13 (4)	22 (3)
L-Sup02	Supervisor	> 20	51-60	12	24 (1)
L-Eng06	Engineer	6-15	26-30	12	15
L-Eng04	Engineer	6-15	26-30	11	8
L-Eng09	Engineer	6-15	26-30	10	19 (5)
L-PM04	Project Manager	> 20	51-60	10	9
F-PM01	Project Manager	6-15	31-40	6	18 (6)
L-P Eng01	Project Engineer	> 20	51-60	6	21 (4)
L-SVP01	Senior Vice President	> 20	51-60	2	10

It is important to investigate whether the in-degree and out-degree values are linked with the actors' attributes, job position, age and years of experience. A clear link was found between the ages, years of experience and centrality values of the actors in this case study. This could indicate that the experts and knowledge consumers in this ICJV project were aged between 51 and 60 and between 31 and 40 respectively.

It is indicated in Table 5.22 that L-Sup02 was a supervisor on this project with an in-degree centrality of 24; hence, he was the most central actor in this network. The in-degree centrality of L-Sup02 was slightly more than that of L-P Eng02, L-S Eng01, L-PM05, and L-P Eng01. This means that L-Sup02 (Supervisor) was a perceived expert, who could respond to any queries in the entire network, followed by L-P Eng02 (Project Engineer), L-S Eng01 (Senior Engineer), L-PM05 (Project Manager) and L-P Eng01 (Project Engineer). L-P Eng02 (Project Engineer) was not only found to have a high in-degree centrality, but also a high out-degree centrality. His out-degree centrality was more than three times that of the next person, L-PM05 (Project Manager). This classifies him as the knowledge broker in this project. The survey results in this case study revealed that one key player from a foreign partner were involved in receiving and disseminating knowledge in the project. Based on the demographic characteristics and the centrality measures in Table 5.22, it could be argued that being a knowledge broker was not associated with a hierarchical position, years of experience or age.

Table 5.23 Betweenness Centrality Measures (ICJV Project-1B)

Actor	Betweenness
L-P Eng02	749.133
L-Sup02	664.817
L-S Eng01	488.267
L-PM05	296.367
L-Eng06	258.867
F-PM01	234.850

L-PEng02 (Project Engineer) had the highest betweenness centrality score, as indicated in Table 5.23, followed by L-Sup02 (Supervisor). This shows that L-PEng02 (Project Engineer) was regarded as the main gatekeeper in this network. Similarly, L-PEng02 (Project Engineer) also had high in-degree and out-degree centrality values. Therefore, it may be said that L-PEng02 (Project Engineer) was not only an expert, but was also regarded as a gatekeeper in this ICJV project. This finding corresponds with that of Borgatti, Everett and Johnson (2013), who found that betweenness centrality plays a gatekeeping role in this context. Nodes with high-betweenness are in a position to filter information and threaten the network with the disruption of operations. The most likely explanation for this result is that L-PEng02 (Project Engineer) played a broker role in this network, since many nodes needed L-PEng02 (Project Engineer) to reach other nodes by an efficient path. L-PEng02 (Project Engineer) was powerful because he could threaten to stop transmitting, making it more difficult for nodes to reach one another. It was shown that L-PEng02 (Project Engineer) could effectively discriminate between nodes and potentially correlate well with other nodes.

c) Cliques of the network/ Cluster analysis

According to the data in Table 5.2, this network contained 24 clusters, each of which consisted of three or more members. Also, cliques 5, 8, 9, 13, 19, 21 and 24 contained a mixture of local and foreign members.

Table 5.24 Cluster Analysis (ICJV Project-1B)

N	Clusters
1	L-Eng06 L-SEng01 L-Sup01 L-Sup02
2	L-Eng07 L-SEng01 L-Sup02
3	L-Eng04 L-SEng01 L-Sup02
4	L-M15 L-Sup01 L-Sup02
5*	F-PM01 L-PM05 L-Sup02
6	L-Eng06 L-PM05 L-Sup02
7	L-PM05 L-PML L-Sup02
8*	F-AD F-PM01 L-SVP01
9*	L-Eng02 L-Eng08 L-PEng02 F-PM01 L-PM05
10	L-Eng03 L-Eng10 L-PEng02
11	L-Eng05 L-PEng01 L-PM05
12	L-Eng09 L-Eng10 L-PEng01 L-PEng02
13*	L-Eng09 L-PEng01 L-PEng02 F-PM01
14	L-Eng09 L-F02 L-PEng02
15	L-Eng09 L-F03 L-PEng02
16	L-Eng09 L-F01 L-PEng02
17	L-Eng06 L-F04 L-PEng02
18	L-Eng04 L-OPT4 L-SEng01
19*	L-PEng01 L-PEng02 F-PM01 L-PM05
20	L-PEng01 L-PEng02 L-SEng01
21*	L-PEng02 F-PM01 L-PM05 L-SVP01
22	L-Eng06 L-PEng02 L-PM05
23	L-Eng06 L-PEng02 L-SEng01
24*	F-PM01 L-PM02 L-SVP01
*	= Mixture of local and foreign partners
 	= The most active cliques

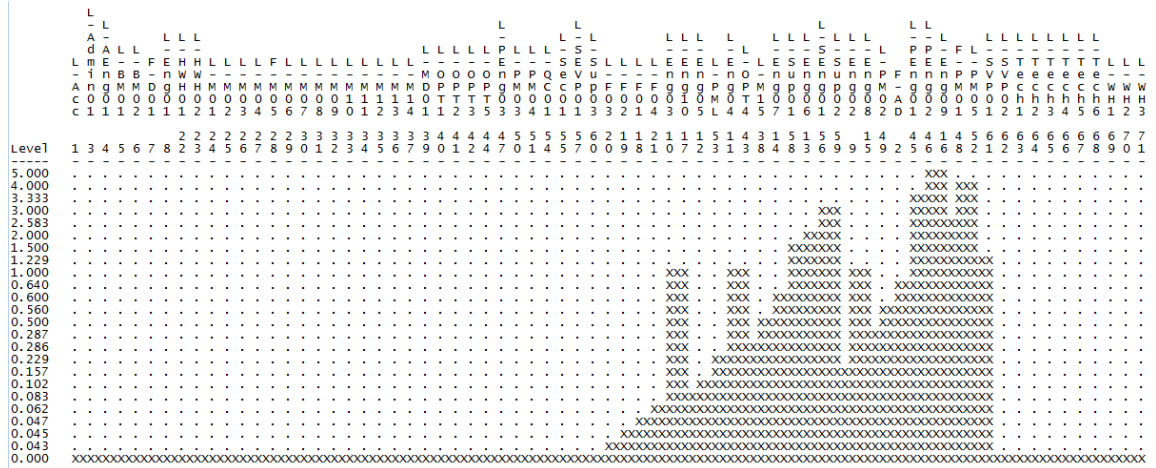


Figure 5.15 Hierarchical Clustering of Overlap Matrix (ICJV Project-1B)

As can be seen from Figure 5.15, L-PEng02 and L-Eng09 were the more active actors in the first highest number of cliques. F-PM01 and L-PM05 were the most active in the second highest and L-PEng01 was the most active at the third level. L-PEng02 was the project engineer of a local partner (with 6-15 years' experience) and L-Eng09 was an engineer (with 6-15 years' experience). Moreover, it is clear from Table 5.24 that L-PEng02 and L-Eng09 were in 5 different cliques together (clique 12, 13, 14, 15 and 16), indicating that these actors were important within the group and possibly held some kind of a leadership role in this ICJV project.

Moreover, it is indicated in Table 5.24 that cliques 9, 12, 13, 19 and 21 were the most active in this project with a mixture of actors. It can be noted that cliques 5, 8, 9, 13, 19, 21, and 24 were a mixture of local and foreign partners in terms of transferring and acquiring knowledge. L-PEng02 and L-Eng09 were active together in cliques 12, 13, 14, 15 and 16. L-PEng02, F-PM01 and L-PM05 were active together in cliques 9, 19, and 21, while L-PEng02, L-Eng09 and F-PM01 were active together in clique 13. It should be noted that cliques 9, 13, 19, and 21 were a mixture of local and foreign partners in terms of transferring and acquiring knowledge. Moreover, it was found that F-PM01 and L-PM05 were also active in cliques 5, 9, 19 and 21, which were a mixture of local and foreign partners in terms of transferring and acquiring knowledge. This indicates that these two actors were regarded as Project Managers; therefore, they were key actors within the group. As a result, it can be assumed that F-PM01 and L-PM05 occupied some kind of leadership role in this ICJV project and they must both have been sufficiently knowledgeable to close a knowledge gap between the local and foreign partners.

This result does not correspond to the in-degree centrality, but it is in line with the out-degree centrality and the betweenness centrality presented in the last section. According to the betweenness centrality score, L-PEng02 (Project engineer of the local partner) could be defined as the gatekeeper in this project and L-Sup02 (Supervisor) could be considered as an expert. It seems that L-PEng02 and L-Sup02 were similarly highly active and also occupied some kind of leadership role. As a result, it should be noted that L-PEng02 (Project engineer of the local partner), L-Eng09 (Engineer), F-PM01 (Project manager of the foreign partner) and L-PM05 (Project manager of the local partner) can be perceived as closing the knowledge gap between the partners. L-PEng02 was a project engineer of the local partner, who, based on the data analysis, received knowledge from his bosses (F-PM01, L-PM05 and L-P Eng01) once a day or

more than once a day by means of face-to-face communication, e-mail or telephone. He said that he regarded them as a team and he sought knowledge from them to fulfil his responsibilities in this project. Moreover, L-Eng09 also maintained that he sought knowledge from F-PM01, L-PM05 and L-P Eng01 once or more than once a week due to trusting their knowledge and experience. In addition, F-PM01 was the only actor who was regarded as a representative actor by the foreign partner; hence, he was involved in different cliques. It appears from the data analysis that he received knowledge from his colleagues and bosses (F-AD, L-Sup02 and L-SVP01) less than once a week by means of face-to-face communication and telephone. The need for their approval and the need to share experience were the most prominent reasons for seeking knowledge and experience, while he preferred to share his knowledge with his colleagues (L-PM05, L-P Eng01, L-P Eng02 and L-Eng08) once or more than once a week by means of face-to-face communication and e-mail. He acknowledged that the need to fulfil his responsibility was the most prominent reason for sharing knowledge and experience with them. L-PM05 was regarded as a project manager of the local partner, who relied on his contact with F-PM01. Surprisingly, he preferred to seek knowledge from and share it with L-SVP01, L-PEng01 and L-PEng02.

The results of an analysis of the source of knowledge and knowledge transfer methods and mechanisms are presented in the next section.

4) Relationships between Key Actors, Knowledge Transfer Methods and Mechanisms, and Tie Contents

a) Sources of Knowledge

The factors that underpinned the actors' roles and the relationship between the source of the knowledge and the receiver are further explored in this section, as well as why this particular people were chosen to seek and share knowledge in this ICJV project. The results of the content analysis and are presented in Tables 5.25-5.27.

Table 5.25 Knowledge Sources and Receivers (ICJV Project-1B)

No	Knowledge Source and Receiver	Count of Knowledge Source	Count of Knowledge Receiverss	Total	%
1	Boss	42	1	43	35.25
2	Partner	0	0	0	0.00
3	Boss and partner	0	0	0	0.00
4	Working colleague	16	61	77	63.11
5	Consultant	0	0	0	0.00
6	Supervisor	1	0	1	0.82
7	Subordinate	0	0	0	0.00
8	Father	1	0	1	0.82
	Total	60	62	122	100

Table 5.26 Communication between Knowledge Sources and Receivers (ICJV Project-1B)

No	Communications between Knowledge Source and Receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	38	44	82	32.03
2	E-mail	40	27	67	26.17
3	Face-to-Face	38	47	85	33.20
4	Social Network	11	11	22	8.59
5	Others	0	0	0	0.00
	Total	127	129	256	100

Table 5.27 Why this person was chosen to seek and share knowledge (ICJV Project-1B)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	In order to adapt the business situation to the project	0	0	0	0.00
2	Coaching and sharing knowledge	0	0	0	0.00
3	Decision making	1	0	1	0.91
4	Job discipline	6	3	9	8.18
6	Need approval/ Need to agree together	2	0	2	1.82
6	Policy/ Procedure	1	0	1	0.91
7	Problem-solving	0	0	0	0.00
8	Provide directions on how to manage the project	0	0	0	0.00
9	Responsibility	0	4	4	3.64
10	Sharing knowledge and experience	1	4	5	4.55
11	Teamwork	3	44	47	42.73
12	Their experiences/ Experiences	34	1	35	31.82
13	Their vision	0	0	0	0.00
14	Trust and their experience	5	0	5	4.55
15	Updated Information	0	1	1	0.91
	Total	53	57	110	100

According to the data in Tables 5.25-5.27, it was found that knowledge can be stored in many different repositories, depending on its type. Table 5.25 shows that the research participants provided these findings for 122 knowledge transfers. The most common knowledge source and receiver with 77 counts (63.11%) was a work colleague in this project, while the second most common was a boss with 43 counts (35.25%). Most of the participants stated that they considered colleagues as reliable sources of knowledge, which correlates well with the research of Kivrak et al. (2008), who found that colleagues were the most important source of knowledge for most firms. Moreover, according to Table 5.26, face-to-face communication (33.20%) was the most essential way for the actors in this project to communication with each other, followed by telephone (32.03%), e-mail (26.17%), and social networking (8.59%). Additionally, the most important reasons for receiving and sharing knowledge and experience was found to be teamwork (42.73%), followed by their knowledge and experience (31.82%), job discipline (8.18%), sharing knowledge and experience (4.55%) and trust and their experience (4.55%) (See more details in Table 5.27). This may be due to working as a team or that some of the participants may have regarded it as a possible way to capture and convert tacit knowledge to explicit knowledge based on any kind of knowledge and experience, especially the

knowledge and experience of a partner, as a source of knowledge for the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within their project.

b) Knowledge Transfer Methods and Mechanisms

Knowledge transfer methods and mechanisms are important components of a successful transfer of knowledge within a project. Various mechanisms can be used to seek and share the required knowledge. The participants in this case study identified the methods and mechanisms shown below that were used for each KT.

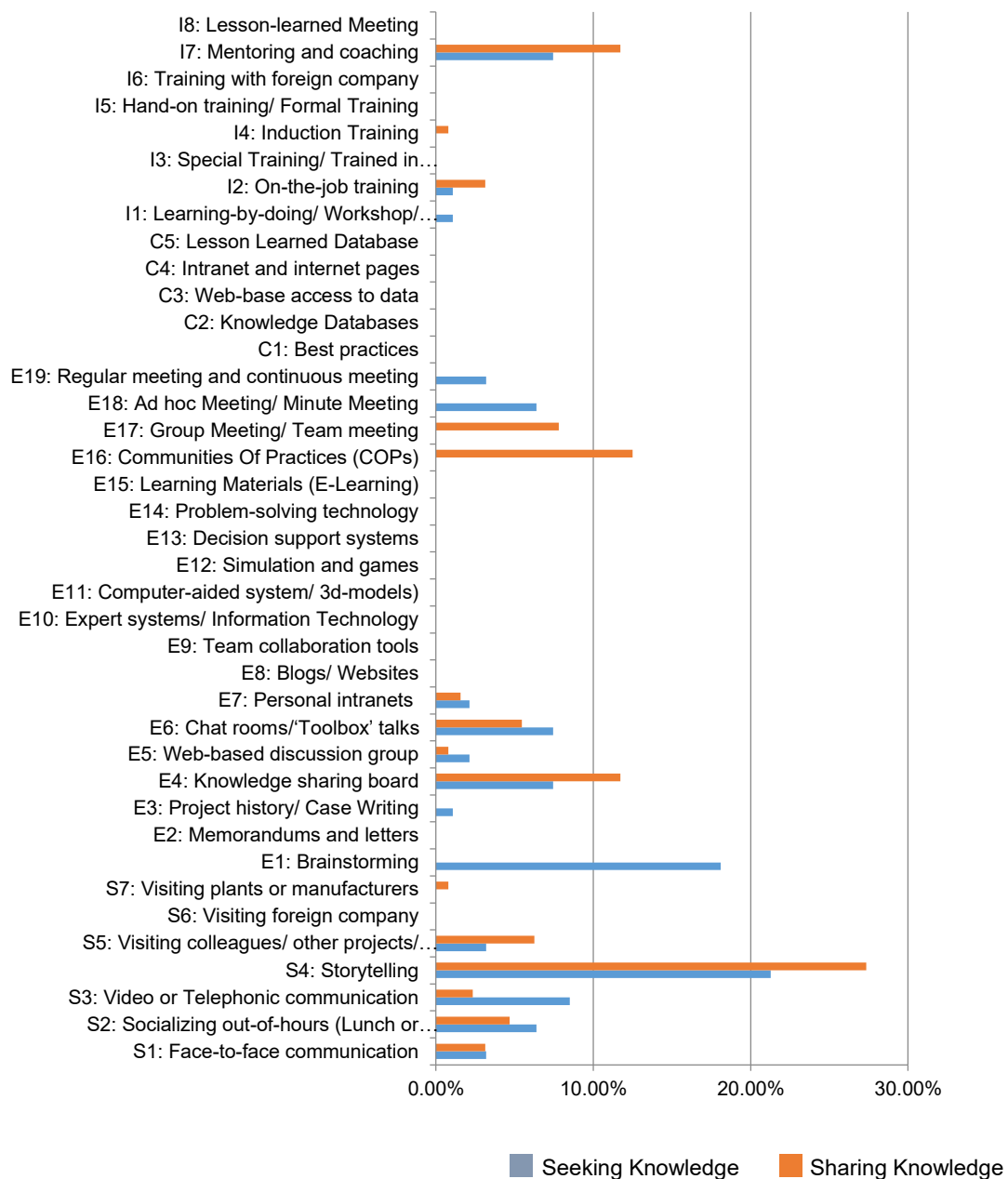


Figure 5.16 KT Methods and Mechanisms when seeking and receiving knowledge (ICJV Project-1B)

Based on Figure 5.16, the participants in this research predominantly used (S4) storytelling as a mechanism to acquire their knowledge of an ICJV project, followed by (E1) brainstorming, (S3) video or telephonic communication, (E4) knowledge sharing board, (E6) chat rooms/ 'toolbox' talks, (I7) mentoring and coaching, and (E18) minutes of meetings. In terms of sharing knowledge, the methods they mainly used in this ICJV project were (S4) storytelling; followed by (E16) communities of practices (COPs), (I7) mentoring and coaching, and (E4) knowledge sharing board respectively.

The findings show that several participants preferred to use socialisation as a process of sharing tacit to tacit knowledge, including skills and ideas, through (S1) face-to-face communication, (S2) socialising out-of-hours (lunch or coffee breaks), (S4) storytelling, externalisation to convert and articulate tacit knowledge into new explicit knowledge through (E5) web-based discussion groups and (E6) chat rooms/ 'toolbox' talks, and Internalisation to create new tacit knowledge from explicit knowledge, (e.g.(I7) mentoring and coaching) to exchange their knowledge and skills. The types of knowledge flow between actors are presented in the next section.

c) Tie Characteristics and Tie Contents

The survey results revealed that management expertise was the most important knowledge exchanged among actors. The second most common types of knowledge were economic, marketing and financial expertise and local conditions and culture and technical expertise. In contrast, the actors rarely exchanged knowledge and experience of safety expertise and quality assurance and control expertise. Hence, it seems that knowledge of safety expertise and quality assurance and control expertise did not exist in this ICJV project.

Moreover, the types of knowledge that were exchanged in this ICJV project are illustrated in Figure 5.17. The participants in this case study considered that project management (C1) was important knowledge for which they needed advice, followed by organisational management (C5), project planning and control (C2), project resource management (C3), human resource management and development (C4) and procurement management (C6). On the other hand, they thought it was important to share their knowledge of construction techniques (B1), construction knowledge (B2), product process and development (B3), transfer and movement of materials and manpower or equipment manufacturing capacity (B4) accumulated experience and track record/good track record (B5), procurement management (C6), and cost management (C11).

These findings indicate that several participants in this ICJV project preferred to discuss and exchange knowledge of procurement management (C6).



Figure 5.17 Tie contents of Knowledge Transfer when seeking and receiving knowledge (ICJV Project-1B)

As argued in the previous section, L-Sup02 (Supervisor) was perceived to be an expert, whereas the in-degree centrality of L-P Eng02, L-S Eng01 and L-PM05 was slightly lower than that of L-Sup02 (Supervisor). L-P Eng02 (Project Engineer) was also considered to be a knowledge consumer in this ICJV project. Moreover, it was shown in the analysis in the previous section that this network was organised around L-PM05. From the perspective of a clique co-

membership matrix, L-P Eng02 (Project Engineer) and L-Eng09 (Engineer) could be said to be the key actors at the highest level in this ICJV project with a strong link to a leadership role. Meanwhile, F-PM01 (Project Manager of the foreign partner) and L-PM05 (Project Manager of the local partner) were the most active at the second level of the clique co-membership matrix, which may imply that these two actors could also be regarded as key actors in this network together with L-P Eng02 and L-Eng09. As a result, it is essential to analyse the KT processes within this group of key actors, whose relationship is indicated in Table 5.28.

Table 5.28 SNA between key actors (ICJV Project-1B)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gatekeeper	Focal point	Co-membership of cliques
L-Sup02	Supervisor	X (1)			X(2)		
L-P Eng02	Project Engineer	X (2)	X(1)	X(1)	X(1)		X(1)
L-S Eng01	Senior Engineer	X (3)			X(3)		
L-PM5	Project Manager		X(2)			X	X(2)
L-Eng09	Engineer						X(1)
F-PM01	Project Manager						X(2)
L-Eng08	Engineer		X(3)				

F = Foreign actor L = Local company

Expert	=	a high in-degree of centrality value
Knowledge Consumer	=	a high out-degree of centrality value
Knowledge Broker	=	a high in- and out-degree of centrality value
Gate Keeper	=	a high betweenness of centrality value
Focal point	=	This network is organised around this actor
Co-membership of cliques	=	The most active actor in the first highest number of cliques

Table 5.29 Knowledge sharing between key actors (ICJV Project-1B)

Actors		L-Sup02	L-P Eng02	L-S Eng01	L-PM05	L-Eng09	F-PM01	L-Eng08
L-Sup02	Received				X		X	
	Shared							
L-P Eng02	Received			X	X		X	
	Shared							
L-S Eng01	Received	X	X					
	Shared							
L-PM05	Received		X					
	Shared		X					
L-Eng09	Received						X	
	Shared							
F-PM01	Received	X						
	Shared				X			
L-Eng08	Received		X		X		X	
	Shared							

Table 5.30 Knowledge exchange between key actors (ICJV Project-1B)

Actors	Position	Received				
		From	Relationship	How often	How to communicate	Why
L-Sup02	Supervisor	L-PM05	Boss	Less than once a week	Telephone, E-mail and F2F	Their experience
		F-PM01	Boss	Less than once a week	Telephone, E-mail and F2F	Their experience
L-P Eng02	Project Engineer	L-S Eng01	Colleague	Once a day	Telephone and F2F	Sharing Knowledge
		L-PM05	Boss	More than once a day	F2F	Responsibility
		F-PM01	Boss	Once a day	E-mail	Teamwork
L-S Eng01	Senior Engineer	L-Sup02	Colleague	Once a day	Telephone and F2F	Sharing Knowledge
		L-P Eng2	Boss	More than once a week	E-mail and F2F	Need Approval
L-PM05	Project Manager	L-P Eng02	Colleague	Once a day	Telephone	Their experience
L-Eng09	Engineer	F-PM01	Boss	Once a week	Telephone, E-mail and F2F	Trust
F-PM01	Project Manager	L-Sup02	Colleague		Telephone and F2F	Sharing Knowledge
		L-PM05	Boss	More than once a week	Telephone, E-mail and F2F	Trust
L-Eng08	Engineer	F-PM01	Boss	More than once a week	E-mail	Their experience
		L-PM05	Boss	Once a week	E-mail	Their experience
		L-P Eng02	Boss	Once a day	E-mail	Their experience

Actors	Position	Shared				
		To	Relationship	How often	How to communicate	Why
L-PM05	Project Manager	L-P Eng2	Colleague	Once a day	F2F	Teamwork
F-PM01	Project Manager	L-PM05	Colleague	More than once a week	E-mail and F2F	Responsibility

According to the data shown in Tables 5.29 and 5.30, most of the key actors usually asked for advice from their bosses (10 counts) and colleagues (4 counts), while they usually shared their knowledge and experience with colleagues. Most of them asked for advice from their bosses because of their experience and also because they trusted them and needed their approval to fulfil their responsibility. The reasons for sharing their knowledge and skills with their colleagues were based on teamwork and the need to fulfil their responsibility in this ICJV project.

Further to the data gathered in the previous section of the perceived experts in this project, it was considered important to examine the KT methods and mechanisms, as well as the types of knowledge received and shared between these key actors. The results of this examination are shown in Tables 5.31 and 5.32.

Table 5.31 KT methods and mechanisms and tie contents received by key actors (ICJV Project-1B)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
L-Sup02	L-PM05	S1 S4	E19										H1		
	**F-PM01	S1 S4	E19		I7								H1		
L-P Eng02	L-S Eng01	S1									F1 F2				
	L-PM05	S1	E1		I7			C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11							
	**F-PM01	S1 S4				A1 A2									
L-S Eng01	L-Sup02	S1	E19				B1 B2 B3 B4 B5								
	L-P Eng2	S1	E19					C6 C11							
L-PM05	L-P Eng2	S1	E1		I7		B4								
L-Eng09	**F-PM01	S1 S4				A1 A2		C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11	D1 D2 D3 D4 D5				H1 H2 H3 H4 H5		
	L-Sup02	S1 S4					B1			E1			H1 H4		
L-Eng08	L-P Eng2	S1	E1		I7		B4								
	L-PM05	S1 S4	E1		I7			C1 C2 C3 C4 C6							
	**F-PM01	S1 S4				A1 A2		C6 C11							

Table 5.32 KT methods and mechanisms and tie contents shared by key actors (ICJV Project-1B)

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
L-PM05	L-P Eng2	S1						C2							
		S4						C3							
*F-PM01	L-PM05	S1			I7		B1	C1		E1	F1		H2		
		S4						C2		E2			H3		
								C3		E7					
								C4							
								C5							
								C6							

F = Foreign actor

L = Local actor

The KT methods and mechanisms, types of knowledge and tie contents that influenced the KT processes between the key actors in this ICJV project are shown in Tables 5.31 and 5.32. In terms of KT methods and mechanisms, it was found that that most of the key actors in this ICJV project preferred to use (S1) face-to-face communication, (S4) storytelling and (I7) mentoring and coaching, (E1) brainstorming and (E19) regular meetings and continuous meetings to exchange knowledge. The choice of these KT methods and mechanisms indicated the tie contents that could be used to develop the conceptual framework. This argument is also supported by the statement of LC01-P Eng02 (Project engineer), who was perceived to be an expert, knowledge consumer, knowledge broker and gatekeeper for enhancing the KT processes in this project. He described how both parties had consolidated their knowledge and expertise in project method statements, as follows;

[...] “we all had knowledge and expertise as methods statements, such as how the construction record and daily report was to be done,...how to monitor the process of the construction. A daily report that included the weather conditions was the most useful information for making decisions.

[...] ... the procedures to be followed to access information in this JV were formalised, allowing each party to work separately but come together to coordinate where the work of both parties intersected. We used e-mail with a clear topic to coordinate with our JV partner and we also used a Line group (JV) via the Line Application for discussions during the construction process.

[...] ...there were no joint training or feedback programme available in this JV project. It was necessary to increase the knowledge of new technologies by being trained by a specialist from a foreign partner, but there was no budget for a training programme. Training was only available at executive and managerial levels. Project engineers and engineers had no opportunity to train with foreign companies or suppliers.

Therefore, it seems from this finding that the construction record and daily report were perceived to be the most useful KT methods and mechanisms to facilitate and monitor the knowledge of the construction process between actors, as well as training with a specialist from a foreign partner.

In terms of the knowledge flow, the findings indicated that (C6) procurement system was the most important knowledge flow in this project, followed by (C2) project planning and control, (C3) project resource management, (C1) project management, (C11) cost Management, (C4) human resource management and development, (H1) construction resources, (A1) conceptual skills, (A2) design skills and design details, (B1) construction techniques, (B4) transfer and movement of materials and manpower/ equipment manufacturing capacity, (C5) organisational management, (C7) sub-contracting arrangements and management/ corporate commitment and ability to assess, (C8) employment of sub-contractors in international project, (C9) risk management, (C10) site management, (E1) investment in the construction sector, (F1) quality assurance and control, (H2) construction equipment, (H3) labour productivity and (H4) local resources respectively.

Hence, it appears that there was a lack of exchange of knowledge of (G) safety expertise, (I) training programmes and (J) local conditions and culture between the key actors in this ICJV project.

The choice of the type of knowledge indicated the tie contents to include in the development of the conceptual framework. This argument is supported by the following statement made by the supervisor, L-Sup02;

[...] “we mainly exchanged knowledge of management expertise, especially in system-thinking and organising the thoughts of people who worked together.”

Moreover, L-Eng09 (Engineer of the local partner), who was regarded as being the most active in the subgroup, recommended the following;

[...] “we mostly discussed management expertise, especially in the procurement system because our JV partner had more experience in this area and they tried to share their knowledge and experience of controlling the budget.”

These findings show that the project manager of the foreign partner aimed to share his knowledge and experience of management expertise, especially in human resource management and procurement.

Moreover, they also indicate that some local actors preferred to use e-mail as a means of communicating and a KT mechanism for discussions with the foreign actor (F-PM01); in addition,

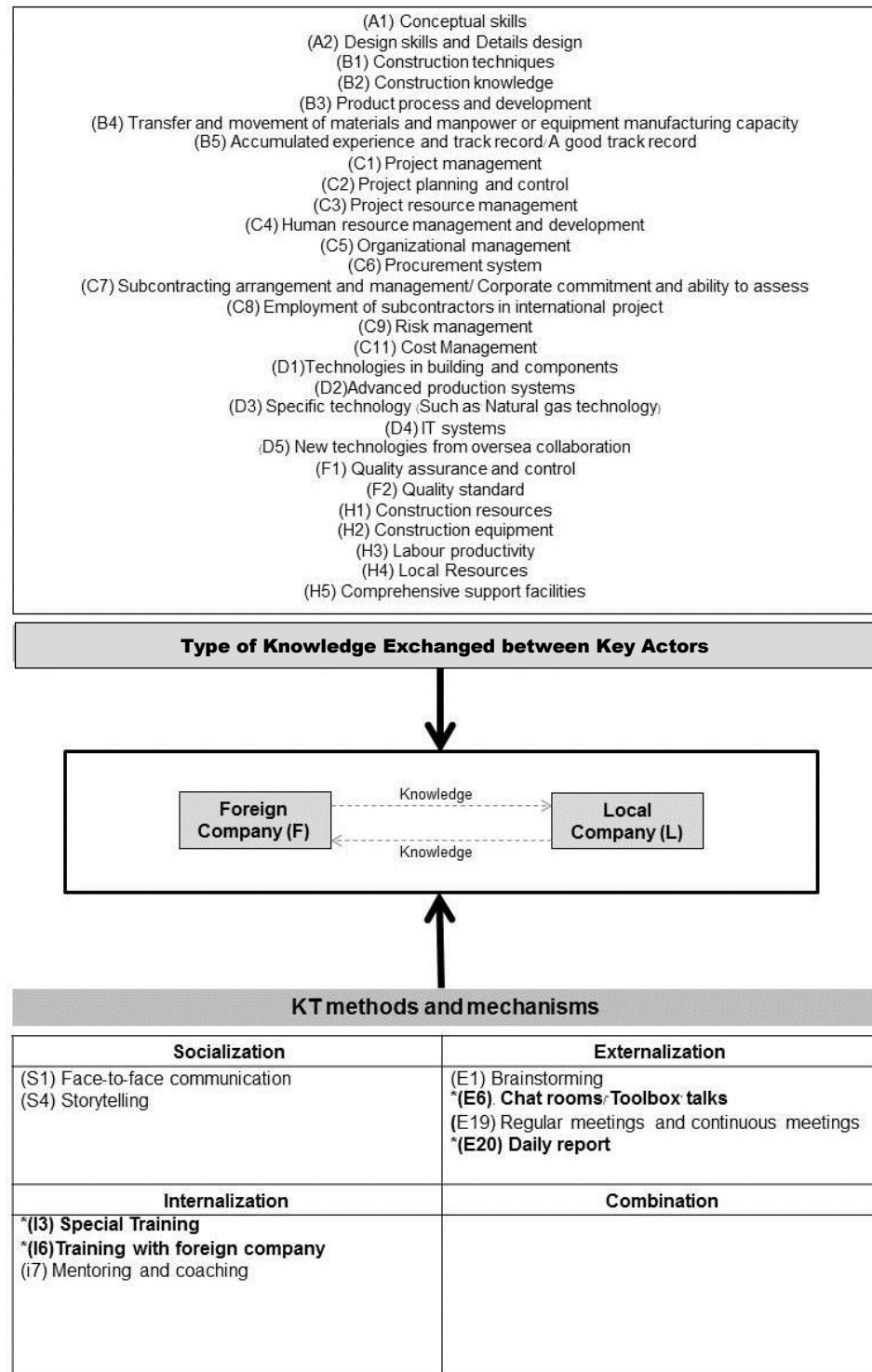
- All the key actors sought advice from their bosses, partners and colleagues, but they did not share information with other key actors.
- All the key actors preferred to use face-to-face communication as a KT method and mechanism to seek and share knowledge and skills within the team.
- F-PM01 (Project manager from the foreign partner) mainly used (S4) storytelling to seek and share knowledge and skills with his partners.

- L-Sup02 (Supervisor) and L-S Eng01 were the only two actors who used regular meetings and continuous meetings to seek advice from colleagues and project managers.
- L-PM05 and L-P Eng02 were the only two actors who preferred to exchange knowledge by (E1) brainstorming.

Moreover, it was indicated in Tables 5.35 and 5.36 that;

- L-P Eng02 was the only central actor who received knowledge about (F1) quality assurance and (F2) quality standards from L-S Eng01. Hence, it seems likely that L-S Eng01 had an abundance of knowledge of quality assurance and control expertise.
- Project engineer (L-P Eng02) and Engineer (L-Eng08 and L-Eng09) mostly received knowledge about (A1) conceptual skills and (A2) design skills and design details from Project Managers (L-PM05 and F-PM01). This is likely to have been because; in their position as project managers in this ICJV project; L-PM05 and F-PM01 were expected to have abundant knowledge of design and skills related to a Track Rehabilitation Project.
- Senior Engineer (L-S Eng01) and Engineer (L-Eng08 and L-Eng09) mainly received knowledge of (B) technical expertise from Supervisor (L-Sup02), Project Engineer (L-P Eng02) and Project Manager (L-PM05). Supervisor (L-Sup02) and Project Manager (L-PM05) mainly shared their experience of (B) technical expertise (e.g. (B1) construction techniques, (B2) construction knowledge, (B3) product process and development, (B4) transfer and movement of materials and manpower or equipment manufacturing capacity and (B5) accumulated experience and track record/ good track record), while Project Engineer (L-P Eng02) only shared knowledge of (B4) transfer and movement of materials and manpower or equipment manufacturing capacity with his boss and colleagues.
- L-Eng09 (Engineer) was the only key actor who received various types of knowledge from the manager of the foreign partner. Hence, it seems clear that he acquired sufficient knowledge to close the gap between the partners.

The KT methods and mechanisms that were most used to exchange knowledge and experience in this ICJV project is shown in Figure 5.18.



*Results of interviews with key actors

Figure 5.18 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-1B)

It was demonstrated in the last section that the transfer of knowledge between actors is essential for an ICJV Project to succeed. The key findings of the knowledge transferred in this ICJV project are summarised in this section, as well as the enabling and inhibiting factors found to influence the transfer of knowledge from the foreign to the local partner, as described by the key actors who were interviewed. The results of those interviews are shown below.

Supervisor (L-Sup02) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "The transfer of knowledge and sharing of experience between actors is essential for a successful ICJV project. Team members who come from different backgrounds have different qualifications, knowledge, skills and experience so that everyone needs to cooperate and learn from each other to increase the efficiency and success of the project. The motivation, attitude and responsibility of each person to seek knowledge and methods of statement are considered to be the main barriers/enhancers of the transfer of knowledge in ICJV projects.

[...] Language is the most useful skill for staff involved in ICJV projects. Thai staff should be able to increase their confidence and capability to communicate in the English language.

[...] "The foreign partner has 60% of the holding in this ICJV project, but it has only provided a few staff to implement the project along with the local partner. It seems that the foreign partner is benefitting more than the local company, but it is important to balance the benefit between the partners.

[...] The JV agreement in the previous project was unclear. These ICJV companies have had a joint venture for more than 20 years, but the agreement seems to have never changed. The number and positions of staff each company will provide should be clarified in future projects.

In terms of the performance and success factors of ICJV projects, the Supervisor (L-Sup02) commented;

[...] Partners' performance and the performance of the IJV management are the most important indicators in ICJV projects. The acceptance of the owner and the completion of the project on time are important for the successful delivery of ICJV projects. Moreover, the combination of foreign technology and the experience of foreign staff are the most important factors in JV projects because foreign staff has a responsibility to transfer and share their knowledge with the staff of the local partner in order to improve the capability of the project. Since the Project Manager from the foreign partner should have much more experience in construction and decision-making, his approval should be sought before any decisions are made.

Moreover, the Project Engineer (L-P Eng 02) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "one of the issues that most influences the KT processes between partners is the attitude toward the formation of a learning and development plan. Foreign staff can compromise and negotiate with Thai staff, but Thai staff has to follow step-by-step procedures when dealing with foreigners. There is no compromise then."

In terms of the ICJV performance and success factors of ICJV projects, the Project Engineer (L-P Eng 02) remarked;

[...] The performance of ICJV management is considered as the most important indicator in an ICJV project.

The data collection involved a number of interviews with key knowledge actors from this ICJV project using open-ended questions. The interviewees were briefed on the background of the research topic. They were also briefed on framework adopted to analyse the transfer of knowledge in this ICJV project. These key actors described the main factors that enabled and inhibited the KT processes in the project. It was found that the motivation, attitude and responsibility of each person to seek knowledge and the method of statement were considered to be the main barriers/enhancers to transfer knowledge in ICJV projects. Moreover, the key actors indicated that the management of the partners of the ICJV project was considered to be the most important indicator of its success. Meanwhile, the Supervisor in this project suggested that the combination of foreign technology and the experience of the foreign staff was the most important factor in the ICJV. Hence, it appears that the Project Manager from the foreign partner should have much more experience of construction and decision making than the local Project Manager for the ICJV project to be successful.

The analysis of the third ICJV Project in this case study is presented in the next section.

5.3.3 ICJV PROJECT-1C

1) Background of Case

This ICJV project was undertaken between a Japanese firm (F) with a 60percent share (the leader of this ICJV project), and a Thai Local Company (L) with a 40percent share. This project involved the construction of the Extradoses 6-lane Chao Praya River Crossing Bridge which was 460 metres in length with a 200-metre main span (Maha Jessada Bodin Bridge) at Nonthaburi I Road. This project was completed in 2016 and was based on a contract worth £90 million. The stated objectives of this ICJV were to combine the resources of the JV members to win the contract, use the expertise of each partner and acquire knowledge of new technologies to construct pre-stressed concrete bridges.

Foreign Company (F) was a leading Japanese construction company formed in April 2003. Its major activities ranged from engineering to general construction and it had experience of 1,000 bridge construction projects. This company had extended its expertise throughout Asia, Africa and the USA and the unification of its know-how, experience and resources had further enabled it to establish a worldwide reputation for quality and expertise with excellence in civil and building works based on the utilisation of the latest technologies. Local Company (L) was one of the largest firms in Thailand with major activities from general construction to infrastructure construction. Most of the data for this case study was collected from an office of Local Company (L) and the construction site.



Figure 5.19 The Construction of the Extradoses 6-lane Chao Praya River Crossing Bridge with a 460-metre span length and a 200 metre main span (Maha Jessada Bodin Bridge)

2) Actors' Attributes

a) Gender, Age, and Nationality

All the participants in this case study (100.00%) were male. The managerial and professional staff came from three different countries participated in this study, 13.33% of them were Filipino, 26.67% were Japanese and 60.00% were Thais (see Table 5.33). Moreover, the findings revealed that 53.00% of the participants were aged between 31 and 40, 33.00% between 41 and 50, and the remainder were between 51 and 60 and >60. Therefore, most of the respondents in this ICJV project could be said to be aged between 31 and 40.

Table 5.33 Nationality of research participants in (ICJV Project-1C)

Nationality	Local Company (L)	Foreign Company (F)	Total	%
Thai	7	2	9	60.00
Japanese	0	4	4	26.67
Filipino	0	2	2	13.33
Grand Total	7	8	15	100.00
	47.67%	53.33%	100.00%	

b) Educational Background and job position

Many researchers have found that individuals' educational background and job position affect their perception of knowledge and experience. The research participants' educational background and diverse stakeholders' expertise in various fields are shown in Table 5.34. Their educational background fluctuated between 13% of them having a certificate and diploma, 20% having a postgraduate degree and 67% an undergraduate degree. Therefore, most of the respondents in this ICJV project described themselves as Construction Managers and Engineers.

Table 5.34 Cross Tabulation between educational background and job position (ICJV Project-1C)

Educational Background	Job position							Total	%
	Vice President	Project Manager/ General Manager/ Administration Manager	QA/QC Manager	Earthwork Manager/ Yard Manager/ Technical Manager	Chief Accountant	Construction Manager	Engineer/ QS Engineer		
Certificate	0	1	0	1	0	0	0	2	13.00
Undergraduate	1	1	1	1	0	2	4	10	67.00
Postgraduate	0	1	0	0	1	0	1	3	20.00
Total	1	3	1	2	1	2	5	15	100.00

The cross tabulation in Table 5.34 indicates that most of the participants had graduated as undergraduates and held the position of Vice President, Project Manager, Administration Manager, QA/QC Manager, Construction Manager, Engineer and QS Engineer in this project. However, one General Manager, one Chief Accountant and one QS Engineer in this case study had a postgraduate degree. Therefore, it seems that their 'educational background' was not related to their 'job position' in this ICJV project.

c) Experience and primary discipline in a construction projects

According to Table 5.35, the respondents in this case study had a range of <5 to >20 years of experience i.e. 6-15 years (33.00%), 16-20 years (40.00%), and >20 years (27.00%). Therefore, the results revealed that most of them have 16-20 years' experience in the construction industry and ICJV projects.

Table 5.35 Cross Tabulation between experience in construction and job position (ICJV Project-1C)

Experience in the construction industry	Job position							Total	%
	Vice President	Project Manager/ General Manager/ Administration Manager	QA/QC Manager	Earthwork Manager/ Yard Manager/ Technical Manager	Chief Accountant	Construction Manager	Engineer/ QS Engineer		
< 5	0	0	0	0	0	0	0	0	0.00
6-15	0	0	0	2	0	0	3	5	33.00
16-20	0	1	1	0	1	2	1	6	40.00
> 20	1	2	0	0	0	0	1	4	27.00
Total	1	3	1	2	1	2	2	15	100.00

Based on Table 5.35, different stakeholders were experienced in various fields and had experience ranging from 6-15 years to >20 years. The cross-tabulation in Table 5.35 demonstrates the existence of a strong relationship between 'experience in construction' and 'job position'. It can be seen that most of the managerial staff in this case study had 16-20 years' experience in the construction industry, i.e. as General Manager, Project Manager, Administration Manager, QA/QC Manager, Chief Accountant, Construction Manager and QS Engineer. The survey results also revealed that 53.33% of the participants had acquired knowledge and experience from training with a foreign company and 40% of them had visited other projects of a foreign partner before commencing this project. Since the data for this case study was collected from an ICJV project, the Construction of Chao Praya River Crossing Bridge at Nonthaburi I Road (Maha Jessada Bodin Bridge), the discipline with the highest percentage in this project was Civil engineering (80%), reflecting the knowledge, skills and experience required for this project. The second highest was Electrical engineering (13.33%) and others (6.67%). It may be considered that experience of constructing pre-stressed concrete

bridges with a 460-metre length and a 200 metre main span and selecting the structural materials to construct the bridge are essential skills for bridge construction. Hence, the Civil Engineers were responsible for the structural design and installation of the new bridge, as well as the demolition of the old one with support from subordinate technical personnel.

3) Social Network Characteristics

a) Size, Structure, and Density of the Network

This section contains the results of the social network analysis, i.e. the size of the network, network structure, and network density. The size of this network was 28 nodes, made up of 15 research respondents and 13 other project participants who were named by them. The network boundary was defined as all the participants from the organisation chart of the project ; as a result, there were 15 participants in this case study. The codes denoting their participation, position and relationship in the network are presented in Figure 5.20 and Table 5.36. The sociogram shown in Figures 5.20 and 5.25 represent the knowledge sharing relationship among team members.

Figure 5.20 Job position of participants and their code (ICJV Project-1C)

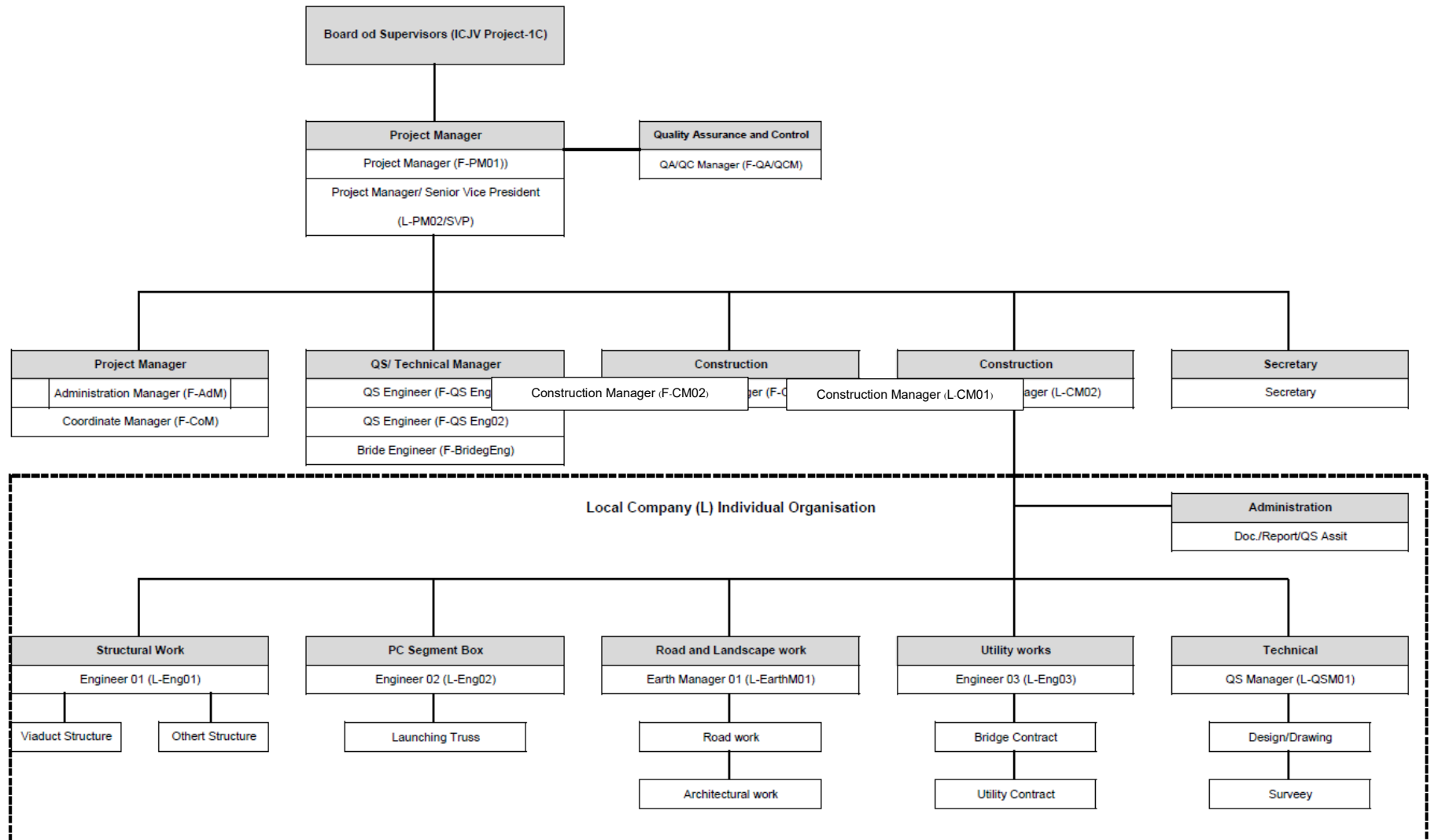


Table 5.36 SNA internal restriction with a position (ICJV Project-1C)

Respondents	This person shares information with you	How often do you exchange knowledge with this person?	You share information with this person	How often do you share knowledge with this person?
L-CM01	L-PM02/SVP	3	L-QSM01	3
			L-EarthM01	3
			L-ErecM01	3
F-CoM	F-PM01	3	F-PM01	2
	L-PM02/SVP	1	L-QS Eng01	2
	F-CM01	1	F-QS Eng02	3
			F-CM01	2
			L-QS Eng03	1
F-PM01	L-GM	1	F-BrideEng	5
	F-QA/QCM	4	F-AdM	5
	F-BrideEng	4		
	L-QS Eng01	5		
	L-CoM	5		
L-QS Eng01	F-PM01	3	F-QS Eng02	3
			L-QS	3
F-QS Eng02	F-PM01	2	L-QS Eng01	4
	L-CoM	3	L-Eng03	3
	L-QS Eng01	5	L-QC Eng01	3
	L-QSM01	1	L-Acc	4
	L-Sup01	2		
F-QA/QCM	L-GM	1	F-PM01	3
			L-CoM	1
			L-QS Eng01	1
F-AdM	F-PM01	3	F-ChAc	3
			L-QS Eng01	4
			L-QS Eng03	3
F-ChAc	F-PM01	3	L-QS Eng01	4
	F-AdM	3	L-QS Eng03	3
	F-QA/QCM	3		
L-QS Eng03	F-ChAc	4	L-Eng01	3
	L-QS Eng01	4	L-Eng02	3
			L-Sup02	3
L-PM02/SVP	L-ExeVP	2	F-CM01	2
			L-QSM02	2
			L-QSM01	2
L-Eng01	F-CM01	4	L-Eng02	3
L-Eng02	F-CM01	4	L-Eng04	3
L-EarthM01	F-CM01	4	L-Eng05	3
L-QSM01	L-PM02/SVP	3	L-CM02	3
	L-QS Eng01	3	F-CM01	3
	F-BrideEng	4	F-QS Eng02	3

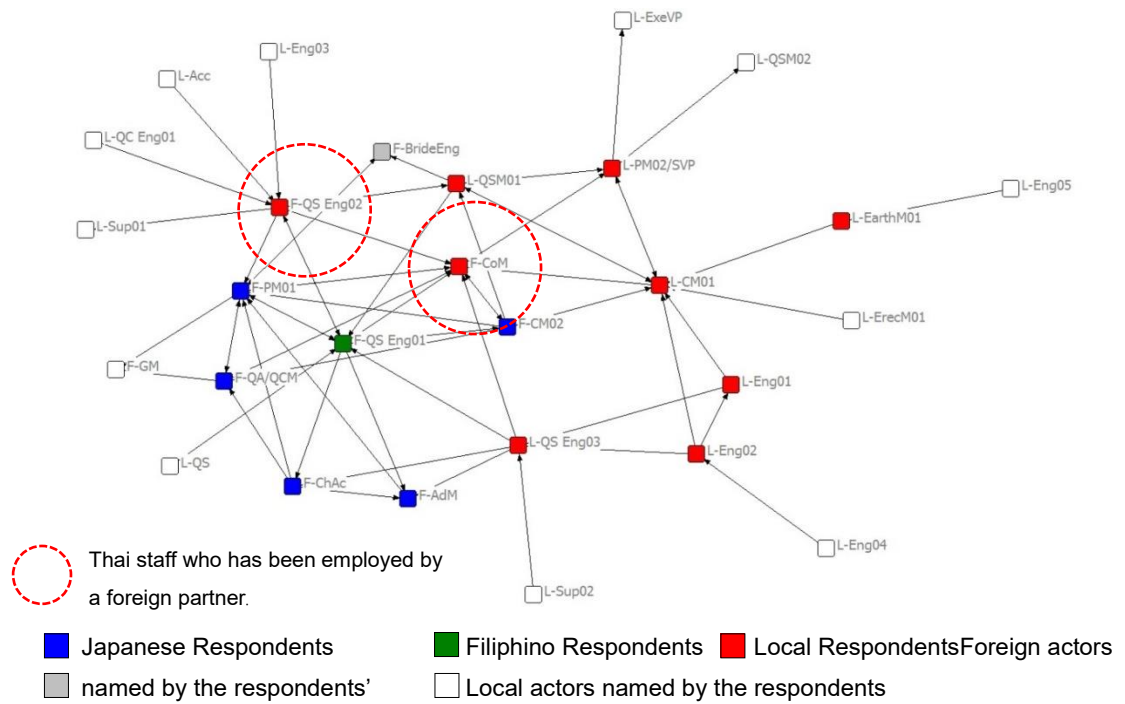


Figure 5.21 Sociogram showing knowledge sharing between respondents (ICJV Project-1C)

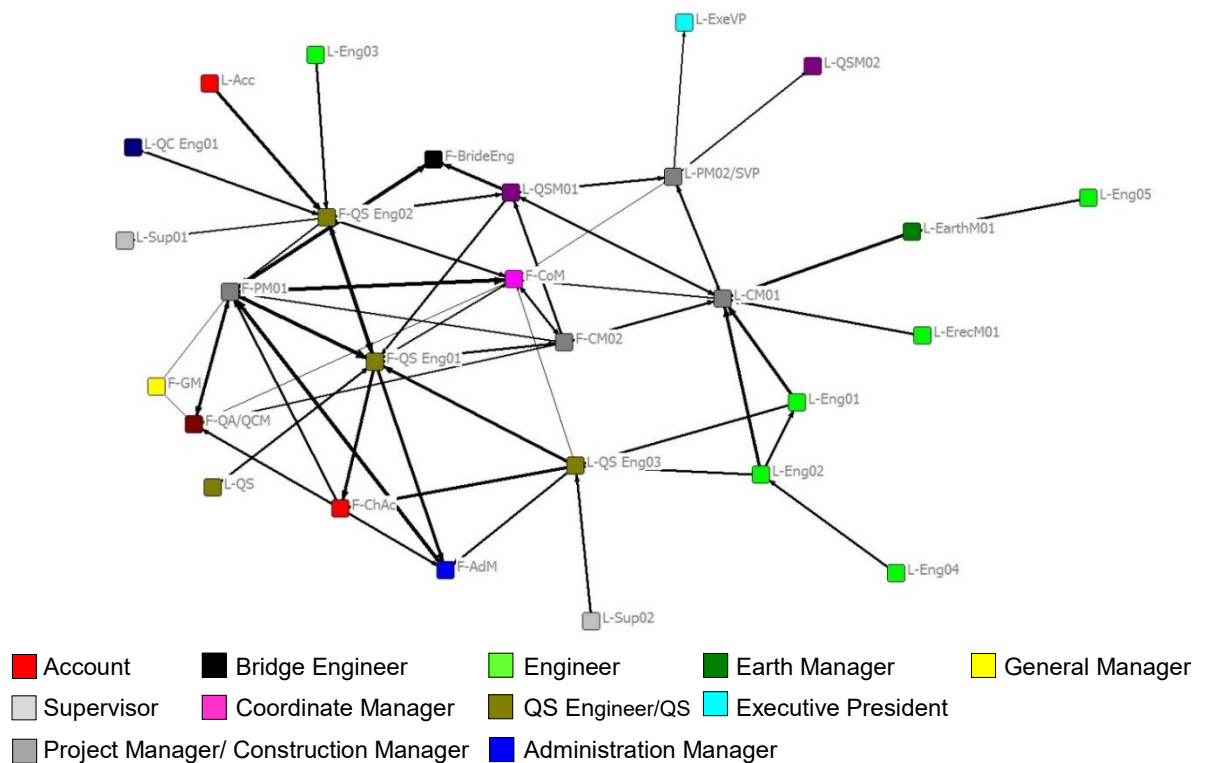


Figure 5.22 Sociogram showing knowledge sharing according to position (ICJV Project-1C)

The collaborative network, network structure and strength of the ties between the nodes developed by the collected ICJV project-1C are shown in Figure 5.21 and the positions of stakeholders with different expertise in the collaborative network are shown in Figure 5.22. An arrow represents the existence of collaboration between two firms. The link direction is from the recipient to the knowledge source and the weight of the links between the nodes indicates the frequency with which knowledge was transferred between two actors. It can be seen that the stronger the tie is, the more often they exchanged knowledge.

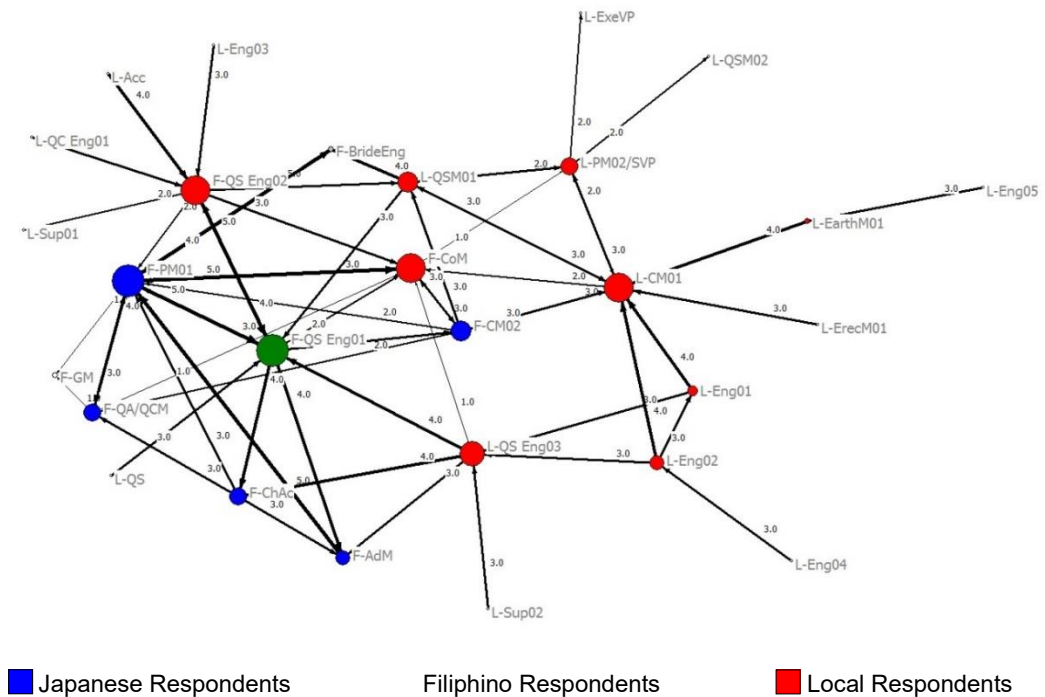


Figure 5.23 Sociogram  Showing network density (ICJV Project-1C)

As can be seen from Figure 5.23, the findings revealed that there were strong links between foreign and local actors, e.g. Project Manager (F-PM01), QS Engineer (F-QS Eng01 and F-QS Eng02), Coordination Manager (F-CoM), and Construction Manager (L-CM01) functioned as interfaces toward their team members. F-PM01, F-QS Eng01, F-QS Eng02, F-CoM and L-CM01 interlinked with actors from various disciplines within this international context. F-PM01 was a Project Manager, F-QS Eng01 and F-QS Eng02 were QS Engineers, F-CoM was a Coordination Manager, and L-CM01 was a Construction Manager from a local firm in this ICJV project.

F-PM1 exchanged his knowledge and experience with F-Qs Eng01, F-Com, F-BridgeEng, and F-Adm more than once a day and with F-QA/QCM once a day. F-QS Eng02 ask for advice from F-QS Eng01 more than once a day and shared his knowledge to F-QS Eng01 and L-Acc once a day. F-CoM was the Coordination Manager in charge. He was mainly responsible for coordinating the knowledge of the workers in the ICJV project. F-CoM was well connected with F-PM01, F-CM02, F-QS Eng01, F-QS Eng02, and L-CM01. This indicates that F-CoM interlinked more with the potential actors in this project.

As stated in Chapter 2, the line weight (how often) expresses the frequency of KT. Therefore, this outcome could confirm that this group of actors were well connected as members of a team and that F-PM1, F-QS Eng01, F-QS Eng02, F-Com and L-CM01 were frequently engaged in KT processes. It could also illustrate that F-PM1, F-QS Eng01, F-QS Eng02, F-Com and L-CM01 were considered to be experts in this ICJV project. Hence, this finding shows that there were potential links between the Project Managers, QS Engineers, Coordination Manager and Construction Manager as team members in this ICJV project.

Moreover, as shown in Figure 5.23, the Coordination Manager (F-CoM) was the focal point of this network; hence, it can be assumed that it was organised around him. F-Com was a

local actor with more than 20 years of marketing experience, who had been employed by the foreign firm to work as a Project Coordinator between the partners in this ICJV Project. He sought advice from the Project Manager of the foreign partner (F-PM01) more than once a week, the Project Manager of the local partner (L-PM02/SVP) and the Construction Manager (F-CM01) less than once a week, whereas he shared his experience with the Project Manager of the foreign partner (F-PM01), the QS Engineers (F-QS Eng01, F-QS Eng02 and L-QS Eng03) and the Construction Manager (F-CM01) less than once a week or once a week. Hence, it can be assumed that F-CoM) was relied upon to coordinate the KT processes and oversee the quality of the construction between the foreign and local actors in this project.

Based on the data gathered from the UCINET 6.0, a network density is 0.249 with a standard deviation of 0.88. Hence, 24.90% of the potential links exist between the actors. [Scott \(2012\)](#) argues that the network density would be 1.00 (100%) if every actor in the team were connected. Since the density of this network was 0.249, which is low, it can be deduced that not all the connections possible were made. However, the density of this network was rather large compared to ICJV Projects-1A and -1B. Hence, it could be claimed that the KT processes in this network were well connected compared to the other two ICJV Projects.

The findings of the knowledge sources in the next section will explain the strong link between the KT methods and mechanisms and the flow of knowledge in this sparse network.

b) Degree of Centrality and Betweenness Centrality

However, it is important to analyse the degree of centrality measures in order to examine which actor is more central and more strongly linked than others with regard to knowledge transfer in this ICJV project. The degree of centrality immediately links the distance from each actor to all others in the network. Actors' centrality measures, both the degree of centrality and betweenness centrality, are used to identify the sources of knowledge. Moreover, actor centrality can also influence KT ([Schröpfer, Tah, and Kurul, 2017](#)). The most central actors for out-degree and in-degree centrality are shown in Table 5.37 which illustrates the average degree of centrality.

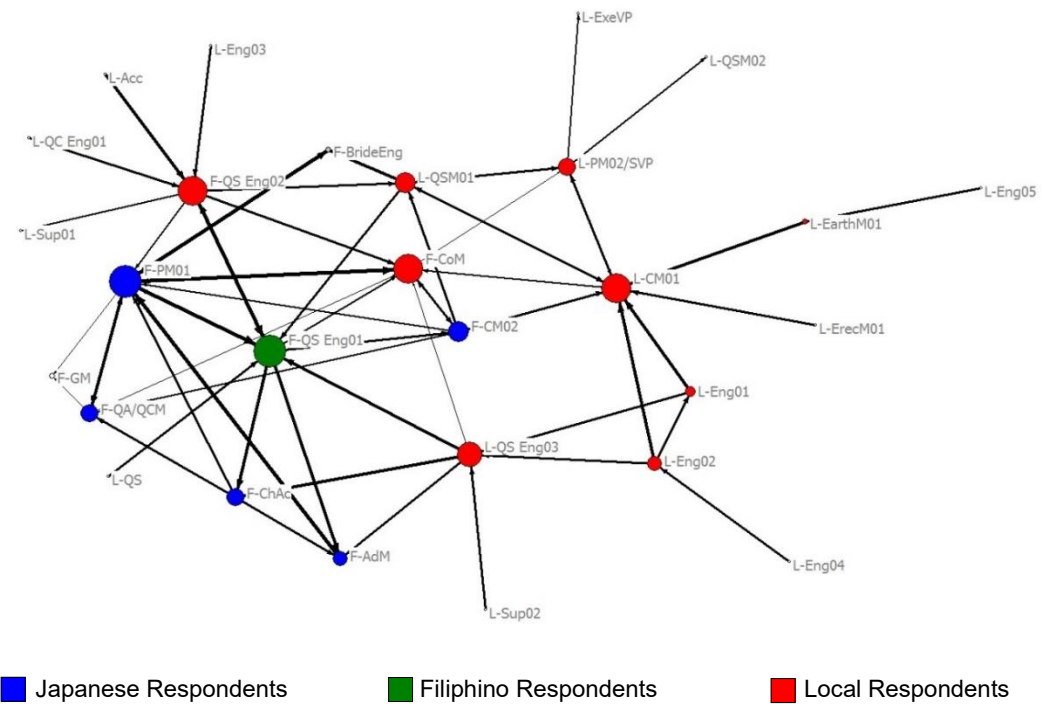


Figure 5.24 Sociogram showing network density (ICJV Project-1C)

Table 5.37 Degree of Centrality (ICJV Project-1C)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
F-QS Eng01	QS Engineer	> 20	41-50	20 (1)	20 (3)
F-PM01	Project Manager	> 20	51-60	19 (2)	26 (1)
*F-QS Eng02	QS Engineer	6-15	31-40	15 (3)	14
L-QSM01	QS Manager	6-15	31-40	13	11
F-CM02	Construction Manager	16-20	41-50	13	9
L-QS Eng03	QS Engineer	6-15	31-40	12	9
L-CM01	Construction Manager	16-20	41-50	11	23 (2)
L-Eng02	Engineer	6-15	31-40	10	3
L-PM02/SVP	Senior Vice President	> 20	51-60	8	7
*F-CoM	Coordinator Manager	> 20	41-50	7	17
F-AdM	Administration Manager	16-20	31-40	5	10

It was important to further investigate the links between the in-degree and out-degree values and the actors' attributes, job position, age and years of experience and a clear link was found between the age, years of experience and centrality values of the actors in this case study. This outcome could indicate that the experts and acknowledge consumers in this ICJV project were aged between 31 and 60 and had 6-15, 16-20 and more than 20 years' experience.

Based on the data gathered in 5.37, it could be assumed that F-PM01 was a Project Manager from a foreign firm on this project and with an in-degree centrality of 26; he was definitely the most central actor in this network. F-PM01's in-degree centrality was slightly more than that of the next person, who was L-CM01 (Construction Manager of the local partner) and F-QS Eng01 (QS Engineer). This finding classifies F-PM01 (Project Manager of a foreign firm) as a perceived expert who can answer any query in this whole network. He was followed by L-CM01 and F-QS Eng01. F-QS Eng01 and F-PM01 not only had high in-degree centrality, but also high

out-degree centrality. F-QS Eng01's out-degree centrality was slightly higher than the next people, who were F-PM01 and F-QS Eng02. This finding classifies F-QS Eng01 as a knowledge consumer. He was followed by F-PM01 and F-QS Eng02. Therefore, these results indicate that F-PM01 and F-QS Eng02 were considered to be knowledge brokers in this project. The survey results in this case study revealed the key players from the foreign partner who both received and disseminated knowledge in this project (e.g. F- PM01, F-QS Eng01, and F-CoM). This could indicate that F-PM01 (Project Manager from the foreign partner), L-CM01 (Construction Manager from the local partner), F-QS Eng01 (QS Engineer from the foreign partner) and F-CoM (Coordinating Manager of the foreign partner) were knowledge holders and also held a position in which their colleagues asked for their advice in this ICJV project.

Based on these results, it is proposed that Project Manager (F-PM01) with more than 20 years of experience was regarded as an expert in this project, followed by Construction Manager (L-CM01) with 15-20 years of experience. Therefore, the number of years' experience and age were not found to be inhibiting factors in the process of acquiring and transferring knowledge. This outcome could indicate that Project Manager (F-PM01) was regarded as a knowledge broker and gatekeeper in terms of receiving and disseminating knowledge and answering any queries, as well as F-QS Eng01. It seems that Project Manager (F-PM01) and QS Engineer (F-QS Eng01) were regarded as experts and since they had more than 20 years of experience of construction projects, they were motivated to share their experience of innovation in bridge construction. Furthermore, not only were the Project Manager and Construction Manager regarded as experts, but the QS Engineer and QS Manager were regarded as knowledge brokers and gatekeepers in receiving and disseminating knowledge in this ICJV project. The reason for this was likely to be the Japanese construction industry's current focus on the 'quality' of projects. Construction quality is acknowledged to be the most important factor of a successful project. This may be why the actors who emphasised 'quality' were regarded as knowledge brokers and gatekeepers in receiving and disseminating knowledge in this ICJV project.

Table 5.38 Betweenness Centrality Measures in this pilot case study (ICJV Project-1C)

Actor	Betweenness
F-QS Eng01	96.858
F-PM01	78.817
L-CM01	74.425
*F-QS Eng02	67.417
*F-CoM	56.400
L-PM02/SVP	51.650
L-QSM01	49.900
L-QS Eng03	37.875
F-CM02	26.567
L-Eng02	18.000

It was important to further investigate the links between the in-degree and out-degree values and the actors' attributes, job position, age and years of experience and a clear link was found between the age, years of experience and centrality values of the actors in this case study. This outcome could indicate that the experts and acknowledge consumers in this ICJV project were aged between 31 and 60 and had 6-15, 16-20 and more than 20 years' experience.

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L-PM02/SVP	51.650
L-QSM01	49.900
L-QS Eng03	37.875
F-CM02	26.567
L-Eng02	18.000

According to Table 5.38, F-QS Eng01 (QS Engineer) had the highest score for betweenness centrality followed by F-PM01 (Project Manager of the foreign partner) and L-CM01 (Construction Manager) respectively. This indicates that F-QS Eng01 (QS Engineer), F-PM01 (Project Manager) and L-CM01 (Construction Manager) were regarded as the main gatekeepers in this network. Similarly, F-QS Eng01 (QS Engineer) and F-PM01 (Project Manager) also had a high in-degree and out-degree centrality in the network. Hence, it may be asserted that F-QS Eng01 (QS Engineer) and F-PM01 (Project Manager) were not only experts, but they were also regarded as gatekeepers in this project. This finding corresponds with that of [Borgatti, Everett, and Johnson \(2013\)](#), who found that betweenness plays a gatekeeping role in this context. Nodes with high betweenness can filter information and threaten to disrupt the network operations. Hence, the most likely explanation for this result is that F-PM01 (Project Manager) and F-QS Eng01 (QS Engineer) played a broker role, since many nodes needed them to reach other nodes via efficient paths. F-PM01 (Project Manager) and F-QS Eng01 (QS Engineer) had power because they could threaten to stop transmission, thereby forcing nodes to use less efficient paths to reach one another. It is useful to note that F-PM01 (Project Manager) and F-QS Eng01 (QS Engineer) effectively discriminated between nodes and potentially correlated well with other nodes.

c) Network Cliques

According to Table 5.39, there were 16 cliques in this network, each of which consisted of three or more members. It can be seen that there was a mixture of local and foreign members in cliques 1, 5, 7, 10, 13, 14, 15 and 16.

Table 5.40 Cluster Analysis (ICJV Project-1C)

N	Clusters
1*	F-CM02 F-CoM F-PM01 F-QS Eng01
2	F-CoM F-PM01 F-QS Eng01 F-QS Eng02
3	F-AdM F-ChAc F-PM01 F-QS Eng01
4	F-GM F-PM01 F-QA/QCM
5*	F-CM02 F-CoM F-PM01 F-QA/QCM
6	F-ChAc F-PM01 F-QA/QCM
7*	L-CM01 F-CM02 F-CoM
8*	L-CM01 F-CM02 L-QSM01
9	L-CM01 L-Eng01 L-Eng02
10*	L-CM01 F-CoM L-PM02/SVP
11	L-CM01 L-PM02/SVP L-QSM01
12	L-Eng01 L-Eng02 L-QS Eng03
13*	F-AdM F-ChAc F-QS Eng01 L-QS Eng03
14*	F-CoM F-QS Eng01 L-QS Eng03
15*	L-CM02 F-QS Eng01 L-QSM01
16*	F-QS Eng01 F-QS Eng02 L-QSM01

* = Mixture of local and foreign partners

 = The most active cliques

Figure 5.25 Hierarchical Clustering of Overlap Matrix (ICJV Project-1C)

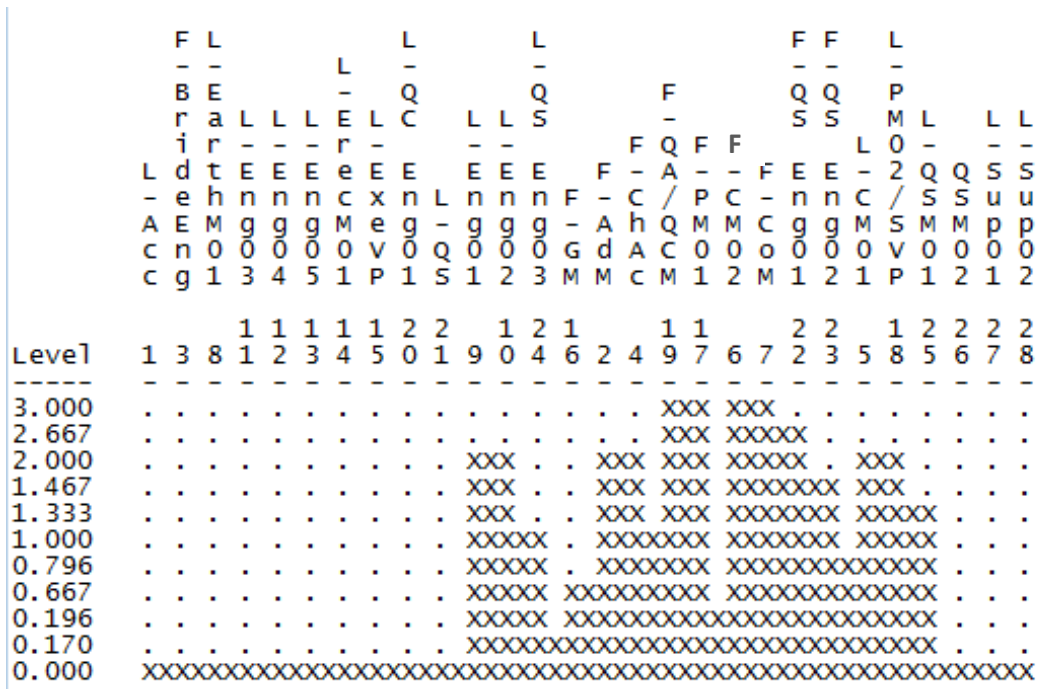


Figure 5.26 Hierarchical Clustering of Overlap Matrix (ICJV Project-1C)

Moreover, Figure 5.25 shows that actors F-QA/QCM, F-PM01, F-CM02 and F-CoM were the most active in the first highest number of cliques, while F-QS Eng01 was the most active in the second and L-Eng01, L-Eng02, E-AdM, F-ChAc, L-CM01 and L-PM02/SVP were the most active in the third. F-QA/QCM was a QA/QC Manager of the foreign company (with 16-20 years' experience), while F-PM01 was a Project Manager of the foreign company (with > 20 years' experience), F-CM02 was a Construction Manager of the foreign company (with 16-20 years' experience), and F-CoM was a Coordinating Manager (a Thai actor who was employed by the

foreign partner). According to [Borgatti, Everett and Johnson \(2013\)](#), cliques' co-membership matrix contains larger values, which indicate a stronger link. Moreover, it can clearly be seen from Table 5.39 that F-QA/QCM, F-PM01, F-CM02 and F-Com were in many different cliques together (Cliques 1, 2, 4, 5, 6 and 7), indicating that these actors were important within the group and possibly occupied some kind of a leadership role in this project. Moreover, it is indicated in Table 5.39 that cliques 1, 2, 3, and 13 were the most active cliques in this project consisting of a mixture of actors.

This result is in line with the in-degree, out-degree of centrality and betweenness centrality reported in the last section. The In-degree and out-degree of centrality and betweenness centrality scores illustrate that F-PM01 (Project Manager of the foreign partner) was regarded as an expert in this project. The results of an analysis of the knowledge source and knowledge transfer methods and mechanisms are presented in the next section.

4) Relationships between Key Actors, Knowledge Transfer Methods and Mechanisms, and Tie contents

a) Source of Knowledge

The results of a content analysis of the factors that underpinned the actors' role and the relationship between the knowledge source and the receiver are presented in Tables 5.40-5.42, as well as why this particular person was chosen to seek and share knowledge in this ICJV project.

Table 5.41 Knowledge Source and receiver (ICJV Project-1C)

No	Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Boss	20	1	21	32.81
2	Partner	1	3	4	6.25
3	Boss and partner	0	0	0	0.00
4	Working colleague	7	22	29	45.31
5	Consultant	1	0	1	1.56
6	Supervisor	0	0	0	0.00
7	Subordinate	3	6	9	14.06
8	Father	0	0	0	0.00
	Total	32	32	64	100.00

Table 5.42 Communications between knowledge source and receiver (ICJV Project-1C)

No	Communications between Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	0	0	0	0.00
2	E-mail	2	0	2	2.86
3	Face-to-Face	25	36	61	87.14
4	Social Network	0	0	0	0.00
5	Telephone and F2F	2	0	2	2.86
6	E-mail and F2F	0	0	0	0.00
7	F2F and Social Network	0	0	0	0.00
8	All types of communication	2	3	5	7.14
9	Others	0	0	0	0.00
	Total	31	39	70	100.00

Table 5.43 Why this person was chosen to seek and share knowledge (ICJV Project-1C)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Decision making	1	0	1	1.28
2	He has potential to be reliable staff	0	1	1	1.28
3	He is expertise in QS	1	0	1	1.28
4	His experience and character	1	0	1	1.28
5	His position is my boss	5	0	5	6.41
6	Knowledgeable	1	0	1	1.28
7	Management policy	1	0	1	1.28
8	Reliable designer	1	0	1	1.28
9	Responsibility	0	33	33	42.31
10	Their knowledge / Experience and skill	10	0	10	12.82
11	To solve the problem at a time/ situation	0	1	1	1.28
12	Trust and their experience	22	0	22	28.20
	Total	43	35	78	100.00

It can be seen from the data in Tables 5.40-5.42 that knowledge can be stored in different repositories according to the type. The findings for 64 knowledge transfers are shown in Table 5.40. The most common knowledge source and receiver in this project with 29 counts (45.31%) was a work colleague, while the second most common was a boss with 21 counts (32.81%). Most of the participants stated that they considered their colleagues to be a reliable source of knowledge. This result corresponds with research by Kivrak et.al. (2008), who found that colleagues were the most important source of knowledge for firms. Moreover, as shown in Table 5.41, Face-to-Face communication (87.14%) was the most essential way for actors in this project to communicate followed by all types of communication (7.14%), e-mail (2.86%), and telephone and F2F (2.86%) respectively.

Additionally, the most important reasons for receiving and sharing knowledge and experience in this project was responsibility (42.31%), followed by trust and their knowledge and experience (28.20%), their knowledge/experience and skill (12.82%), and position as my boss

(6.41%) (See more details in Table 5.42). This may be due to the fact that responsibility may be a proper reason or that some of the participants may have thought that it was a possible way to capture and convert tacit knowledge to explicit knowledge by any kind of knowledge and experience, especially that of a partner as a source of knowledge of the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within their project.

b) Knowledge Transfer Methods and Mechanisms

According to Figure 5.27, the research participants usually used (S1) face-to-face communication as a mechanism to acquire their knowledge of the ICJV project. This was followed by (E17) group meetings, (C1) best practice, (I1) learning-by-doing and (E3) project history/case writing. In terms of sharing knowledge, the methods most used in this ICJV project were (S1) face-to-face communication, followed by (I1) learning-by-doing (E1) brainstorming, (S2) socialising out-of-hours (lunch or coffee breaks), (E17) group meetings, (C1) best practice and (E9) team collaboration tools respectively.

These findings show that several participants preferred to use (S1) face-to-face communication, (E17) group meetings, (C1) best practice and (I1) learning-by-doing to exchange their knowledge and skills. The types of knowledge flow between actors are shown in the next section.

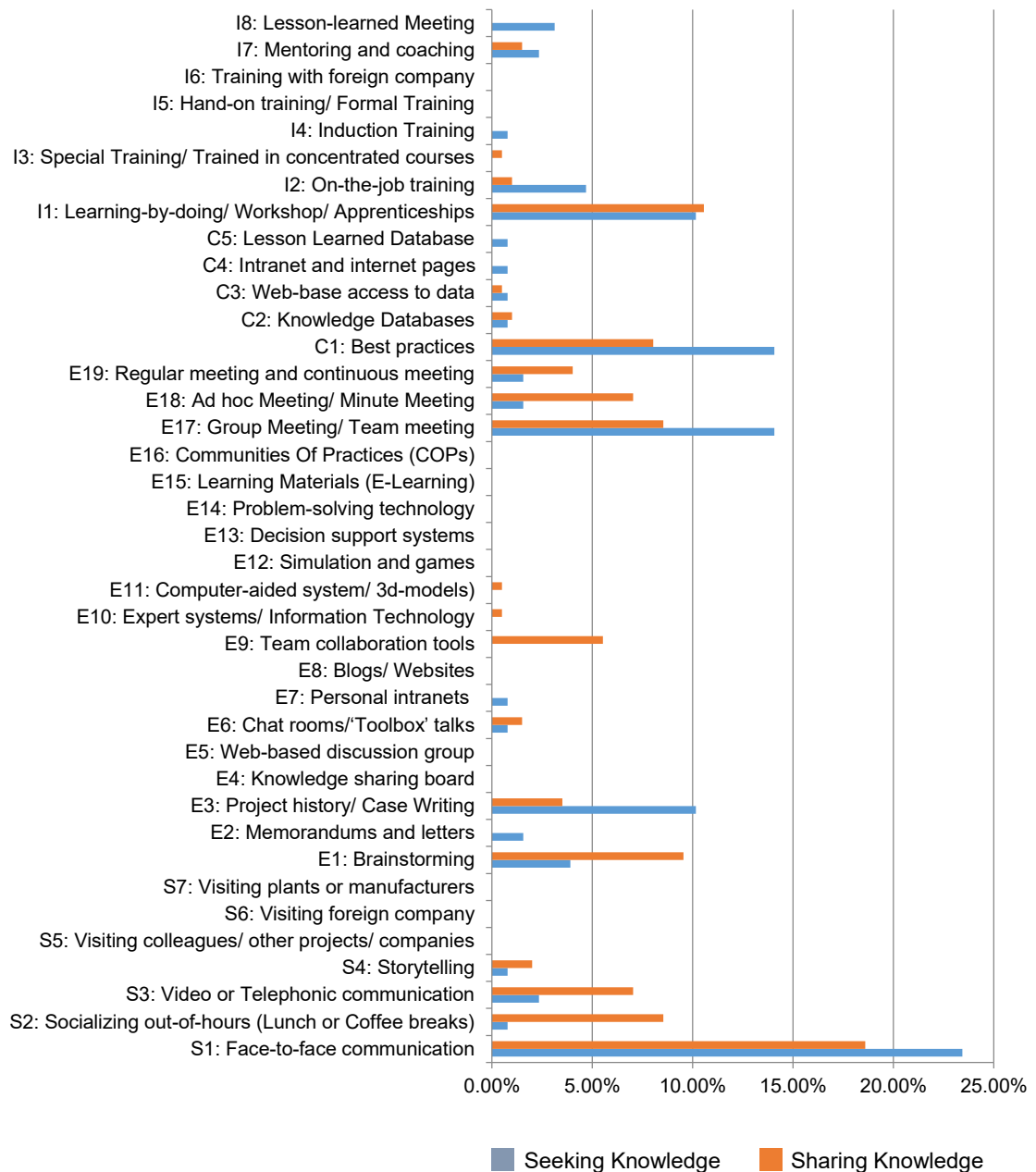


Figure 5.27 KT Methods and Mechanisms when seeking and receiving knowledge (ICJV Project-1C)

c) Tie Characteristics and Tie Contents

The tie contents between actors in the KT processes when seeking and sharing knowledge in this ICJV project are shown in Figure 5.28. The survey results revealed that management expertise was the most important knowledge exchanged by actors. The second most common types were technical expertise, local conditions and culture, construction resources, safety expertise, design knowledge and skills and technological expertise. In contrast, actors rarely exchanged knowledge and experience of quality assurance and control expertise and economic, marketing and financial expertise. Finally, it seems that the knowledge of training programmes did not exist in this ICJV project.

Moreover, Figure 5.28 shows the types of knowledge mainly exchanged in this ICJV project. The practitioners in this case study considered product process and development (B3) to

be important knowledge for which they needed advice, followed by construction techniques (B1), procurement system (C6), technologies in building and components (D1), safety standards (G1) and project management (C1). Conversely, the participants were likely to share their knowledge of construction techniques (B1), local government policies (J5), transfer and movement of materials and manpower or equipment manufacturing capacity (B4), construction knowledge (B2), product process and development (B3), accumulated experience and track record/a good track record (B5) and procurement system (C6) respectively.

The findings show that several of the participants were likely to discuss and exchange knowledge in the areas of technical expertise (e. g construction technique (B1), product process and development (B3) and management expertise (e.g. procurement system (C6) within this ICJV project.

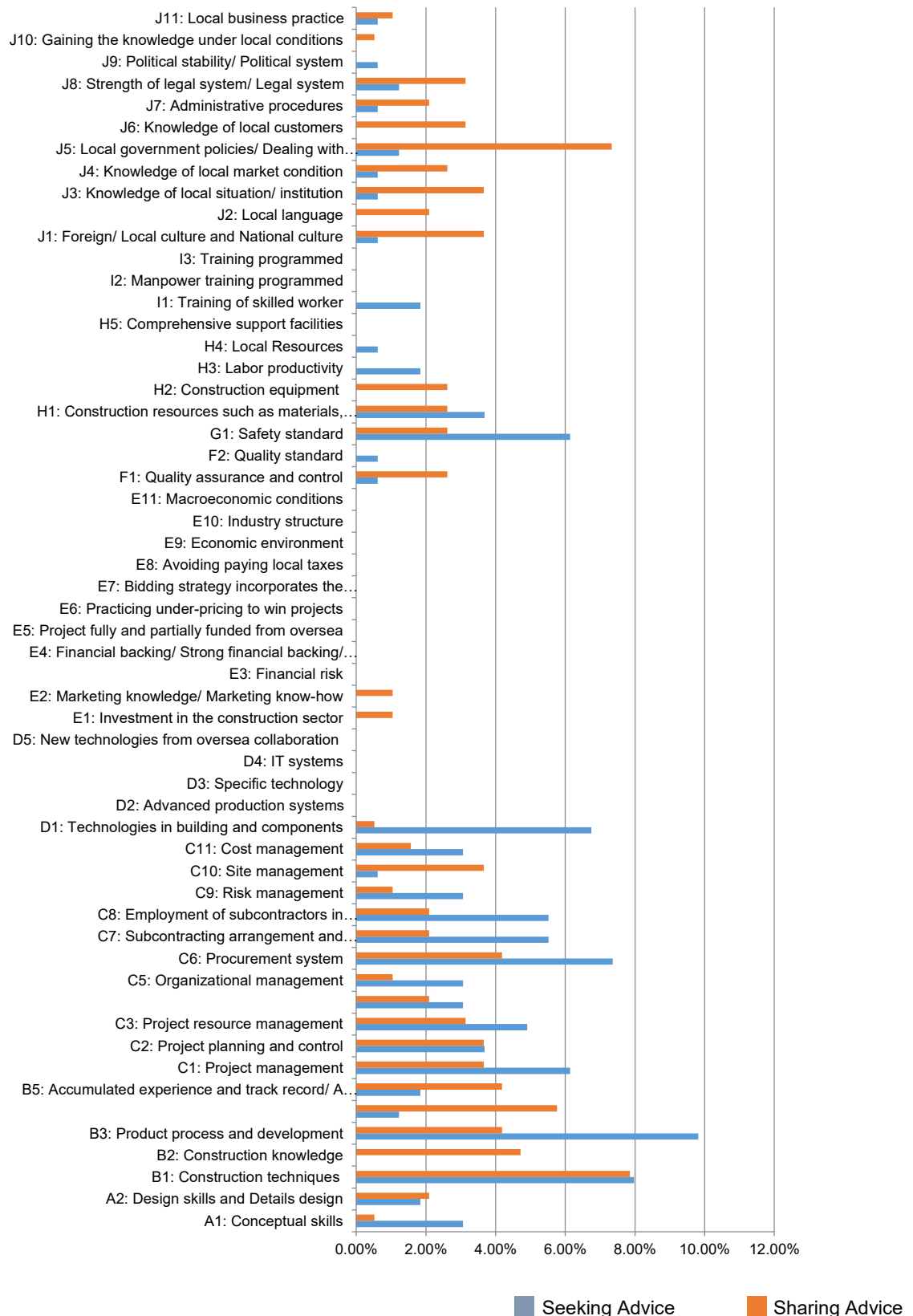


Figure 5.28 Tie contents of Knowledge Transfer when seeking and receiving knowledge (ICJV Project-1C)

As argued in the previous section, F-PM01 (Project Manager from a foreign partner) was perceived as an expert and knowledge consumer, whereas L-CM01 and F-CM02 had a slightly lower in-degree centrality than F-PM01 (Project Manager from a foreign partner). Similarly, F-Q Eng01 and F-Q Eng02 (QS Engineer) were also considered as knowledge consumers in this

ICJV project. Moreover, the clique co-membership matrix shows that cliques 1, 2, 3, and 13 had the highest values, which indicate a stronger link to a leadership role. It seems clear that L-S Eng01, L-Eng09, L-PM05 (Project Manager from the local partner), and L-PM01 (Project Manager from the foreign partner) were regarded as key actors at the highest level, indicating a stronger link to a leadership role in this ICJV project. The relationship between the actors' attributes and social network characteristics of the key actors in this ICJV project is shown in Table 5.43.

Table 5.44 SNA between key actors (ICJV Project-1C)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gatekeeper	Focal Point	Co-membership of cliques
F-PM01	Project Manager	X(1)	X(2)	X	X(2)		X
L-CM01	Construction Manager	X(2)			X(3)		
F-QS Eng01	QS Engineer	X(3)	X(1)		X(1)		
*F-CoM	Coordinate Manager					X	X
*F-QS Eng02	QS Engineer		X (3)				
F-CM02	Construction Manager						X
F-QA/QCM	QA/QC Manager						X

Table 5.45 Knowledge sharing between key actors (ICJV Project-1C)

Actors		F-PM01	L-CM01	F-QS Eng01	*F-CoM	*F-QS Eng02	F-CM02	F-QA/QCM
F-PM01	Received			X	X			X
	Shared							
L-CM01	Received							
	Shared							
F-QS Eng01	Received	X						
	Shared					X		
*F-CoM	Received	X	X					
	Shared	X		X		X		
*F-QS Eng02	Received	X		X	X			
	Shared			X				
F-CM02	Received	X						X
	Shared		X	X	X			
F-QA/QCM	Received							
	Shared	X		X	X			

According to Tables 5.44-5.45, most of the key actors usually exchanged their knowledge and experience once a week OR more than once a week. F-PM01 (Project Manager of the foreign partner) was regarded as an expert, knowledge broker and gatekeeper in this ICJV project, but it seems that he did not share his knowledge and experience with other key actors, whereas he did share his experience with F-BridgeEng and F-AdM. L-CM01 (Construction Manager of the local partner) was also perceived as an expert and gatekeeper in this ICJV project, but he did not exchange his experience and skills with other key actors, while he mainly sought advice from his boss (e.g.L-PM02/SVP) and shared his knowledge and skills with colleagues (e.g. L-QSM01, L-EarthM01, and L-ErecM01).

Table 5.46 Knowledge exchange between key actors (ICJV Project-1C)

Key actors	Position	Received from	Relationship	How often	Reason
F-PM01	Project Manager	F-QA/QCM	Colleague	Once a day	Their Experience
		L-QS Eng01	Subordinate	More than once a day	He is expertise in QS
		*F-CoM	Subordinate	More than once a day	His experience and character
F-QS Eng01	QS Engineer	F-PM01	Boss	More than once a week	Their Experience/ Trust
*F-CoM	Coordinate Manager	F-PM01	Boss	More than once a week	Their Experience/ Trust
		L-CM01	Boss	More than once a week	Their Experience/ Trust
*F-QS Eng02	QS Engineer	F-PM01	Boss	Once a week	His position is my boss
		*F-CoM	Boss	More than once a week	Their Experience/ Trust
		L-QS Eng01	Boss	More than once a day	Their Experience/ Trust
F-CM02	Construction Manager	F-PM01	Boss	More than once a week	Their Experience/ Trust
		F-QA/QCM	Colleague	More than once a day	He is expertise in QS

Key actors	Position	Shared with	Relationship	How often	Reason
F-QS Eng01	QS Engineer	*F-QS Eng02	Colleague	Once a day	He has potential to be reliable staff
*F-CoM	Coordinate Manager	F-PM01	Boss	Once a week	Responsibility
		L-QS Eng01	Colleague	Once a week	Responsibility
		*F-QS Eng02	Colleague	More than once a day	Responsibility
*F-QS Eng02	QS Engineer	L-QS Eng01	Boss	Once a day	Responsibility
F-CM02	Construction Manager	L-CM01	Colleague	Once a week	Responsibility
		*F-CoM	Colleague	Once a week	Responsibility
		L-QS Eng01	Colleague	Once a week	Responsibility
F-QA/QCM	QA/QC Manager	F-PM01	Boss	More than once a week	Their Experience/ Trust
		*F-CoM	Boss	More than once a week	Their Experience/ Trust
		L-QS Eng01	Colleague	Once a week	Responsibility

Moreover, Table 5.45 indicates that F-QA/QCM did not ask for advice from other key actors and he only sought knowledge from his boss (e.g.F-GM). F-QS Eng01 (QS Engineer from the foreign partner) was a perceived expert and gatekeeper in this project. Hence, he shared his knowledge and experience with F-QS Eng02 (QS Engineer from the foreign partner) who was working in the same position in that firm. The knowledge exchanged between the key actors in this ICJV project is shown in Table 5.45, from which it can be seen that most central actors preferred to ask for advice from their boss, while they were likely to share their knowledge and experience with their colleagues. Moreover, the findings indicate that most of the key actors asked for advice from their boss because they trusted him and they mainly share their knowledge and skills in this ICJV project because of their experience and sense of responsibility.

Table 5.47 KT methods and mechanisms and tie contents received by key actors (ICJV Project-1C)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-PM01	F-QA/QCM	S1	E17					C1	D1				H3	I1	
	F-QS Eng01	S1	E19				B4	C6 C7							
	*F-Com	S1	E17										H4		J1 J3 J4 J5 J6 J7 J8 J9 J11
L-QS Eng01	F-PM01	S1	E2 E17 E18 E19				B2 B4	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11				G1			
*F-CoM	F-PM01	S1	E1 E3 E17	C1	I1 I8	A1	B1	C1 C2 C6			F1	G1			
	L-CM01	S1	E3	C1	I1 I2		B1	C1	D1						
F-QS Eng02	F-PM01	S1	E17		I1		B2	C6-C7				G1	H1		
	*F-CoM	S1	E17				B2	C9							J8
	L-QS Eng01	S1	E17	C1	I1		B2 B5	C3 C6 C7 C8-C9							
F-CM02	F-PM01	S1	E2 E17 E18 E19				B2 B4	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11				G1			
	F-QA/QCM	S1	E17					C1	D1				H3	I1	

Table 5.48 KT methods and mechanisms and tie contents shared by key actors (ICJV Project-1C)

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-QS Eng01	*F-QS Eng02	S1	E17 E18 E19					C2 C6 C7 C8 C11							
*F-Com	F-PM01	S1 S2	E1 E3	C1 C2	I1 I2			C4							J3 J5 J6 J8 J9
	L-QS Eng01	S1 S2	E1 E3	C1	I1			C1 C10							J1 J4 J6
	*F-QS Eng02	S1 S2	E1 E3	C1	I1 I7			C6					H1 H2		J6 J7
*F-QS Eng02	F-QS Eng01	S1	E9	C1	I1			C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11							
F-CM02	L-CM01	S1	E3	C1	I1 I2		B1	C1	D1						
	*F-Com	S1	E17										H4		J1 J3 J4 J5 J6 J7 J8 J9 J11
	L-QS Eng01	S1 S2	E1 E3	C1	I1			C1 C10							J1 J4 J6
F-QA/QCM	F-PM01	S1	E17					C1	D1		F1		H3	I1	
	*F-CoM	S1	E17					C1	D1		F1		H3	I1	
	L-QS Eng01	S1	E17					C1	D1		F1		H3	I1	

The KT methods and mechanisms and types of knowledge that influenced the KT processes between the key actors in this ICJV project are shown in Tables 5.46-5.47. In terms of the KT methods and mechanisms, the findings showed that most of the key actors in this ICJV project preferred to use (S1) face-to-face communication, (I7) mentoring and coaching, (E17) group meetings/team meetings, (E3) project history/ case writing, (E1) brainstorming, (S2) socialising out-of-hours (lunch or coffee breaks), (E19) regular meetings and continuous

meetings, (I2) on-the-job training, (E2) memoranda and letters, (E18) minutes of meetings, (E9) team collaboration tools, (C2) knowledge databases, (I7) mentoring and coaching, and (I8) lesson-learned meetings as KT methods and mechanisms to exchange their knowledge.

The choice of KT methods and mechanisms further indicated the tie contents for the development of the conceptual framework. This argument is also supported by the following statement made by L-CM01, the construction manager of the local partner, who was perceived as an expert and a gatekeeper in this ICJV project;

[...] "...there is always a need to up-skill the staff involved in ICJV projects. We discussed this via face-to face-communication (e.g. weekly meeting) where we sought to learn knowledge and experience of construction methods from each other..."

[...] "...learning by doing, and observing are the most useful methods and mechanisms to learn from a foreign partner. 99% of our knowledge transfer between partners was from learning by doing and on-the-job training. Moreover, a presentation with photos of the project was also a good way to access knowledge and understands the construction process to avoid mistakes."

[...] "...meetings were considered to be the best method to transfer knowledge within the project. We based our actions on the conclusions from the meeting. We sometimes discussed problems at the construction site to find solutions, but if we were unable to solve them, the top management of both parties had to meet to make a decision and take action."

The most likely explanation for these findings is that meetings were considered to be the best method to transfer knowledge within the ICJV project, as well as learning by doing and on-the-job training. However, presentations with photos of the project were also a good way to access knowledge and understand the construction process.

In terms of the flow of knowledge, it was indicated that (C1) project management was the most important knowledge flow in this project (13 counts), followed by (C6) procurement system (9 counts), (C7) subcontracting arrangements and management/ corporate commitment and the ability to assess, (D1) technologies in building and components (7 counts), (J6) knowledge of local customers (6 counts), (B2) construction knowledge, (C2) project planning and control, (C8) employment of subcontractors in international projects, (C9) risk management, (C10) site management, (H1) construction resources, (H3) labour productivity, (I1) training of skilled workers, their migration for overseas jobs and their re-employment in domestic construction (5 counts), (C3) project resource management, (C4) human resource management and development, (C11) cost management, (F1) quality assurance and control, (G1) safety standards, (J1) foreign/ local culture and national culture, (J4) knowledge of local market conditions (4 counts), (B1) construction techniques, (B4) transfer and movement of materials and manpower or equipment manufacturing capacity, (C5) organisational management, (J5) local government policies/dealing with various government bureaucracies, (J7) administrative procedures, (J8) strength of legal system/legal system and (J9) political stability/political system (3 counts), (H4) local resources and (J11) local business practices (2 counts), (A1) conceptual skills, and (H2) construction equipment (1 count).

These findings indicate that there was a lack of exchanging knowledge and experience of (E) economic, marketing and financial expertise in this ICJV project. Moreover, only some key

actors asked for advice and shared their knowledge of (D) technological expertise, (F) quality assurance and control expertise, (G) safety expertise, (H) construction resources, and (I) training programmes. As a result, it seems clear that the knowledge and skills of these factors did not exist in this ICJV project.

The choice of the type of knowledge further indicated the tie contents for the development of the conceptual framework. This argument is supported by the following statement made by F-PM01, a Project Manager;

[...] "...we are experts in the construction of pre-stressed concrete bridges and our company is the number one in Japan where we have constructed over 1,000 bridges. Our teams are highly experienced and have superior expertise in the construction of concrete bridges overhanging rivers. We were the first company to do this in Japan and we have brought this innovation to Thailand.

[...] "...the highlights of this project are that it is the widest bridge in Thailand with extradoses 6 lanes and Thailand's first bridge constructed with a combination of concrete and cable support. So, they need to learn from their Japanese partner to develop and improve the construction technology, as well as the safety management in this project"

[...] "...this project was approved by The Japan International Cooperation Agency (JICA), therefore, the safety standards are those of the JICA, which establishes the safety and security standards for each country".

Moreover, and F-CoM, the project coordinator who was regarded as the focal point in this network made the following recommendation;

[...] "...security standards are different between Thailand and Japan and these are considered to be an important component of a project that is not considered in Thailand. Hence, we needed to discuss them in both the meetings and on the construction site in order to avoid any accidents during construction.

The most likely explanation for these findings is that the Project Manager of the foreign partner and the Project Coordinator aimed to share their knowledge and experience of construction technology and safety and security standards with local staff.

The type of knowledge flow between the key actors and the most used KT methods and mechanisms to exchange knowledge and experience in this ICJV project is illustrated in Figure 5.29.

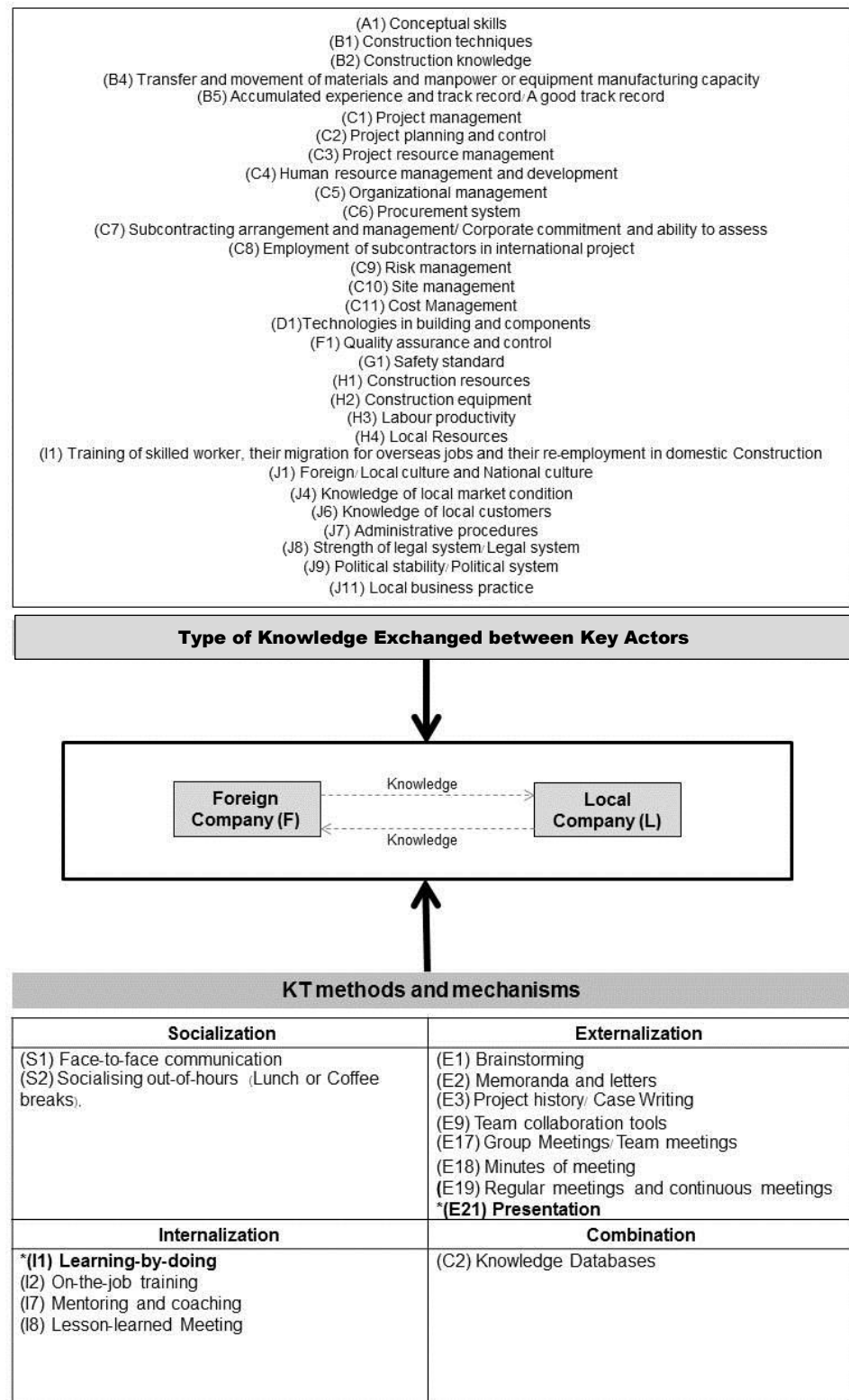


Figure 5.29 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-1C)

It was found in the previous section that the transfer of knowledge was the most important factor for ICJV Projects. The key findings for this ICJV project are summarised in this section with a discussion of the enabling and inhibiting factors that were found to influence the knowledge transfer process from the foreign to the local partner according to the key actors in this ICJV project. Some comments from those key actors during the interviews are shown below.

The Construction Manager of the local partner (L-CM01) defined the key enabling and inhibiting factors that influenced the KT processes in the ICJV as follows;

[...] “Although the two countries had different languages and cultures, a common language was not a problem because English is the second language of both the Thai and the Japanese and we mainly used technical language and body language to exchange knowledge and experience”

[...] “We had a different perceived need of knowledge. The Japanese were highly disciplined and took their jobs more seriously than the Thai staff. They were very punctual and their role was based on a clear agenda. Seniority and discipline are very important to the Japanese whereas Thai people are not aggressive and sometimes do not show their feelings”

In terms of the Performance and Success factors of ICJV projects, the Construction Manager of the local partner (L-CM01) argued that:

[...] “Internal agreement is the most important indicator of an ICJV project, but the relationship between partners or individuals also influences the success of the project”

Moreover, the Project Coordinator (F-Com) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV as follows;

[...] “Security standards and security levels in Thailand and Japan are different. The standard of security is considered to be essential by the Japanese, but it is not considered to be important in Thailand. Therefore, the security and safety of the project was the most important factor we had to discuss in both the meetings and on the construction site in order to avoid any accidents.”

In terms of the Performance and Success factors of an ICJV project, the Project Engineer (L-P Eng 02) made the following comments;

[...] “Cultural management was the factor most often discussed in this project and considered to be the most important indicator in the ICJV business.”

[...] The “time, cost, quality and safety of the project are the most important performance and success factors of an ICJV project”

[...] “...,as well as trust and the financial conditions of the partners.

The data was collected from interviews with a number of key knowledge actors in this ICJV project using open-ended questions. The interviewees were briefed on the background of the topic of the research, as well as the framework adopted to analyse the transfer of knowledge in this ICJV project. When they described the main enabling and inhibiting factors that influenced the KT processes, they stated that language and culture were not barriers to the acquisition of knowledge, but rather, the security and safety of the project was the most important factor to consider avoiding any accidents during the construction. Moreover, the key actors indicated that the relationship and trust between partners and individuals were considered to be the most important indicators of the Performance and Success factors of an ICJV project.

5.4 SUMMARY OF CASE STUDY ONE

This section contains an analysis of the three ICJV projects in case study one (ICJV Project-1A, ICJV Project-1B, and ICJV Project-1C). It should be noted that the sample size in ICJV Project-1A was much smaller than the others and this led to a rather limited comparison. Therefore, some of the conclusions were derived from ICJV Projects-1B and -1C). The data is analysed and considered by linking the empirical data to the main constructs of the conceptual research framework and to the purpose of the study using the analytical generalisation described in Chapter 3.

Actors' Attributes and Sources of Knowledge

The data gathered in case study one (ICJV Project-1A to ICJV Project-1C) related to experience revealed that ICJV staff sought to achieve knowledge transfer throughout the course of the ICJVs. However, it was challenging and its success depended on multiple knowledge characteristics, methods and mechanisms, as well as the type of knowledge. Firstly, as mentioned above, it needs to be noted that the sample of ICJV Project-1A was much smaller than that of the other ICJV Projects in this case study, which may be because this project was completed almost 15 years ago when it was impossible to collect the data from some of the team members. As a result, the comparison between these three ICJV projects is fairly limited. Additionally, the managerial and professional staff who participated in these three case studies was Thai, Japanese, French and Filipino whereas most of the research participants were Thais. Moreover, the results indicated that only one foreign employee participated in ICJV Project-1B compared to the other two projects. In ICJV Project-1A, the Supervisor and Project Managers (from both local and foreign partners) were perceived to be experts, as well as knowledge consumers and knowledge brokers. Moreover, the Supervisor was also perceived to be a gatekeeper in this project. In ICJV Project-1B, the Supervisor, Project Engineer and Senior Engineer were perceived to be experts. The Project Engineer was also perceived to be a knowledge consumer, knowledge broker and gatekeeper, whereas the Project Manager and Engineer were knowledge consumers. In ICJV Project-1C, the Project Manager, Construction Manager and QS Engineer were perceived to be experts, as well as, knowledge consumers. The Project Manager was also identified as a knowledge broker and gatekeeper in this project, while the Construction Manager and QS Engineer were perceived to be gatekeepers.

Moreover, the results revealed that the key actors in this case study were the Project Manager, Construction Manager, Engineer, QS Engineer and Supervisor. These results indicate that the knowledge transfer processes in this study had taken place between these key actors and the Coordination Manager. It seems clear that the KT processes had taken place between the Project Managers (from both local and foreign partners), Supervisors and Project Engineers in ICJV Project-1A and ICJV Project-1B. In contrast, the KT processes in ICJV Project-1C had taken place between the Project Manager from the foreign partner, the QA/QC Manager, Coordination Manager, Construction Managers (from both local and foreign partners), QA Manager and QS Engineer. Additionally, the findings indicate that the key knowledge actors in these ICJV projects consisted of a combination of local and foreign team members (e.g. French, Filipino, and

Japanese). Most of them had 6-15 years and >20 years' experience of construction projects and were aged 41-50, followed by 31-40, 51-60 and 26-30. In terms of experience of training and visiting other foreign companies or projects, the findings indicated that the vast majority of the key actors had experience of training and visiting their JV partners. Only six of them (e.g. Project Managers, Project Engineers and Engineers) had no experience of these two factors.

Influence of Social Networks

Based on the aim of this study, the interviewees were asked to define the processes of transferring knowledge in their ICJV Project between local and foreign partners. In terms of SNA, it was found that ICJV Project-1C had a higher network density (0.249), followed by ICJV Project-1A (0.099) and then ICJV Project-1B (0.005). Since the network density in ICJV Project-1C was 0.249, it seems that 24.9% of the potential links existed between the actors in this ICJV project. This indicates that all the possible connections had been made in this ICJV Project compared to those in the other two. In contrast, the network density in ICJV Project-1B was only 0.005 (0.50%), which was a very low value. Hence, this indicates that not all the connections that could possibly have been made were made in this network. It seems that three of the actors in the collaborative network in ICJV Project-1B had participated and been involved in ICJV Project-1A. It may be claimed that these actors should have driven the KT processes between ICJV Project-1A and ICJV Project-1B, but the network density in ICJV Project-1B was only 0.005 (0.50%), which was rather small compared to ICJV Project-1A. However, when ICJV Project-1A was completed in 2002, it was difficult to recruit research participants; therefore, it can be assumed that all the connections that could possibly have been made in the network of 71 nodes in ICJV Project-1B were not made. As a result, it was impossible for the node to have ties with the remaining actors.

KT Processes/ Methods and Mechanisms

In terms of the contents and reasons to exchange knowledge, the vast majority of the key knowledge actors in this Case Study indicated that 'work colleagues' were more frequently considered to be the source of knowledge in these two ICJV companies, followed by 'bosses' and partners'. The majority of the respondents argued that tacit knowledge was relatively difficult to express and transfer via face-to-face interaction; in contrast, explicit knowledge was easier to capture through reports and meeting reports. However, most of the respondents preferred to use these KT methods and mechanisms to exchange knowledge. The majority of the respondents argued that face-to-face interaction, brainstorming, minutes of meetings, continuous meetings, learning-by-doing and mentoring and coaching were considered as major mechanisms to seek and share knowledge. Staff and experts in this case study tended to transfer knowledge by seeking and sharing it based on experience and trust in work colleagues, bosses and partners in the ICJV project.

Participants in ICJV Project-1A and ICJV Project-1B viewed language and culture as the main barriers to transfer knowledge between local and foreign staff, while the openness and willingness to learn, motivation, attitudes and sense of responsibility of each person to seek knowledge and method of statement were considered to be the main barriers/ enhancers to

transferring knowledge in ICJV projects. In contrast, the participants from ICJV Project-1C stated that language and culture were not a problem in terms of seeking knowledge in ICJV projects. This enabled Case Study one's staff to engage in close relationships and gain access to crucial knowledge from foreign partners. Nevertheless, Case Study one struggled to transfer knowledge when working with the Western partner (e.g. French) since they had dissimilar organisational and national cultures, whereas the Eastern partners (e.g. Filipino and Japanese) was referred to as having a 'closed culture' and similar social activities. Distinctively different working patterns and decision-making processes between partners were found to have a negative impact on the KT processes in these ICJV Projects. In terms of Performance and Success factors, the key actors indicated that commitment, agreement of contract, partners' performance, and performance of IJV management and the relationship and trust between partners and individuals were considered to be the most important indicators of the Performance and Success factors in ICJV projects.

A within-case analysis was used to investigate each case study independently in order to become more familiar with each of the studied organisations and their experience of transferring knowledge in the ICJV Projects. The data analysis was structured by linking the empirical data to the main constructs of the conceptual research framework and the purpose of the study. a cross-case analysis will be provided in Chapter 7 based on the with-in case analysis presented in this chapter and Chapter 6 with the aim of identifying the similarities and differences in the key enabling and inhibiting factors that influence KT processes and the successful transfer of knowledge in ICJV Projects across the three case studies. However, the findings of the three ICJV Projects in case study two are presented in the next chapter.

6. ANALYSIS AND FINDINGS (CASE STUDY TWO)

6.1 INTRODUCTION

The analysis and findings of the case study one were presented and discussed in the previous chapter. The purpose of this chapter is to present the analysis of the findings from an analysis of the three ICJV projects from Case Study Two. The three projects were analysed following the case descriptions' strategy proposed by Yin (2009). The case background of each project and the key findings of the actors' attributes, social network analysis and KT methods and mechanisms for each project are presented. The chapter is divided into four sections, including this introduction and each project analysis follows the format outlined in Table 6.1. Section 6.2 contains an overview of Case Study Two. Section 6.3 contains a detailed analysis of each of three ICJV Projects and Section 6.4 contains a summary of the case studies.

Table 6.1 Case Analysis Format

No	Analysis of data
1)	Case Background
2)	Actors' Attributes a) Gender, Age, and Nationality b) Educational Background and job position c) Experience and primary discipline in a construction projects
3)	Social Network Characteristics a) Size of the Network, Network Structure and Network Density b) Degree of Centrality c) Betweenness Centrality d) Cliques of the network/ Cluster analysis
4)	Knowledge Source and Knowledge Transfer Mechanisms a) Source of Knowledge b) Knowledge Transfer Methods and Mechanisms c) Tie Characteristics and Tie Contents d) Relationships between Key Actors ,Knowledge Transfer Methods and Mechanisms, and Tie Contents

6.2 OVERVIEW OF CASE STUDY TWO

An overview of the second case study is presented in this chapter. This company was incorporated as a limited company on the 27th November 1972 with an initial registered capital of 1.4 million Thai Baht, to engage in the construction business in Thailand, e.g., construction of buildings and general civil works. Case Study two formed a joint venture with one of Japan's top ten construction contractors, the Japan Construction Company, in 1981, in order to enhance its capability with regard to construction technology and to enlarge its business alliances. Case Study two registered capital of 1,050 million Thai Baht to become a public company and was listed on the Stock Exchange of Thailand on the 19th April 1996. It is currently regarded as one of the most successful construction companies in Thailand. It has developed its construction technology through various joint ventures with foreign companies that possess expertise in this

area, e.g., Bilfinger AG from Germany, Thames Water International Limited from England, Kumagai Gumi Limited and the Tokyu Construction Co., Ltd. from Japan. This has enabled the company to expand its scope of engagement to the point of becoming one of the few construction companies that are sufficiently capable of undertaking projects that involve sophisticated advanced construction technology in Thailand.

6.3 CASE STUDY ANALYSIS

The first project, ICJV Project-2A, was the Bang Na Expressway (BNE) Project, while the second one, ICJV Project-2B, was related to the Chaloem Ratchamongkhon line (The first underground mass rapid transit project in Bangkok) and the third, ICJV Project-2C, was the construction of the Purple Line (The mass rapid transit railway in the Bangkok Metropolitan). All three ICJV case studies in Case Study Two are summarised in Table 6.2.

Table 6.2 Three ICJV Projects (CASE STUDY TWO)

No	ICJV Project	Role of Company	Country	Type of Project
1	ICJV Project-2A	(L) Construction of buildings and general civil works	Thailand	Bang Na Expressway (BNE) Project Completed in 2000
		(F) Engineering and Technology as well as Maintenance, Modification and Operation	Germany	
2	ICJV Project-2B	(L) Construction of buildings and general civil works	Thailand	Chaloem Ratchamongkhon line (The first underground mass rapid transit project in Bangkok) Completed in 2004
		(F1) Engineering and Technology as well as Maintenance, Modification and Operation	Germany	
		(F2) Construction of roads and bridges, railway stations and tunnels	Japan	
		(F3) Construction of railway engineering, building, infrastructures, and construction management	Japan	
3	ICJV Project-2C	(L) Construction of buildings and general civil works	Thailand	Construction of the Purple Line (The mass rapid transit railway in the Bangkok Metropolitan) Completed in 2007
		(F) Construction of railway engineering, building, infrastructures, and construction management	Japan	

The background of each case in the Case Study and its ICJV projects are provided in the first section. The actors' attributes of the participants in this research are illustrated in the second section. The key findings of the social network analysis are presented in the third section, while the fourth section contains an analysis of the KT methods and mechanisms that influenced the knowledge transfer processes within the ICJV projects.

6.3.1 ICJV Project-2A

1) Background of Case

This ICJV project was the Bang Na Expressway (BNE) Project, which was jointly undertaken by a German firm (F) and a Local Company (L) with an equity share of 65% percent and 35% respectively and the contract sum was US\$1billion. The contract was completed in January 2000. The stated objectives of this ICJV were to acquire specialist technology related to an extended and interconnected system of expressways and to combine the resources of the members of the JV in order to share the expertise of each partner. This ICJV project was built on top of an at-grade highway for its entire length which stretched from the eastern edge of Bangkok, Thailand to the city of ChonBuri. This project was conceived by the Expressway and Rapid Transit Authority of Thailand (ETA), and BNE was a major element of an extended and interconnected expressway system in the greater Bangkok area. A contract was signed between the ETA and Joint Venture2A under the sponsorship of Foreign Company (F) with Local Company (L) as an important local partner in June 1995. The contract covered 55 km (34 miles) of elevated expressway together with an additional 40 km (25 miles) of ramps and intersections for a total deck area of 1,900,000 m² (20,400,000 sq.ft.). Local Company (L) is one of the largest firms in Thailand with major activities from general construction to infrastructure construction, while Foreign Company (F) is a European company based in Germany that specialises in civil and industrial construction, engineering and services. This company has developed from a construction company to an international engineering and services group by delivering services to two business segments; engineering and technology, as well as maintenance, modification and operations. Foreign Company (F) upholds the highest standards of safety and quality and its operation spans five continents; Europe, United States, Africa, Australia and South East Asia. Meanwhile, Local Company (L) had a joint-venture agreement with Foreign Company (F) from Germany to develop its construction technology and expand its scope of engagement to become one of the major sophisticated construction contractors in road and expressway projects with advanced construction technology, such as the Si Rat-Outer Ring Road Expressway Project (Bangkok, Thailand), the National Road Construction Project (Along Veng-Siem Reap, Kingdom of Cambodia), the toll collection and traffic management systems of Kanchanapisek Road (Bangkok and Samut Prakarn Province, Thailand), the Southern Outer Bangkok Ring Road (Bangkok and Samut Prakarn Province, Thailand) and Construction Contract for Highway Route No.67 (Cambodia), etc.



Figure 6.1 Overview of BNE Project, completed in January 2000 (ICJV Project-2A)

2) Actors' Attributes

a) Gender, Age, and Nationality

Nine participants were recruited from different levels within ICJV Project-2A. Annual reports and the municipality's website were viewed for additional evidence. All the participants in this case study (100%) were male. The managerial and professional staff came from two different countries. 33.33% were German and 66.67% were Thais (see Table 6.3). Moreover, the findings revealed that 90% of the respondents were aged between 51 and 60 and more than 60 and the remainder were between 41 and 50 years old. Therefore, most of the respondents in this ICJV project could be said to be aged between 51 and 60 and more than 60.

Table 6.3 Nationality of research participants (ICJV Project-2A)

Nationality	Local Company (L)	Foreign Company (F)	Total	%
Thai	6	0	6	66.67
German	0	3	3	33.33
Grand Total	6	3	9	100.00
	66.67%	33.33%	100.00%	

b) Educational Background and job position

The educational background and different stakeholders' expertise in various positions are shown in Table 6.4. In terms of their educational background, 11% of the participants had a postgraduate degree, 22% had a certificate and diploma and 67% had an undergraduate degree. Therefore, most of the respondents in this ICJV project described themselves as Co-Construction Managers.

Table 6.4 Cross Tabulation between educational background and job position (ICJV Project-2A)

Educational Background	Job position							Total	%
	Project Manager	Co-Project Manager	Construction Manager	Co-Construction Manager	Technical Advisor	Supervisor	Quality Control		
Certificate/Diploma	1	-	-	1	-	-	-	2	22.00
Undergraduate	-	1	-	2	1	1	1	6	67.00
Postgraduate	-	-	1	-	-	-	-	1	11.00
Total	1	1	1	3	1	1	1	9	100.00

The cross tabulation in Table 6.4 shows that most of the respondents were undergraduates and held positions of Co-project manager, Co-construction Manager, Technical Advisor, Supervisor and Quality Control. However, one Project Manager and one Co-construction manager had a certificate/diploma and one Construction Manager had a postgraduate degree. Therefore, it seems that their "educational background" was not related to their 'job position' in this ICJV project.

c) Experience and primary discipline in a construction projects

It can be seen from Table 6.5 that all the respondents had >20 years' experience in the construction industry and ICJV projects and different stakeholders had experience in various fields. Therefore, the results revealed that most of them had 16-20 and >20 years of experience in the construction industry and ICJV projects and they were all civil engineers with experience of training and visiting foreign partners.

Table 6.5 Cross Tabulation between experience in construction and job position (ICJV Project-2A)

Experience in the construction industry	Job position							Total	%
	Project Manager	Co-Project Manager	Construction Manager	Co-Construction Manager	Technical Advisor	Supervisor	Quality Control		
< 5	-	-	-	-	-	-	-	-	0.00
6-15	-	-	-	-	-	1	-	1	11.00
16-20	-	-	1	1	1	-	1	4	44.00
> 20	1	1	-	2	-	-	-	4	44.00
Total	1	1	1	3	1	1	1	9	100.00

The cross-tabulation in Table 6.5 confirms that there was a strong relationship between 'experience in construction' and 'job position'. It can be seen that most of the managerial staff in this case study had 16-20 years' experience and more than 20 years' experience in the construction industry, i.e. Project Manager, Co-Project Manager, Construction Manager, Co-Construction Manager, Technical Advisor, and Quality Controller. The main reason for this is likely to be that this ICJV project was completed almost 17 years ago in 2000. Hence, it can be assumed that the respondents gained their knowledge and experience of ICJV projects almost 15-20 years ago. Furthermore, since the data for this case study was collected from an ICJV project, the Bang Na Expressway (BNE) Project, which is a highway from the eastern edge of Bangkok to the city of ChonBuri, the bulk of participants were civil engineers with the knowledge, skills, and experience required for this project. It may be considered that the construction of an expressway with advanced construction technology requires engineers with knowledge of precast segmental, span-by-span construction and details of a pre-casting operation. Hence, the civil

engineers were responsible for the inspection, operation and monitoring of the processes of the construction of this expressway.

3) Social Network Characteristics

a) Size, Structure, and Density of Network

This section contains the results of the social network analysis, i.e. the size of the network, the network structure and the network density. Precast segmental construction technology, particularly span-by-span construction, was pioneered in this ICJV project since it was not only the longest bridge in the world, but also the largest pre-casting operation ever undertaken. Since this ICJV project was completed almost 17 years ago in 2000, there was a limited number of respondents. This network consisted of 15 nodes made up of 9 research respondents and 6 other project participants who were named by them. The network boundary was defined as all the participants from the organisation chart of this project, which resulted in this case study having 9 participants. The codes denoting their position, participant code and relationship in the network are presented in Figure 6.2 and Table 6.6.

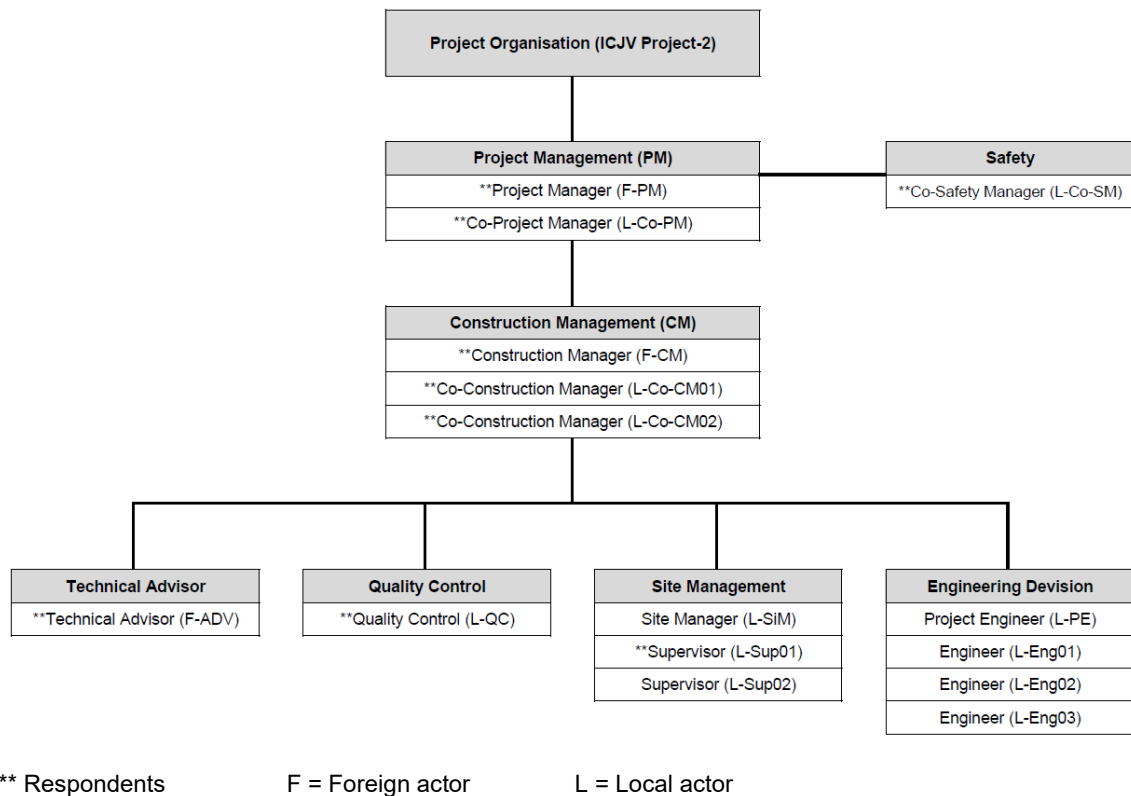


Figure 6.2 Job position of participants and their code (ICJV Project-2A)

Table 6.6 SNA internal restriction with a position (ICJV Project-2A)

Respondents	This person shares information with you	How often do you <u>seek</u> knowledge from this person?	You share information with this person	How often do you <u>share</u> knowledge with this person?
L-Co-PM	F-ADV	4	Co-CM02	5
	F-PM	4	L-Co-CM01	5
F-PM	L-QC	4	F-CM	4
	F-ADV	4	F-ADV	4
	L-Co-PM	3	L-Co-PM	3
F-CM	F-PM	4	L-QC	3
	L-Co-PM	3	F-ADV	4
	L-Co-CM01	3	L-Sup01	3
L-Co-CM01	L-Co-PM	4	F-ADV	3
	L-Co-CM02	4	L-QC	3
L-Co-CM02	F-PM	3	F-ADV	3
	L-Co-PM	3	L-QC	3
			L-Sup01	3
L-Co-SM	L-Co-PM	3	L-QC	3
	F-PM	3	L-PE	3
	L-Co-CM01	3	L-Sup01	3
			L-Sup02	3
L-QC	F-ADV	3	L-PE	3
	L-Co-CM02	3	L-Sup02	3
	L-Co-CM01	4	L-Sup01	3
	L-Co-SM	3		
F-ADV	F-CM	4	L-QC	3
	F-PM	4	L-Sup01	3
	L-Co-PM	3		
L-Sup01	L-QC	3	L-SiM	3
	L-Co-SM	3	L-Eng01	3
	L-Co-CM01	4	L-Eng02	3
			L-Eng03	3

F = Foreign actor

L = Local actor

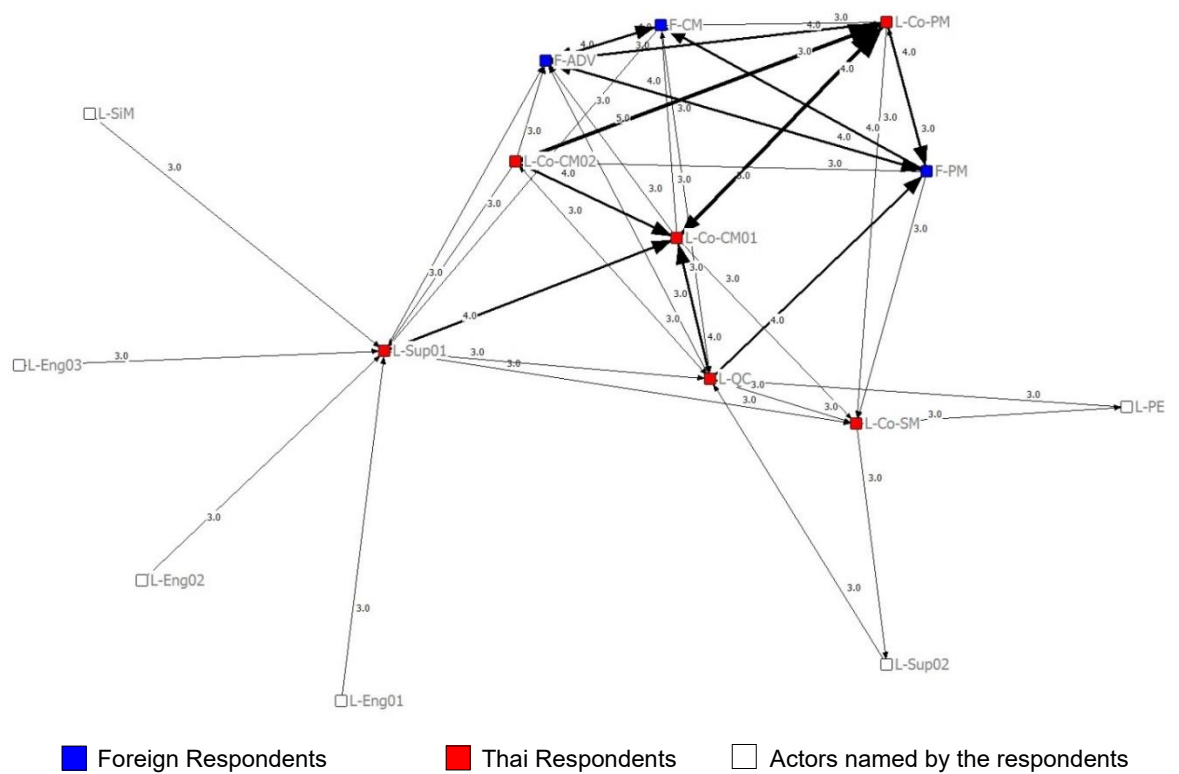


Figure 6.3 Sociogram showing knowledge sharing between actors and their nationality (ICJV Project-2A)

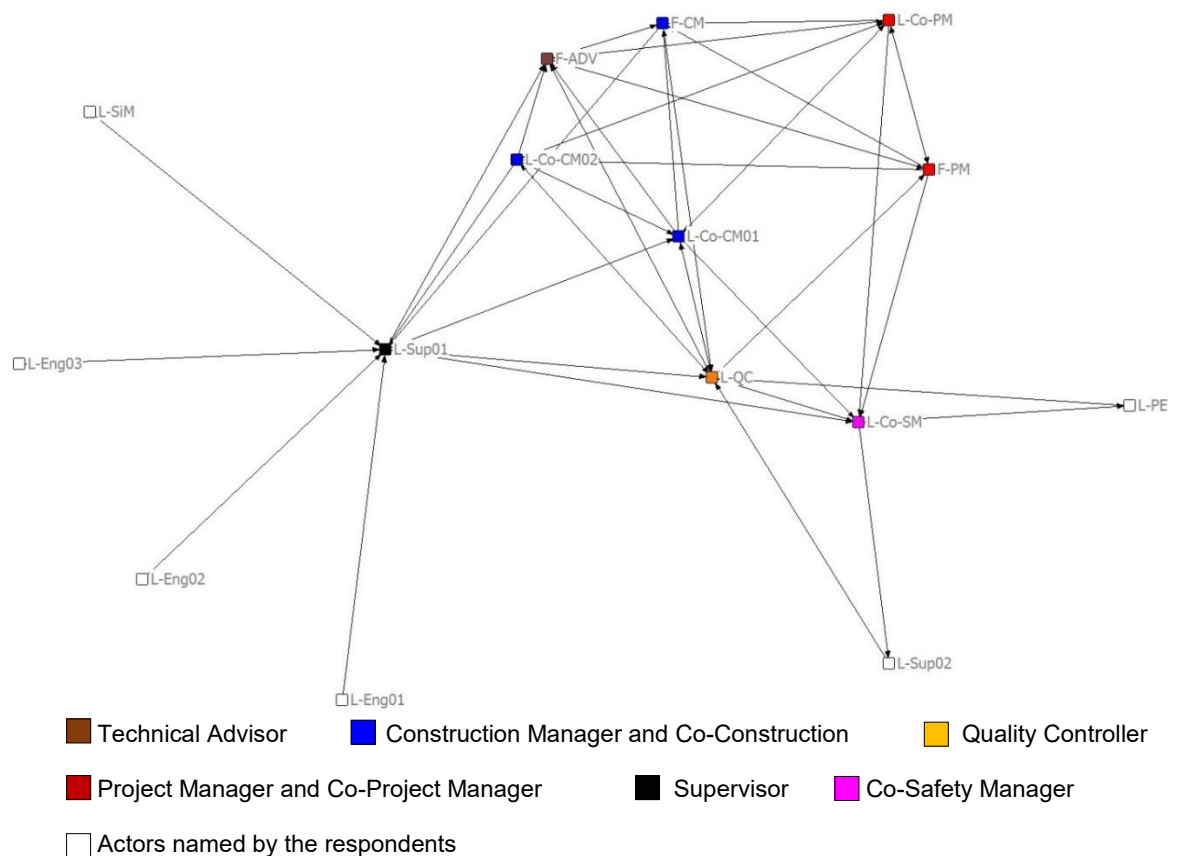


Figure 6.4 Sociogram showing knowledge sharing according to position (ICJV Project-2A)

The collaborative networks, the network structure and the strength of the ties between nodes developed by the collected ICJV project-2A are shown in Figure 6.3 and different stakeholders' expertise in various positions in the collaborative network is shown in Figure 6.4. An arrow represents the existence of collaboration between firms. The link direction is from the recipient to the knowledge source and the weight of the links between the nodes indicates the frequency with which knowledge was transferred between two actors. It can be seen that the stronger the tie is, the more often they exchanged knowledge.

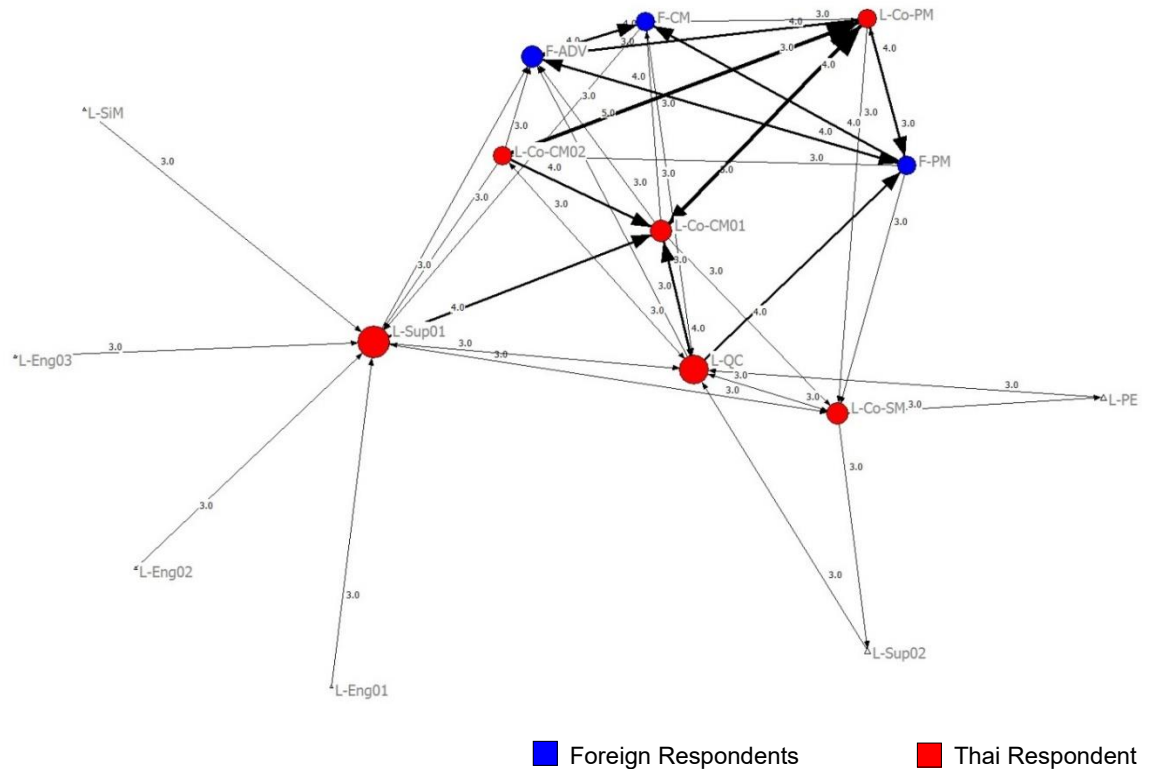


Figure 6.5 Sociogram showing network density (ICJV Project-2A)

It can be seen that this collaborative network consisted of three foreign actors (F-ADV, F-CM, and F-PM) from the Foreign Company (F) involved in this ICJV Project. As can be seen from Figure 6.5, the findings reveal that these foreign and local actors were well connected, particularly the Co-Project Manager (L-Co-PM) and the Co-Construction Managers (L-Co-CM01 and L-Co-CM02). They interlinked with other actors from various disciplines within this international project once a day or more than once a day. Based on Figure 5, 6, most of the local staff in this collaborative network was likely to seek advice from L-Sup01, L-QC and L-Co-CM01, while L-Sup01 preferred to exchange his knowledge with L-Co-CM01 and L-QC and L-Co-CM01 and L-Co-CM02 usually sought advice from L-Co-PM once a day or more than once a day. It seems clear that they were well connected with the local staff to improve the KT processes in this project.

Moreover, it is shown in Figure 6.5 that, in this collaborative network, L-QC was likely to exchange knowledge with L-Co-SM and L-Co-CM01 and he acquired knowledge and experience from F-PM once a day. It seems clear that he was well connected with F-PM in terms of improving the KT processes with the foreign partner. F-PM exchanged his knowledge and experience with the colleagues from his company, e.g. F-ADV and F-CM, as well as with other

colleagues from the local partner, e.g. QC. This indicates that L-QC and F-PM were regarded as being highly active in collaborating with colleagues from both local and foreign companies and seemed to have specialist knowledge on how to deliver the expressways project.

L-Co-CM01 and L-Co-CM02 occupied the positions of Co-construction managers from the local partner. They were relied on to coordinate the project construction process by making potential links within the network. Moreover, since the density of the network indicated that the Co-Construction Manager (L-Co-CM01) was the focal point, it can be assumed that this network was organised around him. Hence, it can be deduced that L-Co-CM01 was in a position that was relied on to coordinate the construction process of this project with F-CM (Construction Manager of a partner), whereas, L-Co-CM01 and L-Co-CM01 preferred to seek advice from F-ADV and his boss (L-Co-PM). Then, F-ADV and L-Co-PM acquired knowledge and experience from F-CM and F-PM to improve the KT between them. This shows that they were not well connected in the collaborative network, which could indicate that KT processes were not made between F-CM, L-Co-CM01 and L-Co-CM01.

According to the data gathered from the UCINET 6.0, the network density is 0.733 with a standard deviation of 0.409. Hence, 73.30% of the potential links exist between actors. Scott (2012) proposes that the network density would be 1.00 (100%) if every actor in the team were connected. Since the network density was 0.733, which is a high value, in a network of 15 nodes, it is possible for the remaining actors in the node to have ties. As a result, it can be deduced that all possible connections were made in this network.

The density in this network was rather large compared to that in ICJV Project-2B and ICJV Project-2C. Hence, it could be claimed that the KT processes in this network were better than in ICJV Project-2B and ICJV Project-2C. Another interesting aspect in this network is that there were 73.30% of the potential links between the actors, which indicates that it was possible for the remaining actors in the node to have ties. However, it was important to analyse the centrality measures in order to identify the key actor who was more central and more strongly linked than the others with regard to knowledge transfer in this ICJV project. Therefore, the inter-connectedness between the actors will be further explored based on the centrality measures in the next section to determine the kind of knowledge that was exchanged.

b) Degree of Centrality and Betweenness Centrality

The network map with differently-sized nodes is shown in Figure 6.6. The node sizes correspond with the average degree of centrality of the actors. The larger nodes were the more central ones in terms of knowledge transfer within the team. The most central actors for out-degree and in-degree centrality are illustrated in Table 6.7, which shows the average degree of centrality.

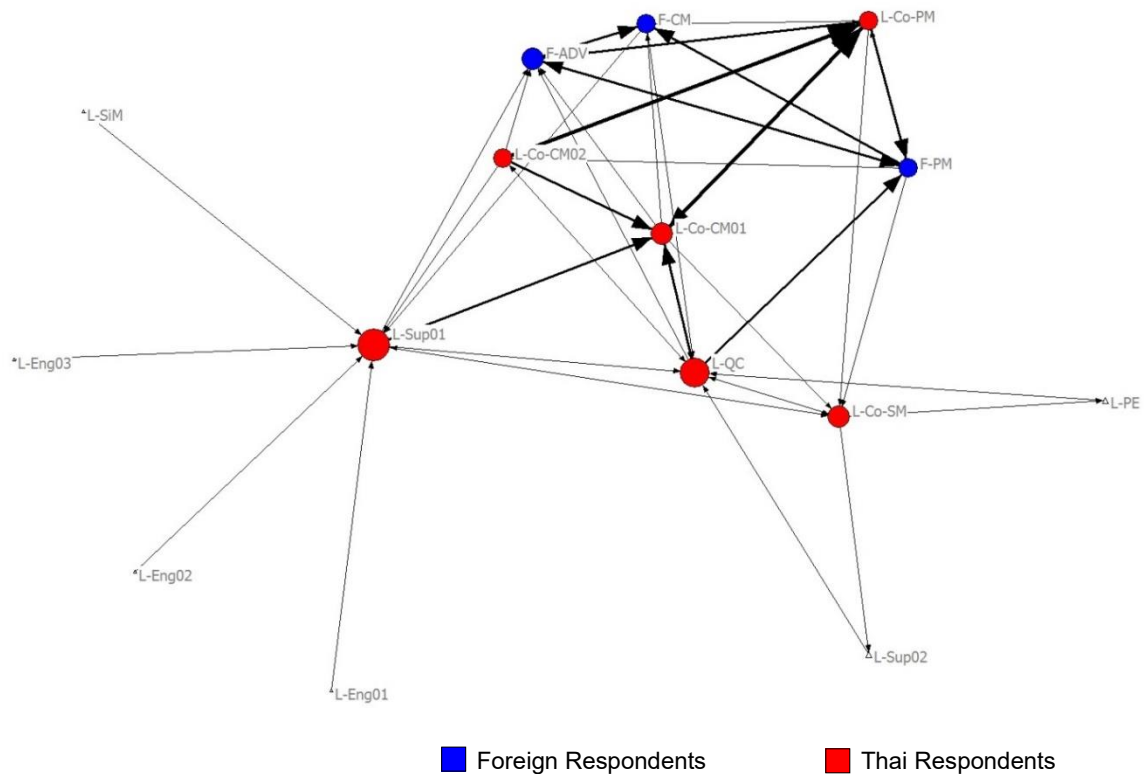


Figure 6.6 Sociogram showing network density (ICJV Project-2A)

Table 6.7 Degree of Centrality (ICJV Project-2A)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
L-Co-PM	Co-Project Manager	> 20	> 60	21 (1)	16
L-Co-CM02	Co-Construction Manager	> 20	> 60	18 (2)	9
L-QC	Quality Controller	16-20	51-60	17	21 (2)
L-Co-CM01	Co-Construction Manager	> 20	> 60	17	16
F-PM	Project Manager	> 20	> 60	17	12
L-Sup01	Supervisor	6-15	41-50	13	21 (2)
L-Co-SM	Co-Safety Manager	16-20	51-60	12	15
F-ADV	Technical Advisor	16-20	51-60	11	24 (1)
F-CM	Construction Manager	16-20	51-60	10	14

The data in Table 6.7 was the result of a further investigation of whether the in-degree and out-degree values were linked with the actors' attributes, job position, age and years of experience and it can be seen that there was a clear link between the age, years of experience and centrality values of the actors in this case study. This outcome could indicate that the experts in this ICJV project were aged 41-50, 51-60 and more than 60 and had 6-15, 16-20 and more than 20 years of experience. It could be assumed that F-ADV's in-degree centrality was slightly more than that of the next actors, who were L-QC and L-Sup01. This difference classifies F-ADV as a perceived expert who could answer any queries in this entire network, followed by L-QC (Quality Controller) and L-Sup01 (Supervisor). F-ADV (Technical Advisor) had a high in-degree centrality but no out-degree centrality. L-Co-PM had more out-degree centrality than the next actors, who were L-Co-CM02 (Co-Construction Manager), L-QC (Quality Controller), L-Co-CM01 (Co-Construction Manager), and F-PM (Project Manager of foreign partner). This difference classified L-Co-PM as a knowledge consumer, followed by L-Co-CM02 (Co-Construction

Manager), L-QC (Quality Controller), L-Co-CM01 (Co-Construction Manager), and F-PM (Project Manager of foreign partner). Hence, these results indicate that L-QC (Quality Controller) was considered to be a knowledge broker in this project.

Table 6.8 Betweenness Centrality Measures (ICJV Project-2A)

Actor	Betweenness
L-Sup01	44.483
L-QC	35.183
L-Co-SM	29.250
F-ADV	12.483
L-Co-CM01	8.817
L-Co-PM	5.750
L-Co-CM02	4.167
F-PM	4.117
F-CM	3.750

F = Foreign actor

L = Local actor

As illustrated in Table 6.8, L-Sup01 (Supervisor) had the highest betweenness centrality score followed by L-QC (Quality Controller). Therefore, L-Sup01 (Supervisor) was regarded as the main gatekeeper in this network and he was also an expert with a high in-degree centrality value. This corresponds with the study of [Borgatti, Everett, and Johnson \(2013\)](#), who found that betweenness plays a gatekeeping role in this context. Nodes with high-betweenness are in a position to filter information and threaten the network with disruption of operations. The most likely explanation for this result is that L-Sup01 (Supervisor) played a broker role, since many nodes needed him to reach other nodes via efficient pathways. Hence, he had power because he could threaten to stop transmitting, forcing nodes to use less efficient paths to reach one another. It could be seen that L-Sup01 (Supervisor) effectively discriminated between nodes and potentially correlated well with other nodes.

c) Cliques of the network/ Cluster analysis

It can be seen from Table 6.9 that 14 clusters existed in this network, each of which consisted of three or more members and Cliques 1, 2, 4, 5, 7, 8, 9, 12, and 13 contained a mixture of local and foreign members.

Table 6.9 Cluster Analysis (ICJV Project-2A)

N	Clusters
1*	F-ADV F-CM L-Co-CM01 L-QC L-Sup01
2*	F-ADV L-Co-CM01 L-Co-CM02 L-QC L-Sup01
3	L-Co-CM01 L-Co-SM L-QC L-Sup01
4*	F-ADV F-CM L-Co-CM01 L-Co-PM
5*	F-ADV L-Co-CM01 L-Co-CM02 L-Co-PM
6	L-Co-CM01 L-Co-PM L-Co-SM
7*	F-ADV L-Co-CM02 L-Co-PM F-PM
8*	F-ADV F-CM L-Co-PM F-PM
9*	L-Co-PM L-Co-SM F-PM
10	L-Co-SM L-PE L-QC
11*	F-ADV L-Co-CM02 F-PM L-QC
12*	F-ADV F-CM F-PM L-QC
13*	L-Co-SM F-PM L-QC
14	L-Co-SM L-QC L-Sup02

* = Mixture of local and foreign partners
 = The most active cliques

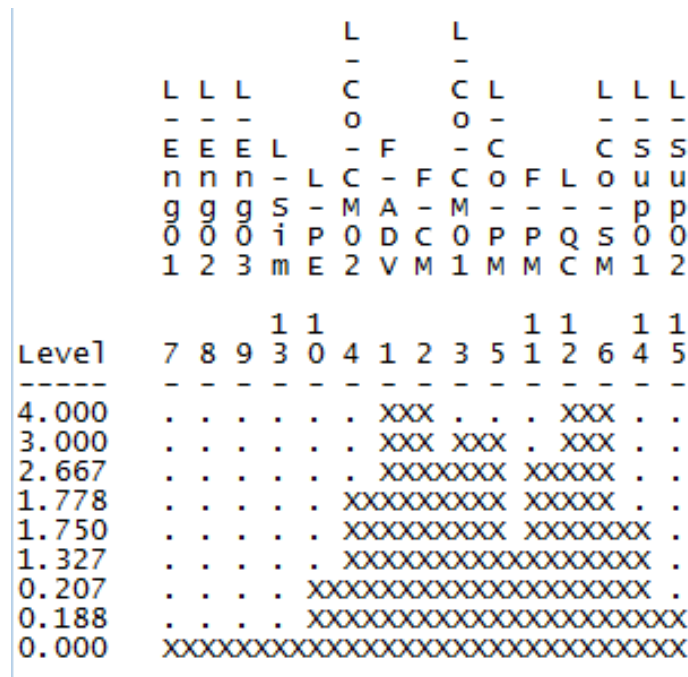


Figure 6.7 Hierarchical Clustering of Overlap Matrix (ICJV Project-2A)

According to Figure 6.7, actors F-ADV, F-CM, L-QC and L-Co-SM were the most active in the first highest number of cliques. L-Co-CM01 and L-Co-PM were the most active in the second, and F-PM was the most active at the third level. Moreover, it can be clearly seen from Figure 6.8 that actors F-ADV and F-CM were in 4 different cliques together (cliques 1, 4, 8, and 12), L-QC and L-Co-SM were in 4 different cliques together (cliques 3, 10, 13, and 14), and F-ADV, F-CM and L-QC were in 2 different cliques together (cliques 1 and 12), indicating that these actors were important within the group and possibly occupied some kind of leadership role in this project.

It can be seen from Table 6.9 that cliques 1 and 2 were the most active cliques with a mixture of actors in this project. It should be noted that all the cliques consisted of a mixture of local and foreign partners in terms of transferring and acquiring knowledge; however, F-ADV and L-QC were active in cliques 1 and 2 together. It should be noted that cliques 1 and 2 were a

mixture of local and foreign partners in terms of transferring and acquiring knowledge. F-ADV, F-CM, L-QC and L-Co-SM were active in many cliques, indicating that these actors were regarded as key players within the subgroup and possibly occupied some kind of leadership role. They must also have had sufficient knowledge to close the knowledge gap between the partners. As a result, it can be assumed that F-ADV, F-CM, L-QC and L-Co-SM were regarded as gatekeepers in receiving and disseminating knowledge from and to the foreign partner. This group of actors must have been perceived to have enough knowledge to close the knowledge gap between the partners. This result is in line with the betweenness centrality presented in the last section. F-ADV and F-CM were the only two actors who were regarded as representatives of the foreign partner who were involved in different cliques together. Moreover, this result was not in line with the in-degree centrality score, which illustrated that F-ADV (Technical Advisor) was regarded as an expert in this project, followed by L-QC.

4) Relationships between Key Actors, knowledge Transfer Methods, and Mechanisms, and Tie contents

a) Source of Knowledge

The factors that underpinned the actors' roles and the relationship between the source and the receiver of knowledge in this ICJV project were further explored, as well as why this particular person was chosen to seek and share knowledge. The results were analysed using a content analysis and they are presented in Tables 6.10-6.12.

Table 6.10 Knowledge Source and receiver (ICJV Project-2A)

No	Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Boss	11	0	11	21.57
2	Partner	5	6	11	21.57
3	Boss and partner	3	1	4	7.84
4	Working colleague	5	13	18	35.29
5	Consultant	0	0	0	0.00
6	Supervisor	0	0	0	0.00
7	Subordinate	1	6	7	13.73
8	Father	0	0	0	0.00
	Total	25	26	51	100.00

Table 6.11 Communications between knowledge source and receiver (ICJV Project-2A)

No	Communications between Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	0	0	0	0.00
2	E-mail	0	0	0	0.00
3	Face-to-Face	25	26	51	100.00
4	Social Network	0	0	0	0.00
5	Telephone and F2F	0	0	0	0.00
6	E-mail and F2F	0	0	0	0.00
7	F2F and Social Network	0	0	0	0.00
8	All types of communication	0	0	0	0.00
9	Others	0	0	0	0.00
	Total	25	26	51	100.00

Table 6.12 Why this person was chosen to seek and share knowledge (ICJV Project-2A)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Coaching and sharing knowledge and experience	0	21	21	38.18
2	He is a partner so he is really to know the local	1	0	1	1.82
3	How to manage the project in local country	0	2	2	3.64
4	Provide directions on how to manage the project	0	3	3	5.45
5	Their experiences/ Experiences	10	0	10	18.18
6	Their experience and character	1	0	1	1.82
7	Their experience in Quality Control	1	0	1	1.82
8	Their vision	5	0	5	9.09
9	Trust and their experience	11	0	11	20.00
	Total	29	26	55	100.00

According to the data in Tables 6.10 to Table 6.12, knowledge can be stored in many different repositories, depending on its type. Table 6.10 shows that the research participants provided these findings for 51 knowledge transfers. The most common knowledge source and receiver in this project with 18 counts (35.29%) was a work colleague, while the second most common was a boss with 11 counts (21.57%) and a partner with 11 counts (21.57%), followed by a subordinate with 7 counts (13.73%) and a boss and a partner with 4 counts (7.84%). Most of the participants stated that they considered their colleagues as reliable sources of knowledge and this result correlates well with the research of [Kivrak et.al. \(2008\)](#), who found that colleagues were the most important source of knowledge for firms. Moreover, it is indicated in Table 6.11 that face-to-face communication (100.00%) was the most essential way for actors in this project to communicate with each other.

Additionally, the most important reasons for receiving and sharing knowledge and experience were found to be coaching and sharing knowledge and experience (38.18%), followed by trust and their experience (20.00%), their knowledge and experience (18.18%), their vision (9.09%), and provide directions on how to manage the project (5.45%) (See more details in Table 6.12). This may be due to the fact that coaching and sharing knowledge and experience may

have been the real reason or that some of the participants may have considered that any kind of knowledge and experience was likely to be a way to capture and convert tacit knowledge to explicit knowledge, especially the knowledge and experience of a partner as a source of knowledge for the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within their project.

b) Knowledge Transfer Methods and Mechanisms

According to Figure 6.8, the research participants mainly used (S1) face-to-face communication as a mechanism to acquire their knowledge of ICJV projects, followed by (E17) group meetings/team meetings, (C1) best practice, (E3) project history/case writing and (I1) learning-by-doing/workshops/apprenticeships. In terms of sharing knowledge, the methods most used in this ICJV project were (S1) face-to-face communications, (I1) learning-by-doing/workshops/apprenticeships, (E1) brainstorming, (S2) socialising out-of-hours (lunch or coffee breaks), (E17) group meetings/team meetings and (C1) best practice respectively.

These findings show that several participants were likely to use (S1) face-to-face communication, (E17) group meetings/team meetings, (C1) best practice and (I1) learning-by-doing/workshops/apprenticeships to exchange their knowledge and skills. Most of them preferred to use (E3) project history/case writing and (I2) on the job training to acquire knowledge from their boss, partner and colleagues, whereas they shared their knowledge and experience with team members by (S2) socialising out-of-hours (lunch or coffee breaks). The type of knowledge flow between actors is presented in the next section.

c) Tie Characteristics and Tie Contents

The tie contents in the KT processes when the actors in this ICJV project sought and shared knowledge are shown in Figure 6.9. The results of the survey revealed that management expertise was the most important knowledge exchanged among actors. The second most common types of knowledge exchanged were technical expertise and local conditions and culture. On the contrary, they rarely exchanged knowledge and experience of training programmes and safety expertise. Therefore, it seems that knowledge of training programmes and safety expertise did not exist in this ICJV project.

Additionally, the types of knowledge that were mainly exchanged within this ICJV project are shown in Figure 6.8. The practitioners in this case study considered project management (C1) to be important knowledge for which they needed advice, followed by construction knowledge (B2). Conversely, they were likely to share their knowledge of construction techniques (B1) and construction knowledge (B2).

These findings show that several participants within this ICJV project preferred to discuss and exchange knowledge in the areas of project management (C1), construction knowledge (B2) and project planning and control (C2).

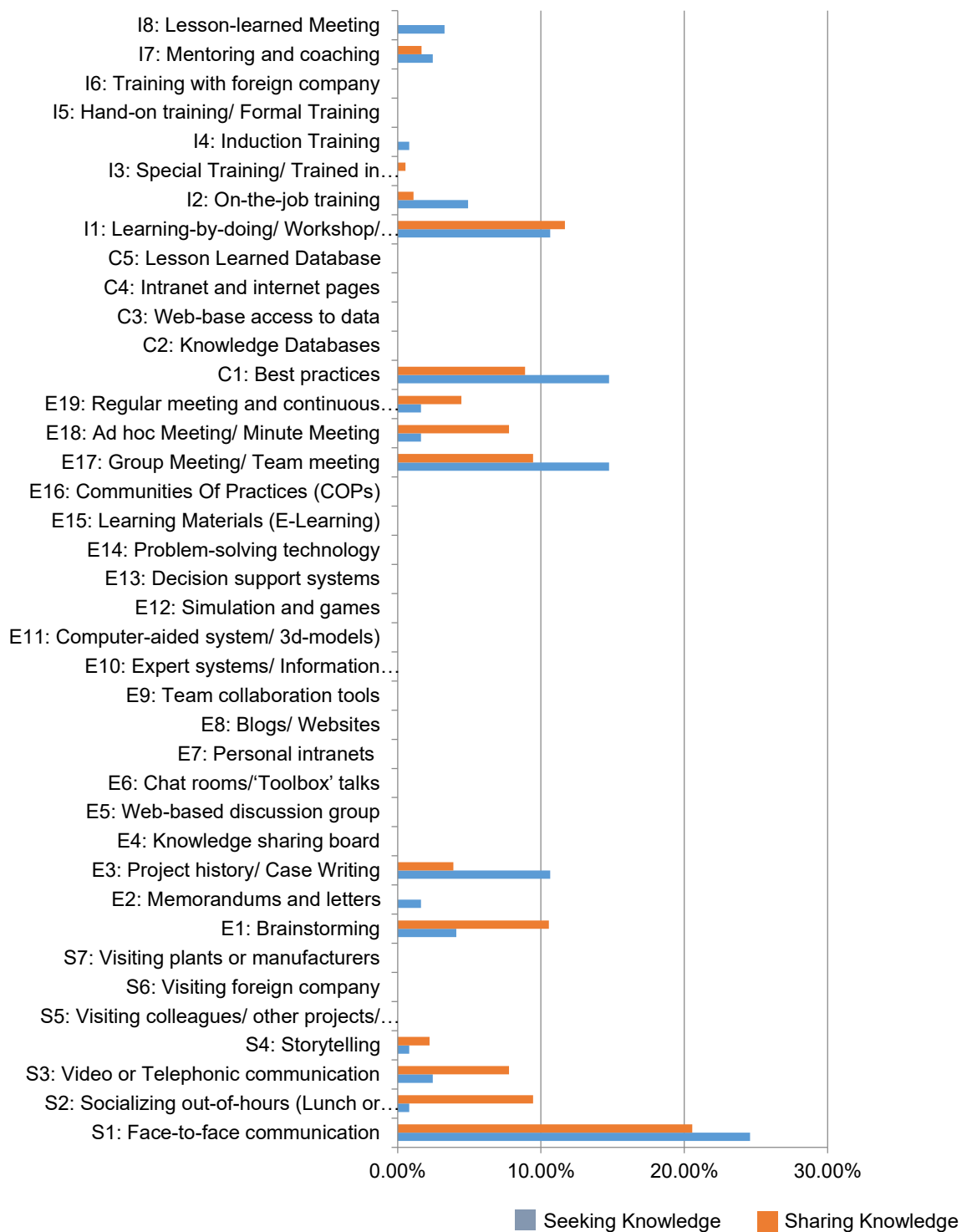


Figure 6.8 KT Methods and Mechanisms when seeking and sharing knowledge (ICJV Project-2A)

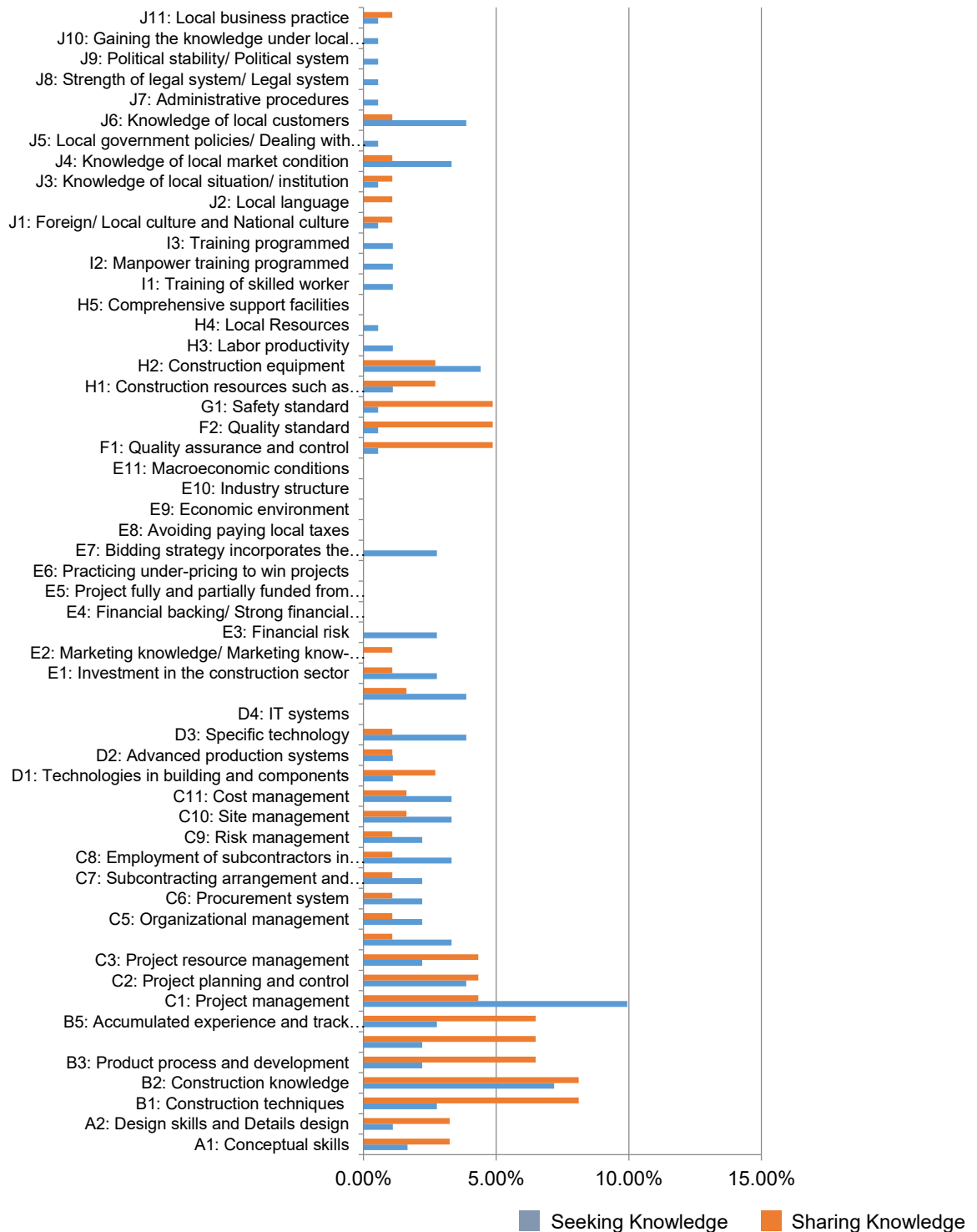


Figure 6.9 Tie contents of Knowledge Transfer when exchanging knowledge (ICJV Project-2A)

As shown in the last section, F-ADV (Technical Advisor), L-QC (Quality Controller), and L-Sup01 (Supervisor) were perceived to be experts in this ICJV project with the highest in-degree centrality. L-QC (Quality Controller) was not only identified as being a perceived expert, but also a knowledge broker and gatekeeper in this project. Moreover, the analysis in the previous section indicated that this network was organised around L-Co-CM01. In terms of the clique co-membership matrix, it seems that F-ADV (Technical Advisor), L-QC (Quality Controller), L-Co-SM (Co-Site Manager) and F-CM (Construction Manager of the foreign partner) were regarded as key

actors at the highest level who had a stronger link to a leadership role in this ICJV project. As a result, it was considered to be important to examine their KT methods and mechanisms as well as the knowledge flow between these key actors, who were the most active in the clique of the network. Moreover, the KT methods and tie contents (types of knowledge) exchanged between them also needed to be identified. Therefore, they were asked about the performance and success factors and the key enabling and inhibiting factors that influenced the KT processes in this ICJV project.

The relationship between the key actors in this ICJV project and their social networking behaviour is indicated in Table 6.13.

Table 6.13 SNA between key actors (ICJV Project-2A)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gatekeeper	Focal point	Co-membership of cliques
F-ADV	Technical Advisor	X(1)					X
L-QC	Quality Controller	X(2)	X(3)	X	X(2)		X
L-Sup01	Supervisor	X(3)			X(1)		
L-Co-PM	Co-Project Manager		X(1)				
L-Co-CM01	Co-Construction Manager					X	
L-Co-SM	Co-Safety Manager				X(3)		X
F-CM	Construction Manager						X
L-Co-CM02	Co-Construction Manager		X(2)				

Table 6.14 Knowledge sharing behaviour of key actors (ICJV Project-2A)

Actors		F-ADV	L-QC	L-Sup01	L-Co-PM	L-Co-CM01	L-Co-SM	F-CM
F-ADV	Received				X			X
	Shared		X	X				
L-QC	Received	X				X	X	
	Shared			X				
L-Sup01	Received		X			X	X	
	Shared							
L-Co-PM	Received	X						
	Shared					X		
L-Co-CM01	Received				X			
	Shared	X	X					
L-Co-SM	Received				X	X		
	Shared		X	X				
F-CM	Received				X	X		
	Shared	X	X	X				

Table 6.15 Knowledge sharing behaviour among key actors (ICJV Project-2A)

Actors	Position	Received			
		From	Relationship	How often	Why
F-ADV	Technical Advisor	L-Co-PM	Boss	Once a day	Trust and their experience
		F-CM	As a Partner	More than once a week	Their vision
L-QC	Quality Controller	F-ADV	As a Partner	More than once a week	Trust and their experience
		L-Co-CM01	Boss	Once a day	Trust and their experience
		L-Co-SM	Boss	More than once a week	Their experience
L-Sup01	Supervisor	L-QC	Colleague	More than once a week	Their experience
		L-Co-CM01	Boss	More than once a week	Their experience
		L-Co-SM	Boss	Once a day	Trust and their experience
L-Co-PM	Co-Project Manager	F-ADV	Colleague	Once a day	Trust and their experience
L-Co-CM01	Co-Construction Manager	L-Co-PM	Boss	Once a day	Their vision
L-Co-SM	Co-Safety Manager	L-Co-PM	Boss	More than once a week	Their vision
		L-Co-CM01	Colleague	More than once a week	Their knowledge and experience
F-CM	Construction Manager	L-Co-PM	Boss and partner	More than once a week	Their vision
		L-Co-CM01	As a Partner	More than once a week	As a partner

Actors	Position	Shared			
		From	Relationship	How often	Why
F-ADV	Technical Advisor	L-QC	As a Partner	More than once a week	Coaching and sharing knowledge
		L-Sup01	As a Partner	More than once a week	Coaching and sharing knowledge
L-QC	Quality Control	L-Sup01	Colleague	More than once a week	Sharing knowledge
L-Co-PM	Co-Project Manager	L-Co-CM01	Colleague	More than once a day	Coaching and sharing knowledge
L-Co-CM01	Co-Construction Manager	F-ADV	Boss and partner	More than once a week	How to manage the project in a local country
		L-QC	Subordinate	More than once a week	Coaching and sharing knowledge
L-Co-SM	Co-Safety Manager	L-QC	Colleague	More than once a week	Coaching and sharing knowledge
		L-Sup01	Colleague	More than once a week	Coaching and sharing knowledge
F-CM	Construction Manager	F-ADV	Subordinate	Once a day	Coaching and sharing knowledge
		L-QC	As a Partner	More than once a week	Coaching and sharing knowledge
		L-Sup01	As a Partner	More than once a week	Coaching and sharing knowledge

F = Foreign actor L = Local actor

As shown in Tables 6.14 and 6.15, most of the key actors in this ICJV project exchanged their knowledge and experience. According to Table 6.15, most of the central actors preferred to ask for advice from their boss, colleagues and partners respectively, whereas they were likely to share their knowledge and experience with partners and colleagues. The results indicated that the key actors exchanged their knowledge and experience more than once a week or once a day. The main reason for asking advice from particular players was trust and their experience followed by their experience and their vision. Coaching and sharing knowledge was the main reason they shared their knowledge and experience.

After gathering and analysing data about the perceived experts in this project in the previous section, it was considered to be important to examine the way these experts communicated, as well as their KT methods and mechanisms. Therefore, the KT methods and mechanisms and knowledge flow between the key actors in this ICJV project are shown in Tables 6.16 and 6.17.

Table 6.16 KT methods and mechanisms and tie contents received by key actors (ICJV Project-2A)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-ADV	F-CM	S1						C1 C2 C4 C8 C11							
	L-Co-PM	S1						C1	D3 D5	E1 E3					J4 J6
L-QC	F-ADV	S3	E2			A1 A2	B1 B2 B3 B4 B5		D1 D2 D3						
	L-Co-CM01	S1					B2	C1					H2		
	L-Co-SM	S1					B1 B2 B3 B4 B5						H1 H2		
L-Sup01	L-QC	S1	E17								F1 F2	G1			
	L-Co-SM	S1					B1 B2 B3 B4 B5						H1 H2		
	L-Co-CM01	S1					B2	C1					H2		
L-Co-PM	F-ADV	S1	E1 E17 E18 E19	C1	I1 I2 I3 I4 I5 I6 I7 I8	A1 A2	B1 B2 B3 B4 B5		D1 D2 D3						
L-Co-CM01	L-Co-PM	S1						C1	D3 D5	E1 E3 E7					J4 J6
	L-Co-CM02	S1					B2	C1	D5				H2		
L-Co-SM	L-Co-PM	S1						C1	D3 D5	E1 E3 E7					J4 J6
	L-Co-CM01	S1					B2	C1					H2		
F-CM	L-Co-PM	S1						C1	D3 D5	E1 E3 E7					J4 J6
	L-Co-CM01	S1					B2	C1					H2		J6

Table 6.17 KT methods and mechanisms and tie contents shared by key actors (ICJV Project-2A)

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-ADV	L-QC	S1				A1 A2	B1 B2 B3 B4 B5		D1 D5		F1 F2	G1			
	L-Sup01	S1	E1 E17			A1 A2	B1 B2 B3 B4 B5		D1 D5						
L-QC	L-Sup01	S1	E2								F1 F2	G1	H1 H2		
L-Co-PM	L-Co-CM02	S1 S3	E17 E18 E19			A1 A2	B1 B2 B3 B4 B5		D1 D2 D3	E1 E2					
	L-Co-CM01	S1 S3	E17 E18 E19			A1 A2	B1 B2 B3 B4 B5		D1 D2 D3	E1 E2					
L-Co-CM01	F-ADV	S1													J1 J2 J3 J4 J6 J11
	L-QC	E2									F1 F2	G1	H1 H2		
L-Co-SM	L-QC	S1	E19				B1 B2				F1 F2	G1			
	L-Sup01	S1	E19				B1 B2 B3 B4 B5								
F-CM	L-QC	S1					B1-B5				F1 F2	G1			
	F-ADV		E2					C1 C2 C4 C8 C11							
	L-Sup01	S1					B1-B5				F1 F2	G1			

The KT methods and mechanisms and type of knowledge that influenced the KT processes between the key actors in this ICJV project are shown in Tables 6.16 and Table 6.17. In terms of the KT methods and mechanisms, it was found that the most important KT method and mechanism most of the key actors in this ICJV project preferred to use to exchange their knowledge and experience was (S1) face-to-face communication followed by (I7) mentoring and coaching, (E19) regular meetings and continuous meetings (E17) group meetings/team meetings, (C1) best practice, and (I1) learning-by-doing. However, only some of them used (S3) telephonic communication, (E1) brainstorming, (E2) memoranda and letters, (E18) minutes of meetings, (I2) on-the-job training, (I3) special training/training on concentrated courses, (I4) induction training, (I5) hands-on training/formal training, (I6) training with foreign company and (I8) lesson-learned meetings as KT methods and mechanisms to seek advice and share their knowledge.

In terms of the knowledge flow between the key actors, it can be seen in Tables 6.16 and 6.17 that they mainly discussed (B2) construction knowledge, followed by (B1) construction techniques, (B3) product process and development, (B4) transfer and movement of materials and manpower or equipment manufacturing capacity, and (B5) accumulated experience and track record/good track record, (C1) project management, (H2) construction equipment, (F1) quality assurance and control, (F2) quality standard, (G1) safety standard, (D3) specific technology, (A1) conceptual skills, (A2) design skills and design details, (D1) technologies in building and components, (H1) construction resources, (J6) knowledge of local customers and knowledge of local market conditions respectively.

Some of the key actors preferred to discuss and exchange information about (C) management expertise and (J) local conditions and culture, whereas type of knowledge about (E4) financial backing/financial support, (E5) project fully and partially funded from overseas, (E6) practicing under-pricing to win projects, (E8) avoiding paying local taxes, (E9) economic environment, (E10) industry structure, (E11) macroeconomic conditions, (H3) labour productivity, (H4) local resources, (H5) comprehensive support facilities, (I1) training of skilled workers, their migration for overseas jobs and their re-employment in domestic construction, (I2) manpower training programmes, (I3) training programmes, (J7) administrative procedures, (J8) strength of legal system/legal system, (J9) political stability/political system, and (J10) gaining knowledge under local conditions did not appear to exist in this project.

As a result, it seems that most of the key actors exchanged their knowledge in the areas of (B) technical expertise, especially (B2) construction knowledge. It can be seen from Table 6.16 that F-ADV received knowledge from F-CM (Construction Manager from the foreign partner who was his boss) in the areas of (C1) project management, (C2) project planning and control, (C4) human resource management and development, (C8) employment of subcontractors in international projects and (C11) cost management. Moreover, the results in Table 6.17 indicate that L-Co-CM01 shared knowledge and experience of (J) local conditions and culture i.e. (J1) foreign/ local cultures and national culture, (J2) local language, (J3) knowledge of local situation/ institutions, (J4) knowledge of local market conditions, (J6) knowledge of local customers, and (J11) local business practices with F-ADV (Technical Advisor from the foreign partner). This was probably due to the fact that knowledge of local

conditions and culture is considered to be important to drive a joint venture between a local and a foreign partner, as well as being useful for KT processes.

Moreover, the perceived experts were asked about the most important way of communicating to transfer knowledge in this project and the results were found to be similar to those of Kivrak et al (2008) that face-to-face conversations, phone calls and meetings were considered to be the key methods and mechanisms for the successful transfer of knowledge by all the perceived experts in this project. Furthermore, L-Sup01 (supervisor from the local partner) asserted that "I almost always have a discussion with the supervisor from the foreign partner every day at the construction site." This implies that knowledge was shared by face-to-face conversation within this JV project. Moreover, most of the perceived experts agreed that weekly meetings and monthly meetings with different topics and fields were also important for sharing knowledge and experience within this ICJV project. However, the perceived experts also suggested that e-mails were considered to be an important way of communicating with partners as well as face-to-face conversations and meetings. This may be because most of the foreign staff usually used e-mail as a tool to communicate within the team.

Additionally, the perceived experts were asked about the type of knowledge they mainly discussed regarding this ICJV project. F-ADV (Technical Advisor from the foreign partner) indicated that they most often discussed technical expertise, quality assurance and control expertise and management expertise, especially in the project schedule, cost and quality when he made the following statement;

[...] "In terms of management, young engineers should carefully consider the costs when preparing the work schedule, but although they focus on how to work fast and complete the tasks on time, they fail to simultaneously look at the cost. So I make every effort to emphasise to them to always think of the cost at the same time because there is no point in losing money. I try to encourage them to keep thinking about the cost and look for the best way to balance the schedule, quality and cost in order to teach those more about budget control."

L-QC also made the following comment;

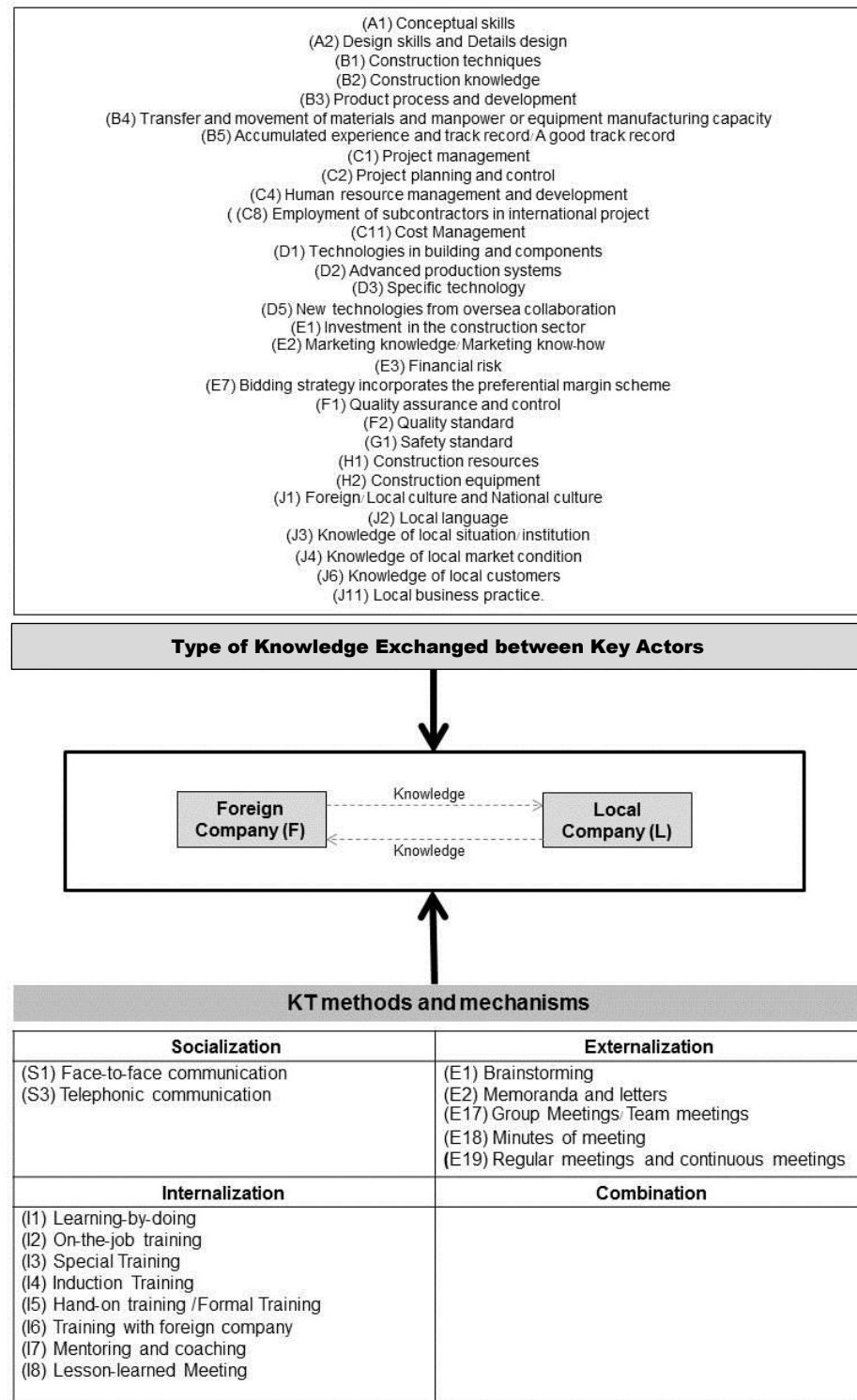
[...] "we usually discussed technical, commercial and marketing issues in terms of how to work together in this project. Moreover, we discussed and shared knowledge and experience about their previous projects in Germany. A foreign partner can provide lots of external knowledge and information about foreign suppliers so that we can compare it with other sources in Thailand. Furthermore, we asked them for more information on how this system was used in Germany to obtain an alternative solution and then made a decision to select the materials, system and suppliers for the project."

In summary, the data related to knowledge sources, methods and mechanisms and tie contents gathered for this case study indicated that most of the respondents were likely to seek and share knowledge and skills with their colleagues rather than their bosses and partners. This finding is consistent with that of Kiveak et al (2008), that work colleagues were deemed to be firms' most important knowledge sources. In addition, Kiveak et al (2008) suggest that current project documentation was also an important source of knowledge, but this was not mentioned

by the participants in this case study. Moreover, the survey results indicated that most of the actors in this ICJV project only considered face-to-face communication as a way to communicate. Another important finding was that the most important reasons for exchanging knowledge and experience in the project were found to be coaching and sharing knowledge followed by trust and their experience and their knowledge and experience. This corresponded with the study of Hajidimitriou and Rotsios (2009), in which they found that trust played an important role in a business alliance. Trust also led to a common understanding of the managerial staff in this ICJV project because trusted partners were cited as one of the sources of knowledge for them.

In terms of the KT methods and mechanisms, it was shown that most of the key actors used similar KT methods and mechanisms e.g. (S1) face-to-face communication and (S3) video or telephonic communication as tools to seek and share knowledge, as well as (E17) group meetings or team meetings. In contrast, the key actors preferred to use memoranda and letters as KT methods and mechanisms to share knowledge and experience between them as well as minutes of meetings and continuous meetings. According to Hajidimitriou and Rotsios (2009), this may be because personal contact and face-to-face communication facilitate a better understanding of the knowledge being transferred. They also suggest that meetings and visits play an important role in KT processes. Furthermore, the survey results indicated that the key actors in this ICJV project did not seek and share knowledge and experience in the area of training programmes. Surprisingly, they failed to mention that training and site visits were important methods in the KT processes. The reason for this may be that all of the key actors in this ICJV project had gained their knowledge and experience by visiting other projects of foreign partners before starting the project, but they appear not to have exchanged their knowledge and skills during those visits.

The KT methods and mechanisms that were most used to exchange knowledge and experience in this ICJV project is listed in Figure 6.10.



*Results from interviews with key actors

Figure 6.10 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-2A)

It was demonstrated in the last section that the transfer of knowledge was of the greatest advantage for ICJV Projects. The key findings of this ICJV project will be summarised in this section and the enabling and inhibiting factors that were found to influence knowledge transfer processes from the foreign to the local partner will be discussed. As a result, the key actors in this ICJV project were asked to define the main enabling and inhibiting factors that influenced their KT processes and some of their responses are presented below.

The Co-project manager of the local partner (L-Co-PM) defined the key enabling and inhibiting factors that influenced the KT processes in the ICJV project, as follows;

[...] "...our partner's staff seem to be quite open about their knowledge and willingness to share knowledge and our staff clearly value the opportunity to obtain expertise. Our top management support our staff to learn from our international partner. All their relevant expertise was collated and documented in this project for easy access.

[...] "The practice in ICJV has been highly influenced by our partner's experience and our local staff have adapted to work and learn from the foreign partner's' practice. The partner's staffs were comfortable fitting into the local industry driven by their desire to acquire local knowledge.

In terms of the performance and success factors of ICJV projects, the Co-project manager of the local partner (L-Co-PM) argued that:

[...] "...we tend to establish friendly relationships with our foreign partners, which enables us to access more valuable knowledge". However, he is also commented that;

[...] "...the organisational distance between partners was also found to have an impact on the success of knowledge transfer."

Moreover, the Quality Controller (L-QC) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "...the Construction Manager and myself (Quality Controller) reviewed the method of statement for a particular work and then made comments before delivering it to the team members." Moreover, he is also claimed that;

[...] "...because it was a JV project and also the largest pre-casting job ever undertaken, we clearly stated that we wanted to learn from them."

The data collection involved a number of interviews with key knowledge actors from this ICJV project using open-ended questions. The interviewees were briefed on the research background of the topic of the research. They were also briefed on the research's adopted framework for analysing knowledge transferring. In this ICJV project, key actors described the key enabling and inhibiting factors that influence KT processes in the ICJV project. They state that the openness and willingness to learning are considered as the main barriers to transfer knowledge between local staff and foreign staff as well as the partners' experience. Moreover, the key actors indicate that relationship and the organisational distance between partners considered as the most important indicators in ICJV Performance and Success factors of ICJV projects.

The analysis of the second ICJV Project in this case study is presented in the next section.

6.3.2 ICJV Project-2B

1) Background of Case

This ICJV project involved four partner firms; a German firm (F1) (the leader of this ICJV project) with a 35% share, a Local company (L) with a 25% share, a Japanese firm (F2) with a 20% share, and another Japanese firm (F3) with a % share. It entailed the construction of about 22km-long, twin bored, single track tunnels, 18 station boxes and cut-and-cover tunnels of the Chaloem Ratchamongkhon line of the Metropolitan Rapid Transit Authority (MRTA). The contract sum was 23.60 billion Thai Baht and it was completed in 2004. This was the first underground mass rapid transit project in Bangkok, Thailand, and it began on the 19th November 1996. Its stated objectives were to fulfil the client's wish for a local firm to be involved, to complement each partner's expertise, as well as to develop construction technology and expand the scope of engagement of the local company to become one of the most sophisticated construction contractors with advanced construction technology in Thailand. F1 was a European company based in Germany, which had developed from a construction firm into an international engineering and services group specialised in civil and industrial construction, engineering and services. The company serves two business sectors, namely, engineering and technologies with maintenance, modification and operations. F1 upholds the highest standards of safety and quality and spans five continents with operations in Europe, the United States, Africa, Australia and South East Asia, including Thailand. F2 was a Japanese construction company founded in 1898 and incorporated in 1938. It operates as a construction company in Japan and internationally. The company constructs roads and bridges, railway stations and tunnels, energy facilities, sewer and water projects, offices, residential buildings, hotels, government offices, hospitals, factories, educational facilities, exhibitions, skyscrapers, and airports. F2 took advantage of being an international business and sought work overseas, as both a construction company and a developer, using Built-Operate-Transfer (BOT) as a form of project financing to become one of the leading proponents of BOT in Southeast Asia, including Thailand. F3 was an expert in the construction business including railway engineering, building construction, infrastructure, and construction management. It was also involved in the construction business in overseas markets through its associate company.

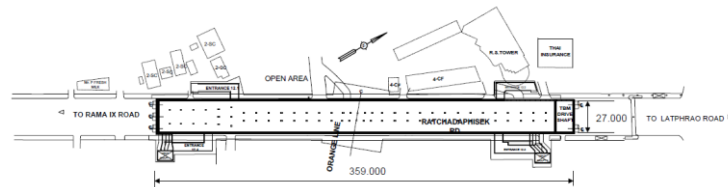


Figure 6.11 Overview of The Chaloem Ratchamongkhon line, the first underground Mass Rapid Transit (MRT) project in Bangkok, Thailand. (ICJV Project-2B)

2) Actors' Attributes

a) Gender, Age, and Nationality

All the participants in this case study (100.00%) were male. The managerial and professional staffs were from three different countries. 54.00% were Thais, 23.00% were German and 23.00% were Japanese (see Table 6.18). Moreover, the findings revealed that 38.00% of the participants were aged between 41 and 50, 31% between 51 and 60, and the remainder were more than 60 years old. Therefore, most of the respondents in this ICJV project could be said to be aged between 41 and 50.

Table 6.18 Nationality of research participants (ICJV Project-2A)

Nationality	B+B	CH.Karnchang	Kumagai	Tokyu	Total	%
Thai	0	6	0	1	7	54.00
German	3	0	0	0	3	23.00
Japanese	0	0	2	1	3	23.00
Grand Total	3	6	2	2	13	100.00

b) Educational Background and job position

The educational background and expertise of different stakeholders in various positions are shown in Table 6.19 from which it can be seen that 23% of them had a certificate/diploma and 77% had an undergraduate degree. Therefore, most of the respondents in this ICJV project described themselves as Co-Construction Managers.

Table 6.19 Cross Tabulation between educational background and job position (ICJV Project-2B)

Educational Background	Job position							Total
	Project Manager	Co-Project Manager	Construction/ Yard Manager	Co-Construction Manager	QA/QC Manager	Administrative Manager	QS Engineer/ Engineer	
Certificate/Diploma	0	1	0	1	1	0	0	3
Undergraduate	1	1	2	2	1	1	2	10
Postgraduate	-	-	-	-	-	-	-	0
Total	1	2	2	3	2	1	2	13

According to the cross tabulation in Table 6.19, most of the participants had graduated as undergraduates to hold the positions of Project Manager, Co-project Manager, Construction Manager/Earthwork Manager/Yard Manager, Co-construction Manager, QA/QC Manager, Administrative Manager, QS Engineer and Engineer in this project. However, it can be seen from the table that one of the Co-project managers, one Co-construction manager and one QA/QC Manager only had a certificate/diploma. Hence, it seems that their 'educational background' was not related to their 'job position' in this ICJV project.

c) Experience and primary discipline in a construction projects

Based on Table 6.20, the respondents in this case study had a range of 16-20 to >20 years' experience i.e. 16-20 years (46.15%) and >20 years (53.85%); therefore, most of them had >20 years' experience in the construction industry and ICJV projects. The majority of the respondents in this case study (69.25%) (e.g. Project Manager, QA Manager, Construction Manager, Co-Project Manager, Co-Construction Manager, Co-Site Manager, QS Engineer, QA/QC Manager and Administrative manager) had received construction training. This indicates that three out of 4 respondents lacked construction training and had not visited a foreign project (e.g. Co-Site Manager, Project engineer, Co-Project Manager and Engineer).

Table 6.20 Cross Tabulation between experience in construction and job position (ICJV Project-2B)

Educational Background	Job position							Total	%
	Project Manager	Co-Project Manager	Construction/ Yard Manager	Co-Construction Manager	QA/QC Manager	Administrative Manager	QS Engineer/ Engineer		
< 5	-	-	-	-	-	-	-	-	0.00
6-15	-	-	-	-	-	-	-	-	0.00
16-20	-	1	-	1	1	1	2	6	46.15
> 20	1	1	2	2	1	-	-	7	53.85
Total	1	2	2	3	2	1	2	13	100

It can be seen from Table 6.20 that different stakeholders were experienced in various fields and their experience ranged from 16-20 to >20 years. The cross-tabulation in Table 6.20 confirms that there was a strong relationship between their 'experience in construction' and their 'job position'. Most of the managerial staff in this case study had more than 20 years' experience in the construction industry, i.e. Project Manager, Co- project Manager, Construction Manager, Co- construction Manager and QA/QC Manager. Since the data for this case study was collected from an ICJV project: the underground mass rapid transit project, the discipline with the highest percentage in this project was Civil Engineering followed by Mechanical Engineering and Electrical Engineering, reflecting the knowledge, skills and experience required in a mass rapid transit project. It is assumed that the construction of an underground mass rapid

transit would require experience of construction in subsoil conditions, cast-in diaphragm walls, foundation barrettes, reinforcement, concrete casting and Installation of Stanchion in Barrettes. Hence, Civil Engineers were responsible for the installation of the underground mass rapid transit.

3) Social Network Characteristics

a) Size of the Network and Network Structure

This section contains the results of the social network analysis, i.e. the size of the network, network structure and network density. Since this project was completed 13 years ago, there were a limited number of respondents. As a result, the size of this network was 29 nodes, made up of 13 respondents and 16 other project participants named by them. The network boundary was defined as all the participants from the organisation chart of this project; as a result, there were 13 participants in this case study. The codes that denote their position, participant code and relationship to the network are presented in Figure 6.12 and Table 6.21.

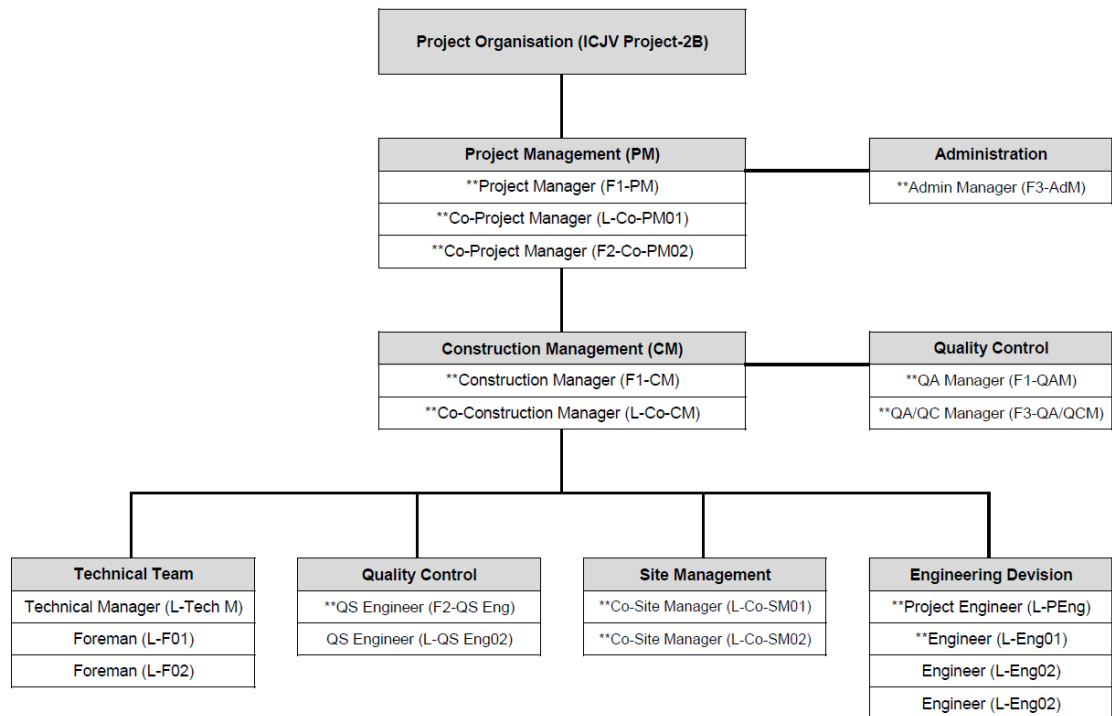


Figure 6.12 Job position of participants and their code (ICJV Project-2B)

Table 6.21 SNA internal restricted with a position (ICJV Project-2B)

Respondents	This person shares information with you	How often <u>do you seek</u> from this person?	You share information with this person	How often <u>do you share</u> knowledge with this person?
F1-PM	L-Co-PM01	1	F1-CM	3
			F1-Cost Eng	3
F1-QAM	F1-PM	1	L-Eng02	1
	F1-CM	3		
F1-CM	F1-PM	1	L-Eng02	1
	L-P Eng	3	L-Eng01	3
	L-Co-PM01	1	L-Eng03	3
L-Co-PM01	F1-QAM	1	Co-SM01	3
	F1-PM	1	F1-CM	1
			L-P Eng	3
L-Co-CM	L-Co-PM01	3	L-Co-SM01	3
			L-P Eng	3
			L-Co-SM02	3
L-Co-SM01	L-P Eng	3	L-P Eng	3
	F1-CM	3		
L-P Eng	L-Co-SM01	4	L-Eng02	3
	F1-CM	3		
L-Co-SM02	L-Co-PM01	1	L-PIM	3
	F1-CM	3	L-Eng04	3
	L-Co-SM01	3	L-Tech	4
	F2-QS Eng	3	L-F01	4
			L-F02	4
			L-Opt	4
L-Eng01	F1-CM	3	L-Pro Eng	3
	L-P Eng	3		
F2-Co-PM02	F3-GM	1	L-Tech M	5
	F3-QA/QCM	4	F3-AdM	5
	F2-QS Eng	5		
	F3-AdM	5		
F2-QS Eng	L-Co-PM01	3	L-QS Eng02	3
			L-QS	3
F3-QA/QCM	F3-GM	1	F2-Co-PM02	3
			F3-AdM	1
			F2-QS Eng	1
F3-AdM	L-Co-PM01	3	F2-Co-PM02	2
	F2-Co-PM02	1	F2-QS Eng	2
	L-Co-CM	1	L-QS Eng02	3
			L-PM01	2
			L-QSM01	1

F1 = German actors

F2 and F3 = Japanese actors

L = Local actors

The collaborative network, network structure and strength of the ties between nodes developed by the collected ICJV project-2B are shown in Figure 6.13 and the expertise of the different stakeholders in various positions in the collaborative network is shown in Figure 6.14. An arrow represents the existence of collaboration between two firms. The direction of the link is from the recipient to the knowledge source and the weight of the links between the nodes indicates the frequency with which knowledge was transferred between two actors. It can be seen that the stronger the tie is, the more often they exchanged knowledge.

Since the aim of this study is to identify and understand the knowledge transfer processes in ICJV Projects, the processes of transferring knowledge between the local and foreign partners in this ICJV project were identified. It was found that seven actors (from three foreign firms) participated in the collaborative network of this ICJV Project e.g. F1-CM, F1-QAM, F1-PM, F2-QS Eng, F2-Co-PM02, F3-QA/QCM and F3-AdM'; therefore, the KT methods and mechanisms of the KT processes and the knowledge flow between these actors and their local counterparts were examined.

As can be seen from Figure 6.15, there was a good connection between F2-QS Eng, F2-Co-PM02, and F3-AdM. F2-Co-PM02 and F3-AdM exchanged their knowledge and experience within this international project more than once a day. F2-Co-PM02 held a Co-project manager position and F3-AdM was an Administrative Manager. It could be said that, being well connected, they were a source of knowledge required to construct the underground mass rapid transit project.

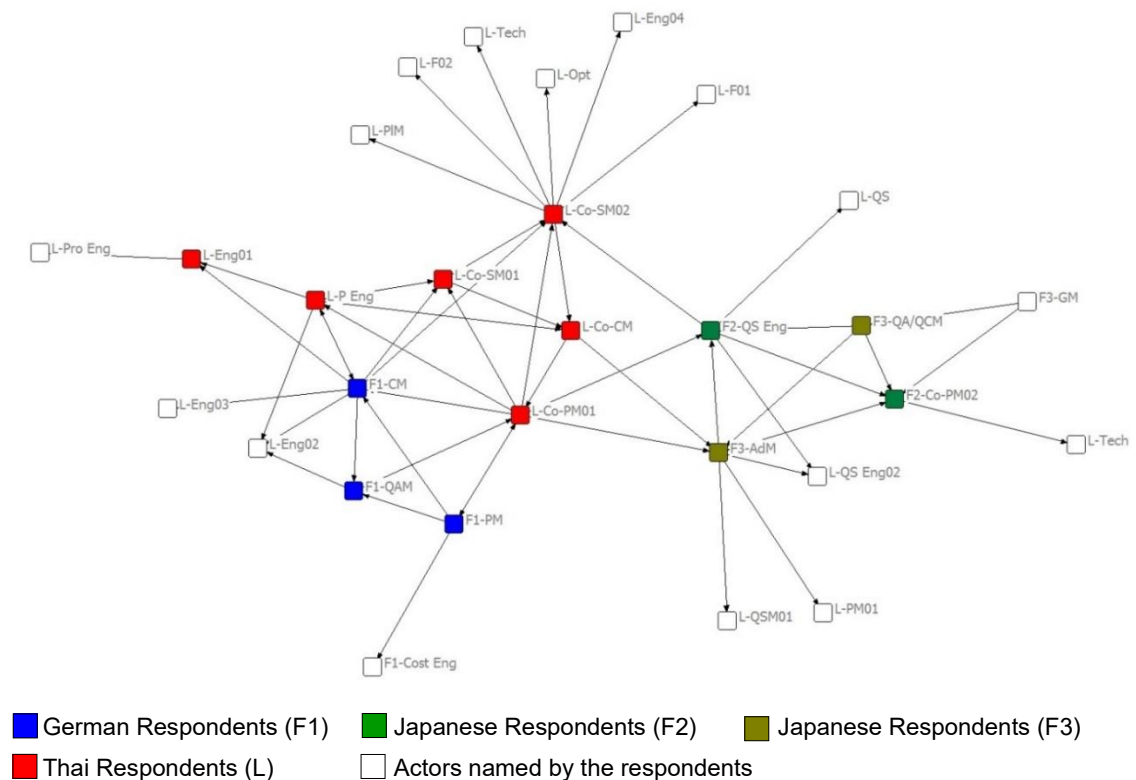


Figure 6.13 Sociogram showing knowledge sharing between actors and their nationality (ICJV Project-2B)

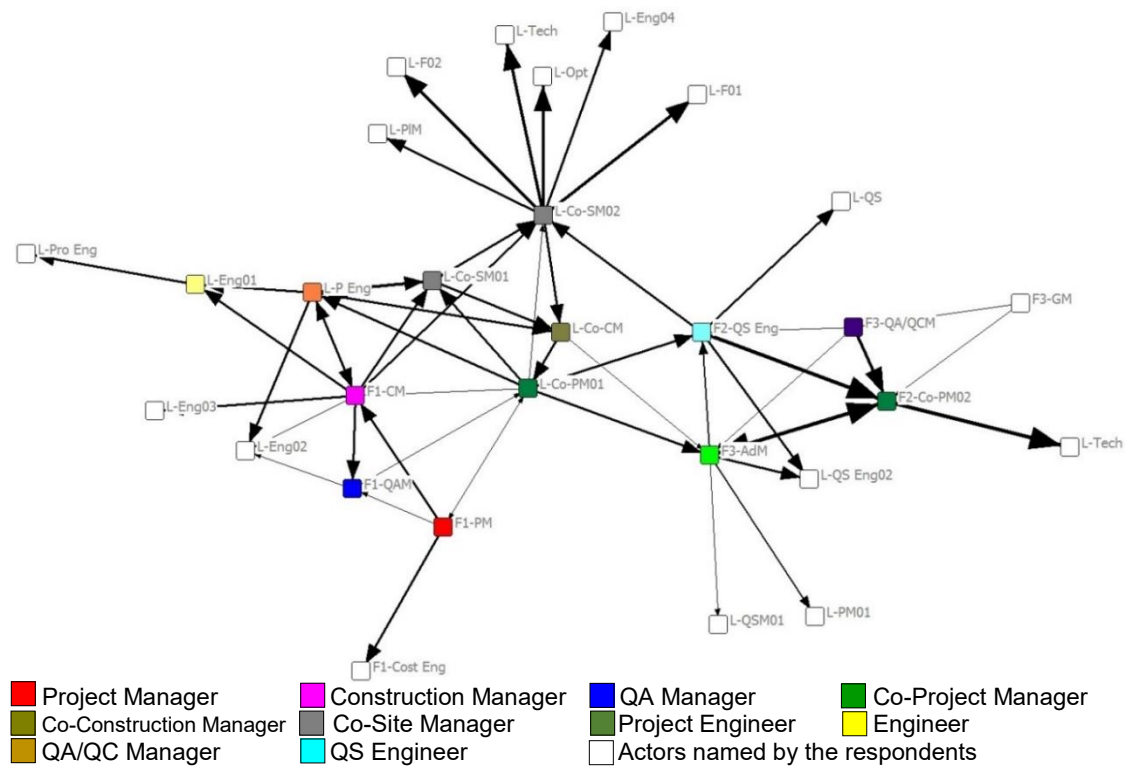


Figure 6.14 Sociogram showing knowledge sharing according to prior experience (ICJV Project-2B)

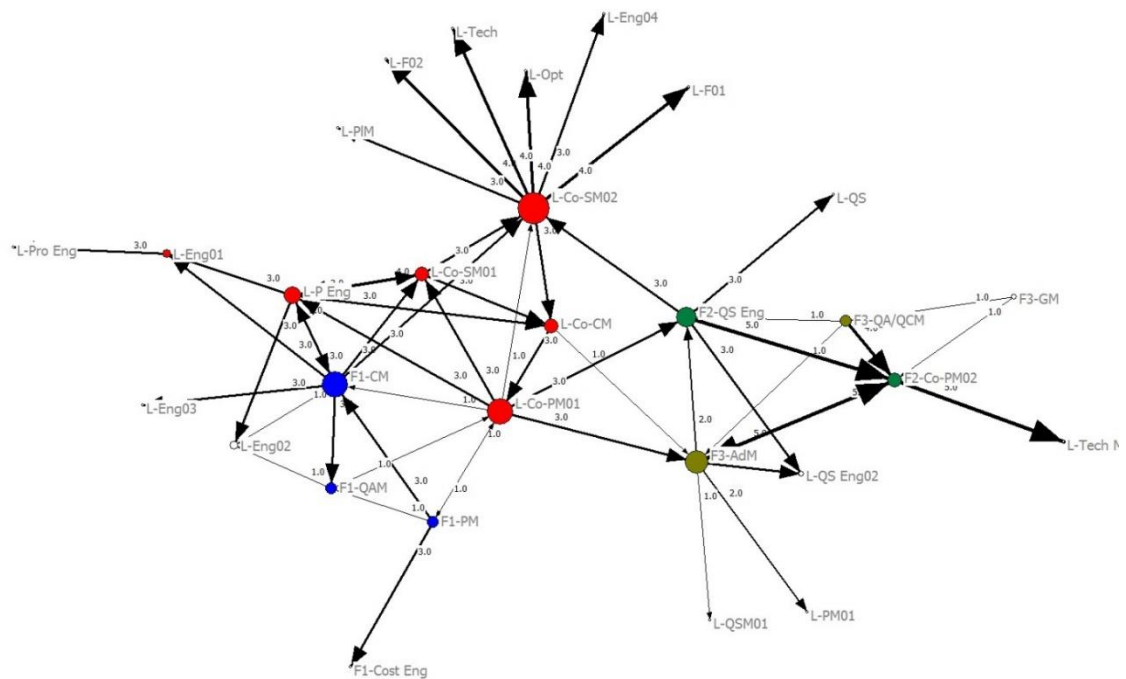


Figure 6.15 Sociogram showing network density (ICJV Project-2B)

It can be seen from the collaborative network in Figure 6.15 that most of the local staff and some of the foreign staff preferred to seek advice from L-Co-SM01 and L-Co-SM02, whereas F1-CM and F2-QS Eng were likely to ask L-Co-SM02 for advice rather than L-Co-SM01. It seems that L-Co-SM02 was highly engaged in KT between the partners. However, it is also indicated that F1-CM also acquired knowledge and experience from L-Co-SM01. This could indicate the existence of a good connection between partners in the international context.

Moreover, it is indicated in Figure 6.15 that Co-Construction Manager (L-Co-CM) was the focal point in this network; hence, it can be assumed that this network was organised around him. It can be assumed that whoever occupied the position of Co-Construction Manager was relied on to coordinate the construction process of this project with CM (Construction Manager of the partner). Another interesting point is that only some of the local actors asked for advice from him and he did not exchange his knowledge and experience with foreign partners. It seems that the success of the KT processes did not rely on the job position but the motivation to transfer the knowledge.

Based on the data gathered from the UCINET 6.0, the network density is 0.180 with a standard deviation of 0.739. Hence, 18% of the potential links exist between actors. Scott (2012) argues that the network density would be 1.00 (100%) if every actor in the team were connected. Since the network density was 0.180, which is a low value, it can be deduced that all the connections possible in this network were not made. It is rare for a node to have ties with the remaining actors. In a network of 29 nodes, the density in this network was rather small compared to that in ICJV Project-2A. Another interesting aspect of this network is that 18% of the potential links existed between the actors. Hence, it could be asserted that this was a sparse network in which it is rare for a node to have ties with the remaining actors.

However, it is important to analyse the centrality measures in this study in order to identify the key actor in the ICJV project who is more central and more strongly linked than others with regard to knowledge transfer. The results of the analysis of the centrality measures are provided in the next section. Additionally, it was vital to explore the flow of knowledge through this ICJV Project.

b) Degree of Centrality and Betweenness Centrality

The network map with different node sizes is shown in Figure 6.16. The node sizes are in accordance with the average degree of centrality of the actors. The larger nodes are the more central ones in terms of knowledge transfer within the team. The most central actors for out-degree and in-degree centrality are shown in Table 6.22 which illustrates the average degree of centrality. The in-degree and out-degree values of this case study are shown in Table 6.22.

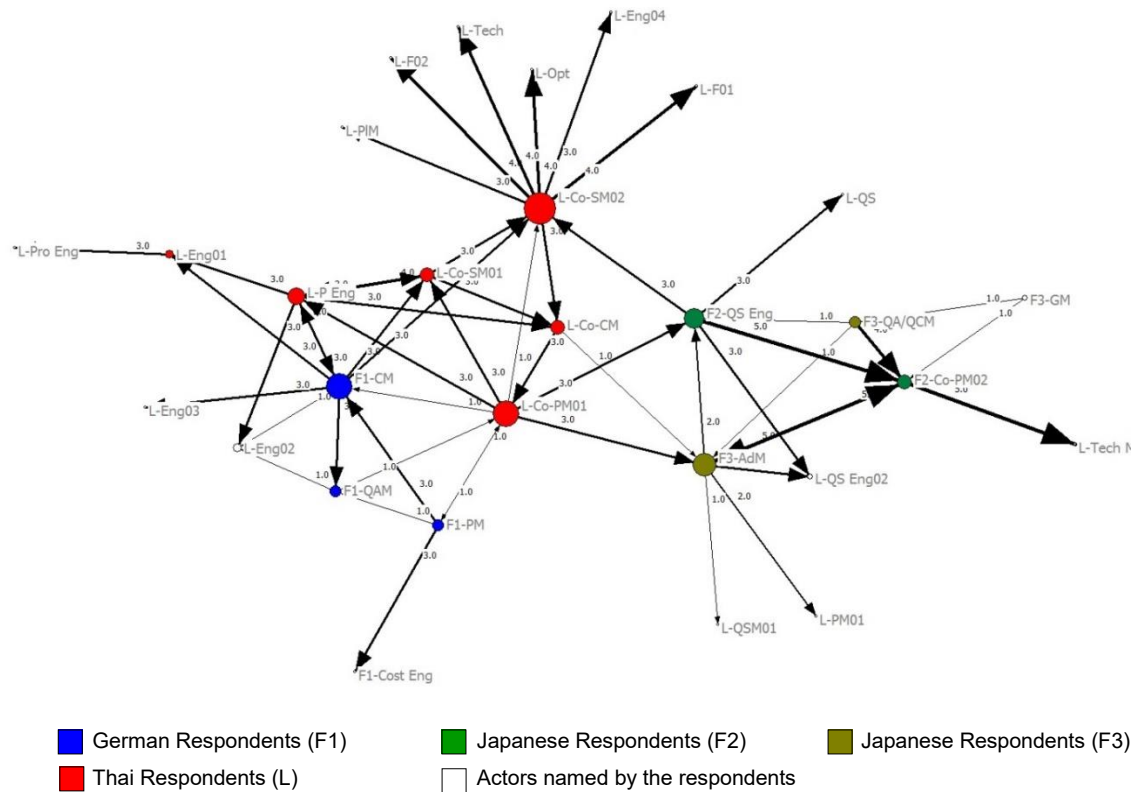


Figure 6.16 Knowledge transfer network (ICJV Project-2B)

Table 6.22 Degree of Centrality (ICJV Project-2B)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
L-Co-SM02	Co-Site Manager	> 20	51-60	25 (1)	10 (2)
F1-CM	Construction Manager	> 20	>60	19 (2)	7
L-P Eng	Project Engineer	15-20	41-50	15	10 (2)
L-Co-PM01	Co-Project Manager	> 20	>60	15	5
F2-QS Eng	QS Engineer	15-20	41-50	14	6
*F3-AdM	Administrative Manager	15-20	51-60	13	10 (2)
F2-Co-PM02	Co-Project Manager	> 20	41-50	10	15 (1)
L-Co-SM01	Co-Site Manager	15-20	51-60	10	9

Based on the data gathered in Table 6.22, it could be assumed that F2-Co-PM02 was a Co-Project Manager on this project and definitely the most central actor in this network with an in-degree centrality of 15. F2-Co-PM02's in-degree centrality was more than that of the next actors, who were L-Co-SM02, L-P Eng and F3-AdM and slightly more than twice of that of L-Co-SM01, F1-CM and F2-QS Eng. This difference classifies F2-Co-PM02 as a perceived expert who could answer any queries in the whole network, followed by L-Co-SM02, L-P Eng and F3-AdM. L-Co-SM02, who also had high in-degree centrality. L-Co-SM02 not only had high in-degree centrality but also high out-degree centrality. L-Co-SM02 had higher out-degree centrality than F1-CM, L-P Eng and L-Co-PM01 and more than twice that of F2-QS Eng, F2-Co-PM02 and L-Co-SM01. This difference classifies L-Co-SM02 as a knowledge consumer. Therefore, the results indicate that L-Co-SM02 was considered to be a knowledge broker in this project.

Table 6.23 Betweenness Centrality Measures (ICJV Project-2B)

Actor	Betweenness
L-Co-SM02	134.683
L-Co-PM01	127.950
L-Co-CM	100.050
F2-QS Eng	93.933
*F3-AdM	70.067
F1-CM	42.000

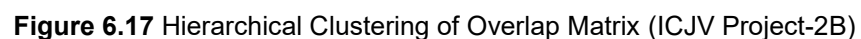
According to Table 6.23, L-Co-SM02 (Co-Site Manager) had the highest betweenness centrality score followed by L-Co-PM01 (Co-Project Manager of the local partner). This indicates that L-Co-SM02 (Co-Site Manager) was regarded as the main gatekeeper in this network. Similarly, L-Co-SM02 (Co-Site Manager) also had high in-degree and out-degree centrality values in the network. Hence, it may be asserted that L-Co-SM02 (Co-Site Manager) was not only an expert but was also regarded as a gatekeeper in this project. This finding corresponds with that of [Borgatti, Everett, and Johnson \(2013\)](#), who found that betweenness plays a gatekeeping role in this context. Nodes with high betweenness are in a position to filter information and threaten the network with the disruption of operations. The most likely explanation for this result is that L-Co-SM02 (Co-Site Manager) plays a broker role, since many nodes need him to reach other nodes via efficient paths. He has power because he can threaten to stop transmitting, forcing nodes to use less efficient paths to reach one another. It is notable that the actors in the position of L-Co-SM02 (Co-Site Manager) effectively discriminate between nodes and potentially correlate well with other nodes.

c) Network Cliques/Cluster Analysis

The results of the data analysis in Table 6.24, indicate that 14 clusters existed in this network, each of which consisted of three or more members, and Cliques 1, 3, 4, 5, 6, 7, 9, 10, 11, 13, and 14 contained a mixture of local and foreign members.

Table 6.24 Cluster Analysis (ICJV Project-2B)

N	Cluster
1*	F1-CM L-Co-PM01 L-Co-SM01 L-Co-SM02
2	L-Co-CM L-Co-PM01 L-Co-SM01 L-Co-SM02
3*	L-Co-PM01 L-Co-SM02 F2-QS Eng
4*	F3-AdM F2-Co-PM02 F3-QA/QCM F2-QS Eng
5*	F2-Co-PM02 F3-GM F3-QA/QCM
6*	F3-AdM F2-QS Eng L-QS Eng02
7*	F3-AdM L-Co-PM01 F2-QS Eng
8	F3-AdM L-Co-CM L-Co-PM01
9*	F1-CM L-Eng01 L-P Eng
10*	F1-CM L-Eng02 L-P Eng
11*	F1-CM L-Eng02 F1-QAM
12	L-Co-CM L-Co-PM01 L-Co-SM01 L-P Eng
13*	F1-CM L-Co-PM01 L-Co-SM01 L-P Eng
14*	F1-CM L-Co-PM01 F1-PM F1-QAM
* = Mixture of local and foreign partners	
= The most active cliques	



4) Relationships between Key Actors, Knowledge Transfer Methods, and Mechanisms, and Tie contents

The factors that underpinned the actors' roles and the relationship between the knowledge source and the receiver are further explored in this section, as well as why particular actors were chosen to seek and share knowledge in this ICJV project. The results were analysed using a content analysis and they are presented in Tables 6.25- 6.27.

Table 6.25 Knowledge Source and Receiver (ICJV Project-2B)

No	Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Boss	15	1	16	26.67
2	Partner	10	1	11	18.33
3	Boss and partner	0	0	0	0.00
4	Working colleague	1	16	17	28.33
5	Consultant	0	0	0	0.00
6	Supervisor	0	0	0	0.00
7	Subordinate	2	14	16	26.67
8	Father	0	0	0	0.00
	Total	28	32	60	100.00

Table 6.26 Communications between knowledge source and receiver (ICJV Project-2B)

No	Communications between Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	0	0	0	0.00
2	E-mail	6	0	6	9.52
3	Face-to-Face	17	15	32	50.79
4	Social Network	0	0	0	0.00
5	Telephone and F2F	5	20	25	39.68
6	E-mail and F2F	0	0	0	0.00
7	F2F and Social Network	0	0	0	0.00
8	All types of communication	0	0	0	0.00
	Total	28	35	63	100.00

Table 6.27 Why this person was chosen to seek and share knowledge (ICJV Project-2B)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Coaching and sharing knowledge	0	3	3	4.29
2	Decision making	2	0	2	2.86
3	He has potential to be reliable staff	0	1	1	1.43
4	He is a partner so he is really to know the local	5	0	5	7.14
5	He is expertise in QS	1	0	1	1.43
6	His experience and character	1	0	1	1.43
7	His position is my boss	2	0	2	2.86
8	Increasing the performance	0	1	1	1.43
9	Knowledgeable	1	0	1	1.43
10	Management policy	1	0	1	1.43
11	Need approval/ Need to agree together	3	0	3	4.29
12	Provide directions on how to manage the project	0	2	2	2.86
13	Responsibility	0	18	18	25.71
14	Sharing knowledge and experience	0	7	7	10.00
15	Their experiences/ Experiences	10	0	10	14.29
16	Their vision	5	0	5	7.14
17	Trust and their experience	7	0	7	10.00
	Total	38	32	70	100.00

It can be seen from Tables 6.25 to 6.27 that knowledge can be stored in many different repositories, depending on its type. The research participants provided details of the repository of 60 knowledge transfers, which can be seen in Table 6.25. The most common source and receiver of knowledge in this project with 17 counts (28.33%) was a work colleague, while the second most common was a boss with 16 counts (26.67%) and a subordinate with 16 counts (26.67%) followed by a partner with 11 counts (18.33%). Most of the participants stated that they considered colleagues to be reliable sources of knowledge and this correlates well with the research of Kivrak et al. (2008), who found that colleagues were the most important source of knowledge for firms. Moreover, it is indicated in Table 26.6 that face-to-Face communication (50.79%) was the most essential way for the actors in this project to communicate with each other, followed by telephone and face-to-Face communication (39.68%) and e-mail (9.52%) respectively. Additionally, the most important reasons for receiving and sharing knowledge and experience was found to be responsibility (25.71%), followed by their knowledge and experience (14.19%), sharing knowledge and experience (10.00%), trust and their experience (10.00%), he is a local partner so he really knows the local conditions (7.14%), and their vision (7.14%) (See more details in Table 6.27). This may be due to the fact that responsibility was the real reason or that the participants thought that they were more likely to capture and convert tacit knowledge to explicit knowledge by any kind of knowledge and experience, especially the knowledge and experience of a partner as a source of knowledge for the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within the project.

b) Knowledge Transfer Methods and Mechanisms

The methods and mechanisms used for each KT identified by the participants in this case study were shown in Figure 6.18, from which it can be seen that (S1) face-to-face communication was generally used by most of the participants as a mechanism to acquire knowledge of ICJV projects. This was followed by (E17) group meetings/team meetings, (I1) learning-by-doing/workshops/ apprenticeships, (E1) brainstorming, (E19) regular meetings and continuous meetings and (C1) best practice. In terms of sharing knowledge, the methods most used in this ICJV project were (S1) face-to-face communication, followed by (E1) brainstorming, (E17) group meetings/team meetings, (S2) socialising out-of-hours, (E19) regular meetings and continuous meetings and (C1) best practice. These findings show that the majority of the participants preferred to use (S1) face-to-face communication, (E1) brainstorming, (E17) group meetings/team meetings, (E19) regular meetings and continuous meetings (C1) best practice, and (I1) learning-by-doing/workshops/apprenticeships to exchange their knowledge and skills. Only some of the participants in this project preferred to use (S2) socialising out-of-hours to share their knowledge and experience. The type of knowledge flow between actors is presented in the next section.

c) Tie Characteristics and Tie Contents

The tie contents between actors in the KT processes when seeking and sharing knowledge in this ICJV project are shown in Figure 6.19. According to the results of the survey, management expertise was the most important knowledge exchanged among actors. The second most common types of knowledge exchanged were local conditions and culture, followed by economic, marketing and financial expertise, technical expertise and construction resources. In contrast, actors rarely exchanged knowledge and experience of quality assurance and control expertise, safety expertise, training programmes and design knowledge and skills. Moreover, the types of knowledge mainly exchanged within this ICJV project are shown in Figure 6.19. The practitioners in this case study considered project management (C1) to be important knowledge for which they needed advice, followed by project planning and control (C2), project resource management (C3), procurement system (C6) and employment of subcontractors in an international project (C8). Conversely, the participants were likely to share their knowledge of the procurement system (C6), construction techniques (B1), and the transfer and movement of materials and manpower or equipment manufacturing capacity (B4). These findings show that several participants in this ICJV project preferred to discuss and exchange knowledge of the procurement system (C6). It seems that there was no knowledge of quality assurance and control expertise and safety expertise in this ICJV project.

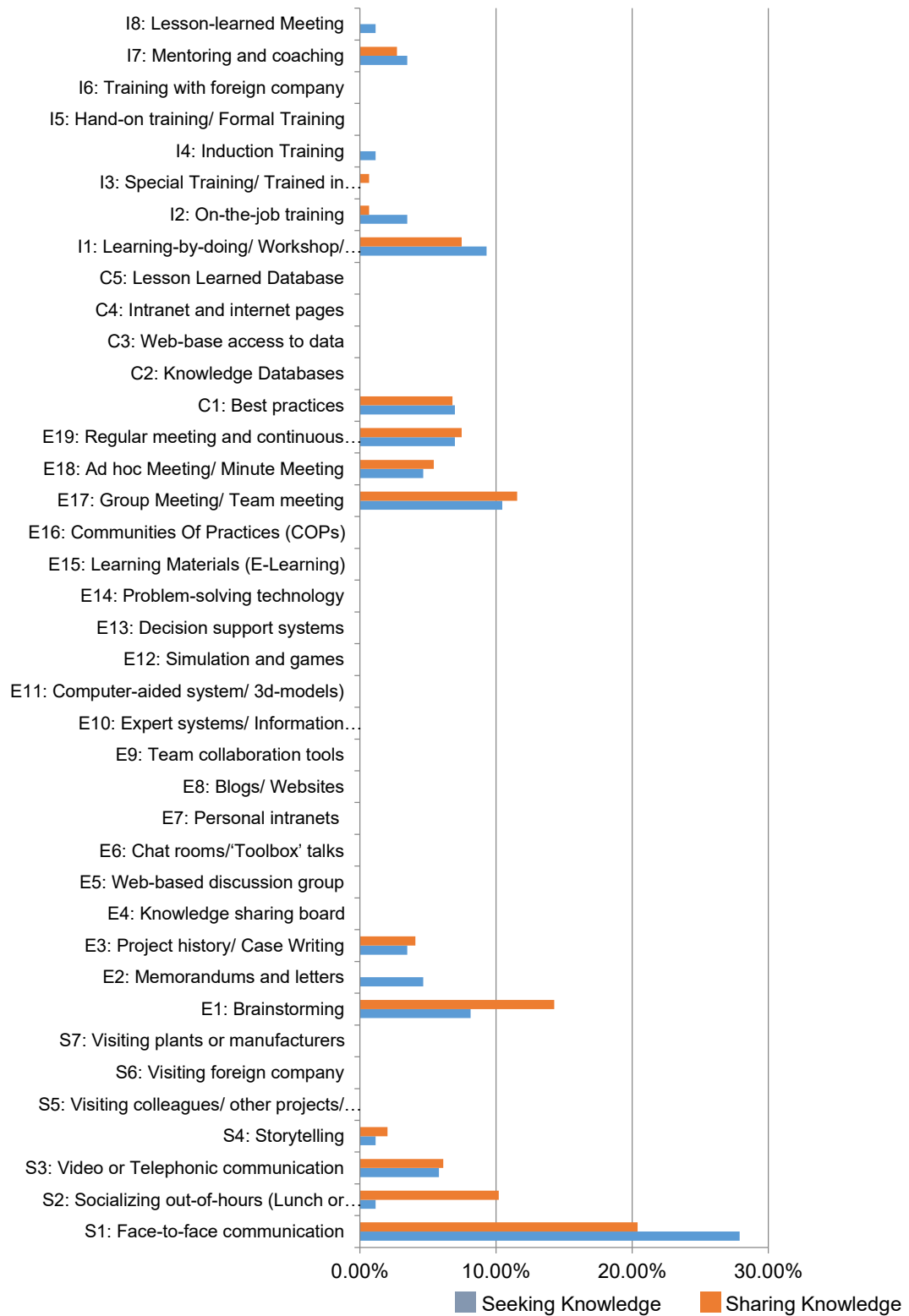


Figure 6.18 KT Methods and Mechanisms when seeking and sharing knowledge (ICJV Project-2B)



Figure 6.19 Tie contents of Knowledge Transfer when seeking and receiving knowledge (ICJV Project-2B)

The relationship between the attributes and social networking characteristics of the key actors in this ICJV project is indicated in Table 6.28.

Table 6.28 SNA between key actors (ICJV Project-2B)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gatekeeper	Focal point	Co-membership
F2-Co-PM02	Co-Project Manager	X(1)					
L-Co-SM02	Co-Site Manager	X(2)	X(1)	X	X(1)		
L-P Eng	Project Engineer	X(2)					X(2)
*F3-AdM	Administrative Manager	X(2)					X(2)
L-Co-SM01	Co-Site Manager						X
F1-CM	Construction Manager		X(2)				X(2)
F2-QS Eng	QS Engineer						X(2)
L-Co-PM01	Co-Project Manager				X(2)		X
L-Co-CM	Co-Construction Manager				X(3)	X	

Table 6.29 Knowledge sharing between key actors (ICJV Project-2B)

Actors		F2-Co-PM02	L-Co-SM02	L-P Eng	*F3-AdM	L-Co-PM01	L-Co-CM	F2-QS Eng	L-Co-SM01
F2-Co-PM02	Received				X			X	
	Shared				X				
L-Co-SM02	Received					X		X	X
	Shared								
L-P Eng	Received								X
	Shared								
*F3-AdM	Received	X				X	X		
	Shared	X						X	
L-Co-PM01	Received								
	Shared			X					X
L-Co-CM	Received					X			
	Shared		X	X					
F2-QS Eng	Received	X							
	Shared								
L-Co-SM01	Received			X					
	Shared			X					

F = Foreign actor
(F3)

L = Local actor

* Thai actor who has been employed by a foreign partner

According to Table 6.29, most of the key actors usually exchanged knowledge and experience. L-Co-SM02 (Co-Construction Manager) was perceived to be an expert and knowledge consumer, but he did not share his knowledge and experience with other key actors. This may be because he preferred to ask their advice rather than share his knowledge and experience with them.

Table 6.30 Knowledge exchanged between key actors (ICJV Project-2B)

Actors	Position	Received			
		From	Relationship	How often	Why
F2-Co-PM02	Co-Project Manager	*F3-AdM	Subordinate	More than once a day	His experience and character
		F2-QS Eng	Subordinate	More than once a day	His expertise in QS
L-Co-SM02	Co-Site Manager	L-Co-PM01	Boss	Less than once a week	Trust and their experience
		F2-QS Eng	Subordinate	Less than once a week	Need approval
		L-Co-SM01	Colleague	Less than once a week	Need approval
L-P Eng	Project engineer	L-Co-SM01	Boss	Once a day	Trust
*F3-AdM	Administrative Manager	F2-Co-PM02	Boss	Less than once a week	Trust and their experience
		L-Co-PM01	Boss	More than once a week	Trust and their experience
		L-Co-CM	Boss	Less than once a week	Trust and their experience
L-Co-CM	Co-Construction Manager	L-Co-PM01	Boss	More than once a week	Decision Making and Management policy
F2-QS Eng	QS Engineer	F2-Co-PM02	Boss	More than once a week	Trust
L-Co-SM01	Co-Site Manager	L-P Eng	Colleague	More than once a week	Trust

Actors	Position	Shared			
		To	Relationship	How often	Why
F2-Co-PM02	Co-Project Manager	*F3-AdM	Subordinate	More than once a day	Responsibility
*F3-AdM	Administrative Manager	F2-Co-PM02	Boss	Once a week	Responsibility
		F2-QS Eng	Colleague	More than once a week	Responsibility
L-Co-PM01	Co-Project Manager	L-P Eng	Subordinate	More than once a week	Coaching and sharing knowledge
		L-Co-SM01	Subordinate	More than once a week	Coaching and sharing knowledge
L-Co-CM	Co-Construction Manager	L-Co-SM02	Subordinate	More than once a week	Responsibility
		L-P Eng	Subordinate	More than once a week	Responsibility
L-Co-SM01	Co-Site Manager	L-P Eng	Colleague	More than once a week	Provide directions on how to manage the project

Having examined the data about the perceived experts in this project in the previous section, it was considered to be important to examine the KT methods and mechanisms, as well as the type of knowledge exchanged between these key actors. Therefore, the KT methods and mechanisms and knowledge flow between the key actors in this ICJV project are shown in Tables 6.31 and 6.32.

Table 6.31 KT methods and mechanisms and tie contents received between key actors (ICJV Project-2B)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F2-Co-PM02	F2-QS Eng	S1	E19				B4	C6 C7 C8							
	*F3-AdM	S1	E17										H4		J1 J3 J4 J5 J7 J8 J9 J11
L-Co-SM02	L-Co-PM01	S1	E1	C1	I1			C1 C4 C5							
	L-Co-SM01	S1	E1		I1			C1							
	F2-QS Eng	S1			I1		B4	C6 C7 C8							
L-P Eng	L-Co-SM01	S1						C1							
*F3-AdM	F2-Co-PM02	S1	E3	C1	I1 I2	A1	B1	C1 C2 C6			F1	G1			
	L-Co-PM01	S1	E1 E3 E17	C1	I1 I8		B1	C1	D1						
	L-Co-CM	S1	E3	C1	I1 I2		B1		D1						
L-Co-CM	L-Co-PM01	S4	E1 E6 E17 E18	C1	I4 I7	A1	B1	C1 C2 C3 C4 C5 C8	D1				H1		
F2-QS Eng	F2-Co-PM02	S1	E2 E17 E18 E19		I1 I2		B2 B4	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11				G1			
L-Co-SM01	L-P Eng	S1	E2					C1							

Table 6.32 KT methods and mechanisms and tie contents shared between key actors (ICJV Project-2B)

Actors	Shared from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F2-Co-PM02	*F3-AdM	S1	E19							E2					J7 J9
*F3-AdM	F2-Co-PM02	S1 S2	E1 E3	C1	I1 I2			C4							J3 J5 J6 J8 J9
	F2-QS Eng	S1 S2	E1 E3	C1	I1			C1 C10							J1 J4 J6
L-Co-PM01	L-Co-SM01	S1 S3	E17 E18 E19				B1 B2 B3 B4 B5	C11							
	L-P Eng	S1 S3	E17 E18 E19				B1 B2 B3 B4 B5	C11							
L-Co-CM	L-Co-SM01	S1 S2 S3	E6 E17			A2	B1	C6			F1				
	L-P Eng	S1 S2 S3	E6 E17				B1 B2 B3 B4 B5	C11							
L-Co-SM01	L-P Eng		E1			A1 A2	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11	D1 D2 D3 D4 D5	E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11					

F = Foreign actor L = Local actor * Thai actor who has been employed by a foreign partner (F3)

The KT methods and mechanisms and type of knowledge that influenced the KT processes of the key actors in this ICJV project are indicated in Tables 6.31 and 6.32. These findings show the KT methods and mechanisms and tie contents that were considered to influence the KT processes in this ICJV. In terms of the KT methods and mechanisms, most of the key actors in this ICJV project preferred to use (S1) face-to-face communication, followed by (I1) learning-by-doing, (E17) group meetings/team meetings, (E1) brainstorming, and (C1) best practice. However, some of the key actors were more likely to use (S2) socialising out-of-hours (lunch or coffee breaks), (S3) Telephonic communication, (E3) project history/case writing,

(E19) regular meetings and continuous meetings, (E18) minutes of meetings and (I2) on-the-job training as KT methods and mechanisms to seek advice and share their knowledge. On the other hand, L-Co-CM preferred to use (I7) mentoring and coaching and F3-AdM preferred to use (I8) lesson-learned meetings as KT methods and mechanisms.

The choice of KT methods and mechanisms further indicates the tie contents to help to develop the conceptual framework. This argument is also supported by the following statement made by LC-Co-SM02, the Co-site manager, who was perceived to be an expert, knowledge consumer, knowledge broker and gatekeeper for enhancing the KT processes in this project;

[...] ‘we usually discussed issues by e-mail, face-to-face communication and meetings. Most of the foreign partners in the project used e-mail as a communication tool because it is easy to check when an e-mail has been delivered. We usually discussed the operational progress in weekly meetings and monthly meetings and then wrote a performance report.

Moreover, F3-AdM made the following comments;

[...] there are many types of knowledge transfer methods and mechanisms that help and are needed for ICJV projects, such as on the job training, learning by doing, F2F communication, training received from foreign suppliers, in-house training, general meetings and visiting the’ factory or manufacturer of the supplier.

[...] Visiting other projects or companies is a good idea to up-skill staff involved in ICJV projects. However, we have not done it yet. It might be possible to see the high technology of the construction project but it involves a high cost. We sometimes learn from the other projects of other contractors in Thailand. We can currently learn more construction knowledge and skills from the Internet.

[...] In some cases, we discuss issues with the patentee (knowledge holder) from suppliers’ companies in order to obtain their know-how such as Radar-Track work. However, if we need to obtain more knowledge and skills that our foreign partners do not have, they act as coordinators and contact their companies in Germany and Japan to share them.

In terms of the type of knowledge, the research results indicated that the key actors mainly discussed (C1) project management and (B1) construction techniques. These were followed by (B4) transfer and movement of materials and manpower or equipment manufacturing capacity, (C6) procurement system, (B2) construction knowledge, (C4) human resource management and development, (C8) employment of subcontractors in international projects and (C11) cost management. It seems that most of the key actors were likely to have exchanged knowledge of (B) technical expertise and (C) management expertise from each other, especially in terms of (C1) project management and (B1) construction techniques. However, some of them rarely shared knowledge of (D) technological expertise and (E) economics, marketing and financial expertise. Moreover, the results indicated that the key actors in this project did not discuss (F2) quality standards, (H2) construction equipment (such as Increasing equipment, materials or equipment manufacturing techniques and capacities), (H3) labour productivity, (H5) comprehensive support facilities, (I) training programmes, (J2) local language and (J10) knowledge of local conditions.

The choice of this type of knowledge further indicated the tie contents to be used in the development of the conceptual framework. This argument was supported by the following statements of LC-Co-SM02, the Co-site manager;

[...] “we have been working together for 20-30 years. Our goal is to acquire as much technical knowledge from them as possible. This project involves a kind of construction that has not been done in Thailand before. Moreover, our company has never been involved in this kind of project, including the design knowledge and skills. Therefore, we only focused on the policy and management of this ICJV construction project”

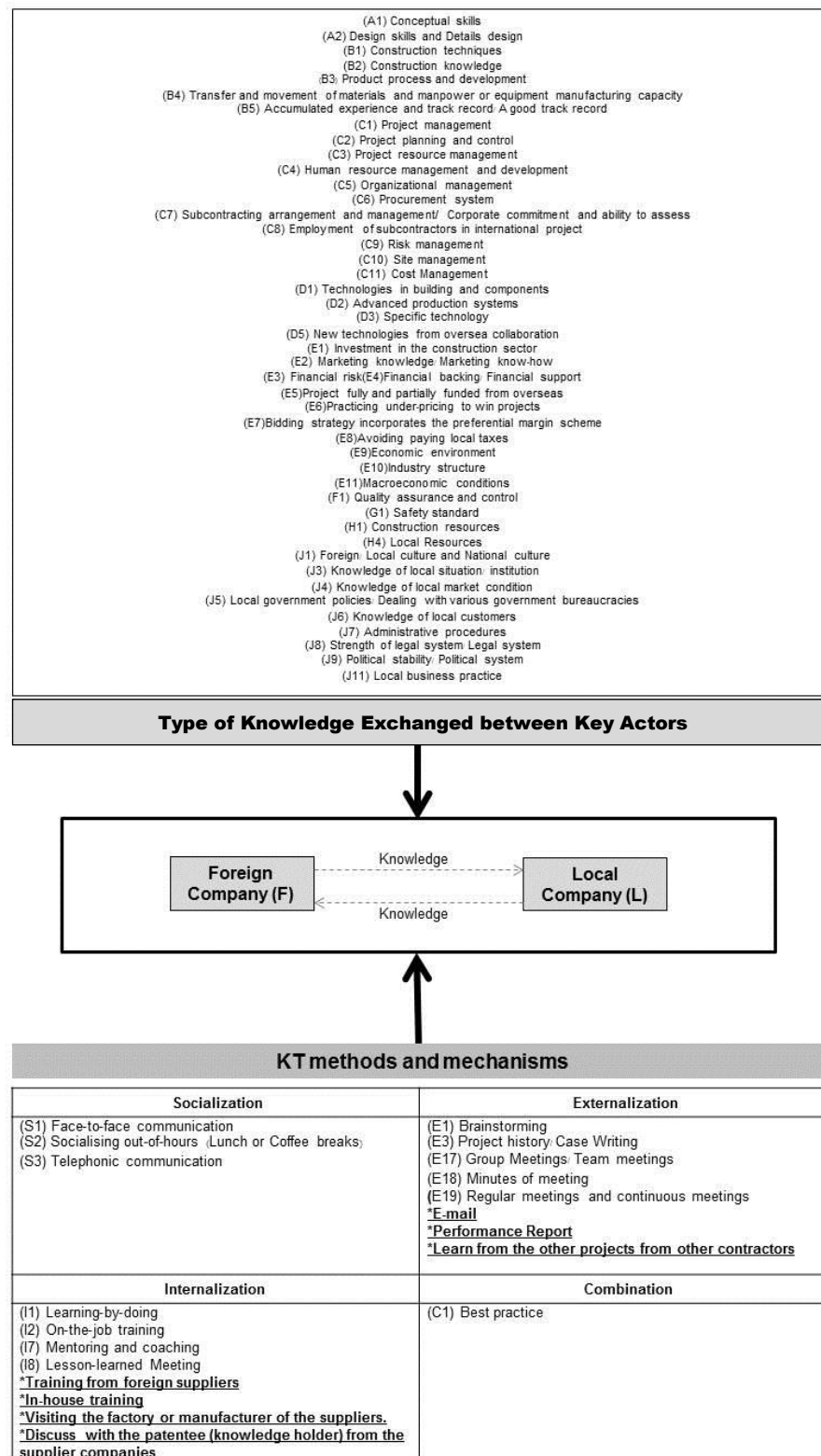
[...] In terms of knowledge transfer, we usually discussed the technical terms, the commercial and or marketing aspects of how to obtain new projects and work together, both inside Thailand and abroad. Moreover, we talked about the type of JV agreement and the percentage of holding”

[...] In this ICJV project, we mainly discussed and shared knowledge and experience of previous case studies in Germany and Japan. Both Thai and foreign suppliers provided more external knowledge and information than other sources. Furthermore, we asked them for more information on how this system had been used in Germany and Japan in order to find an alternative solution and make a decision to select the materials, the system and suppliers for the project”

Moreover, LC-Co-PM02 (Co-Project Manager) made the following statement;

[...] “ It is very good to transfer and share the knowledge and potential of actors in an ICJV project in order to find a good solution and make a decision. ICJV projects are a way to collaborate and acquire the solution together. Moreover, most foreign actors have a good system of thinking and management, which our local staffs, was able to learn from them.

The KT methods and mechanisms most used to exchange knowledge and experience in this ICJV project are shown in Figure 6.20.



*Results from interviews with key actors

Figure 6.20 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-2B)

The significance of the transfer of knowledge for ICJV Projects was illustrated in the last section. This section contains a summary of the key findings of this ICJV project and a discussion of the enabling and inhibiting factors found to influence knowledge transfer processes from a foreign to a local partner this ICJV project, as defined by the key actors during the interviews.

The Co-project manager of the foreign partner (F2-Co-PM02) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "Both partners emphasised the importance of properly documenting the work and ensuring that the staff were aware of how to access these documents. We were open to sharing knowledge with the local partner so that the staff could learn the way of doing things and any special technology"

Moreover, he is also claimed that;

[...] " The top management of the local partner cultivated a learning culture to encourage its staff to learn. This contributed to better cultural compatibility within the JV."

In terms of the performance and success factors of ICJV projects, the Co-project manager of the foreign partner (F2-Co-PM02) argued that:

[...] "...the different learning cultures, as well as different languages, made any initiative to share knowledge between the different members of the JV very difficult"

Moreover, the Project Engineer (L-P Eng) described the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "Language is a big problem between the parties from a foreign and local partner in an ICJV project. We have been working together for 20-30 years so we know how to work together. The Thai and Japanese cultures seem to be similar. However, we still have different corporate cultures. Japan's is highly disciplined and more serious than Thailand's. We have absorbed the Japanese way of working, but there are environmental differences. Japanese staffs are much more flexible than Thai staff.

In terms of the performance and success factors of ICJV projects, the Project Engineer (L-P Eng) argued that:

[...] " the characteristics of knowledge being transferred from a foreign partners affect the ease and success of the knowledge transfer. Some technical knowledge is so complicated".

He also claimed that;

[...] HR management is the most important factor of a successful JV. A mutual understanding of teamwork is very important to the success of a JV agreement. The agreement of the top management of each partner is the most important factor of a good relationship, friendship, and sincerity between the actors in the project.

Moreover, he is also indicated that the key success factors of ICJV projects were; Profit, Cost Saving, Time, Quality, Aesthetic, Leadership of both parties. In addition, he asserted that;

[...] "The top management of both parties must feel that we are the same company. Leaders need to see their staffs' potential. The Japanese exerted pressure to improve productivity, but it didn't work with the Thai staff. Encouraging them would have been better."

Moreover, the Administrative Manager (F3-AdM) described the key enabling and inhibiting factors that influence KT processes in the ICJV, as follows;

[...] "The Construction Manager of a local firm acknowledged the opportunity of learning from our firm and emphasised the value of learning practices to manage a project at times of crisis and in emergencies. It is also essential to create a learning culture in international projects."

Moreover, he is also claimed that;

[...] " Individuals' intention to learn is an important factor of the transfer of knowledge, as well as, motivation."

Therefore, motivation was identified as an important factor that facilitated the transfer of knowledge between partners. He also highlighted that the establishment of a motivational work environment during ICJV projects was essential. Team members needed to be self-motivated and find ways to learn and acquire knowledge.

The data was collected during a number of interviews with the key knowledge actors of this ICJV project using open-ended questions. The interviewees were briefed about the background of the research topic as well as the framework used to analyse the knowledge transfer processes and they described the main enabling and inhibiting factors that influenced the KT processes in this ICJV project. It seemed that language was a huge problem in an ICJV project with foreign and local partners. Therefore, language was considered to be the main barrier to transferring knowledge between local and foreign staff, as well as their openness and willingness to share knowledge. Moreover, the key actors indicated that the agreement of the top management of each partner was the most important factor of a good relationship, friendship and sincerity between the actors in the project. As a result, the top management of both parties must feel that they are the same company and they need to see the potential of their staff. Encouragement was declared to be a better way to deal with Thai staff than exerting pressure, which worked for Japanese staff.

The results of the analysis of the third ICJV Project in this case study are presents in the next section.

6.3.3 ICJV Project-2C

1) Background of Case

This ICJV project was undertaken by a Local Company (L) with a 75% share (the leader of this project), and a Japanese firm (F) with a 25% share. This project involved the construction of the Purple Line of the mass rapid transit railway between Bang Sue and Bang Yai in the Bangkok Metropolitan Area. It began in October 2007 and the contract sum was 241,198 million Japanese yen. The contract was completed in 2014. The aim of this project was to mitigate the traffic congestion in the Bangkok Metropolitan Area by constructing a new mass transit railway line, thereby contributing to urban economic development and environmental improvement. A Japanese ODA loan financed the civil works, including the elevated structure, stations, depot, park and ride buildings and consultancy services (including the construction supervision and environmental management planning) which involved the construction of about 23 km-long track. The stated objectives of this ICJV were to combine the resources and expertise of the partners and to create a JV with specialised technology to acquire knowledge of the construction of the mass rapid transit railway.

Local Company (L), which was incorporated as a limited company on the 27th November 1972 to engage in general construction in Thailand, entered into a joint venture business with Foreign Company (F), one of Japan's top ten construction contractors to learn construction technology and enlarge its business alliance in 1981. Foreign Company (F) is a leading Japanese company with expertise in construction, including railway engineering, building construction, infrastructure and construction management. Foreign Company (F) operates in many countries across the world, including the United States and Australia, as well as in Asian Countries like Thailand.



Figure 6.21 Overview of the construction works of (ICJV Project-2C).

2) Actors' Attributes

a) Gender, Age, and Nationality

91.67% of the participants in this case study were male and 8.33% were female. Managerial and professional staff from three different countries participated in this study. 58.34% were Thais, 3.33% were Filipino and 33.33% were Japanese (see Table 6.33). Moreover, the findings revealed that 50% of the participants were aged between 31 and 40, 33.33% between 41 and 50, 8.33% between 51 and 60 and the remainder were more than 60 years old. Therefore, it could be said that most of the respondents in this ICJV project were aged between 31 and 40.

Table 6.33 Nationality of research participants (ICJV Project-2C)

Nationality	Local Company (L)	Foreign Company (F)	Total	%
Thai	7	0	7	58.34
Filipino	0	1	1	3.33
Japanese	0	4	4	33.33
Grand Total	7	5	12	100.00

b) Educational Background and job position

The educational background and the different stakeholders' expertise in various positions are shown in Table 6.34. The educational background of the participants fluctuated with 17% of them having a certificate, 17% having a postgraduate degree and 66% an undergraduate degree. Therefore, most of the respondents in this ICJV project described themselves as Construction Managers and QS Engineers.

Table 6.34 Cross Tabulation between educational background and job position (ICJV Project-2C)

Educational Background	Job position							Total	%
	Director/ General Manager	Construction Manager/ Co - Construction Manager	Earthwork Manager/ Yard Manager	QA/QC Manager	Technical Advisor	Administrative Manager	QS Engineer/ Engineer		
Certificate/Diploma	-	1	-	-	1	-	-	2	17.00
Undergraduate	1	2	1	1	-	1	2	8	66.00
Postgraduate	1	-	-	-	-	-	1	2	17.00
Total	2	3	1	1	1	1	3	12	100.00

The cross tabulation in Table 6.34 shows that most of the participants were undergraduates and held positions such as Managing Director, General Manager, Construction Manager, Co-construction Manager, Earthwork Manager/Yard Manager, Administrative Manager, QS Engineers and Engineers. Moreover, one Co-construction manager and one Technical Advisor had a certificate/diploma, while one General Manager and one QS Engineer had a postgraduate degree. Therefore, it seems that their 'educational background' was not related to their 'job position' in this ICJV project.

c) Experience and primary discipline in construction projects

According to Table 6.35, the respondents in this case study had a range of <5 to >20 years of experience i.e. 16-20 years (41.66%), >20 years (33.34%) and 6-15 years (25%). Therefore, it could be said that most of them had 16-20 years' experience in the construction industry and ICJV projects.

Table 6.35 Cross Tabulation between experience in construction and job position (ICJV Project-2C)

Educational Background	Job position							Total	%
	Director/ General Manager	Construction Manager/ Co - Construction Manager	Earthwork Manager/ Yard Manager	QA/QC Manager	Technical Advisor	Administrative Manager	QS Engineer/ Engineer		
< 5	-	-	-	-	-	-	-	0	0.00
6-15	-	-	1	-	1	-	1	3	25.00
16-20	-	2	-	1	-	1	1	5	41.66
> 20	2	1	-	-	-	-	1	4	33.34
Total	2	3	1	1	1	1	3	12	100.00

Based on Table 6.35, different stakeholders were experienced in various fields and had experience ranging from 6-15 years to >20 years. The cross-tabulation in Table 6.34 confirms that there was a strong relationship between 'experience in construction' and 'job position'. It can be seen that most of the managerial staff in this case study i.e. Construction Manager, Co-Construction Manager, QA/QC Manager and Administration Manager had 16-20 years' experience in the construction industry.

3) Social Network Characteristics

a) Size of the Network, Network Structure, and Network Density

This section contains the results of the social network analysis, i.e. the size and structure of the network and the network density. This network consisted of 27 nodes, made up of 12 respondents and 15 other project participants who were named by them. The network boundary is defined as all the participants from the organisation chart of this project ;as a result, there were 12 participants in this case study. The codes that denote their position, participant code and relationship to the network are presented in Figure 6.22 and Table 6.36.

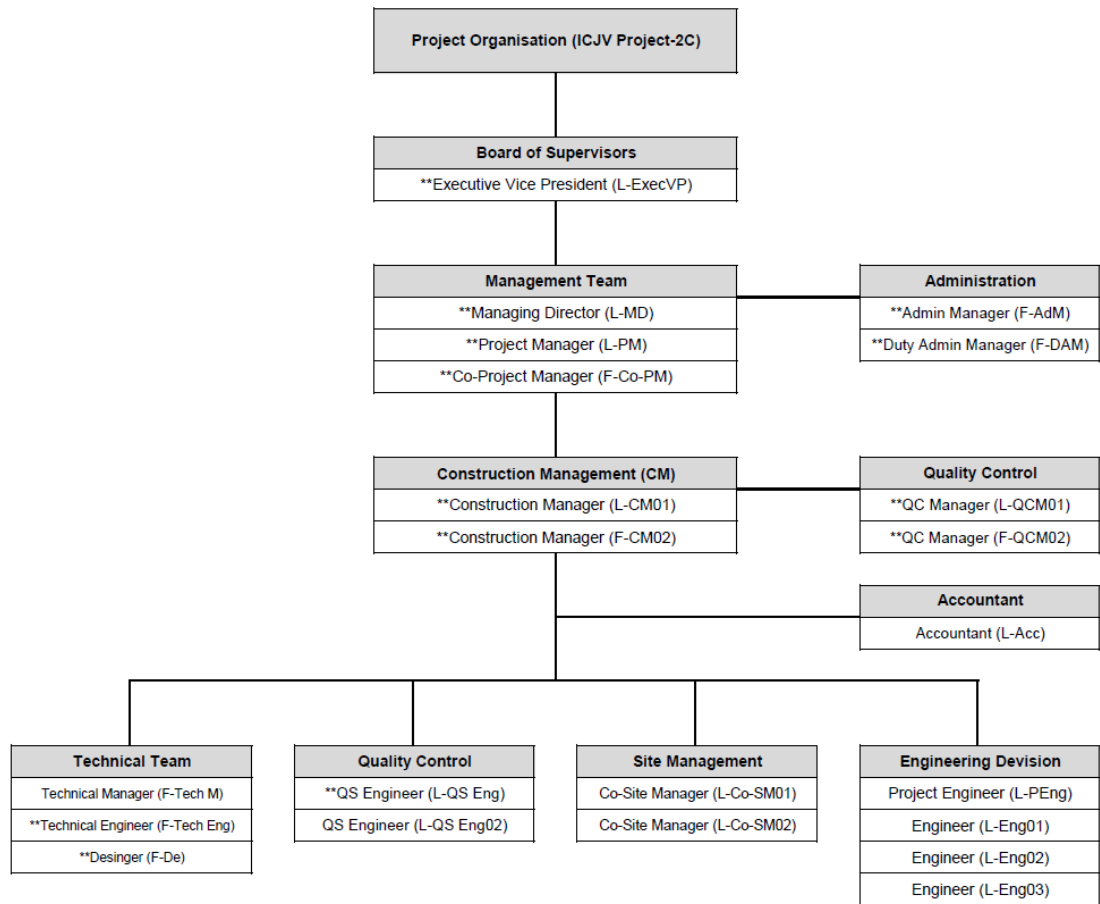


Figure 6.22 Job position of participants and their code (ICJV Project-2C)

Table 6.36 SNA internal restricted with a position (ICJV Project-2C)

Respondents	This person shares information with you	How often do you <u>seek</u> knowledge with this person?	You share information with this person	How often <u>do</u> you share knowledge with this person?
L-MD	L-ExecVP	2	L-ExecVP	2
			L-QCM01	2
			L-QCM01	2
L-ExecVP	L-MD	3	L-QCM01	3
			L-CM01	3
			L-ErecM01	3
L-PM	L-ExecVP	4	L-Eng01	3
L-CM01	L-ExecVP	4	L-Eng02	3
L-QCM01	L-ExecVP	3	F-CM02	3
	F--Tech Eng	5	L-ExecVP	3
			L-QS Eng	3
L-QS Eng	F-Co-PM	2	F-Tech Eng	4
	F-DAM	3	L-Eng03	3
	F-Tech Eng	5	L-QC Eng01	3
	L-QCM01	1	L-Acc	4
	L-Sup01	2		
F-Co-PM	F-GM	1	F-De	5
	F-QCM02	4	F-AdM	5
	F-Tech M	4		
	F-Tech Eng	5		
	F-DAM	5		
F-QCM02	F-GM	1	F-Co-PM	3
			F-GM	1
			F-Tech Eng	1
F-CM02	F-Co-PM	2	L-ExecVP	3
	F-QCM02	4	F-GM	3
			F-Tech Eng	3
F-AdM	F-Co-PM	3	F-ChAc	3
			L-QS Eng01	4
			L-QS Eng02	3
F-Tech Eng	F-Co-PM	3	L-QS Eng	3
			L-QS	3
*F-DAM	F-Co-PM	3	F-Co-PM	2
	L-MD	1	F-Tech Eng	2
	L-ExecVP	1	L-QS Eng	3
			L-ExecVP	2
			L-QCM01	1

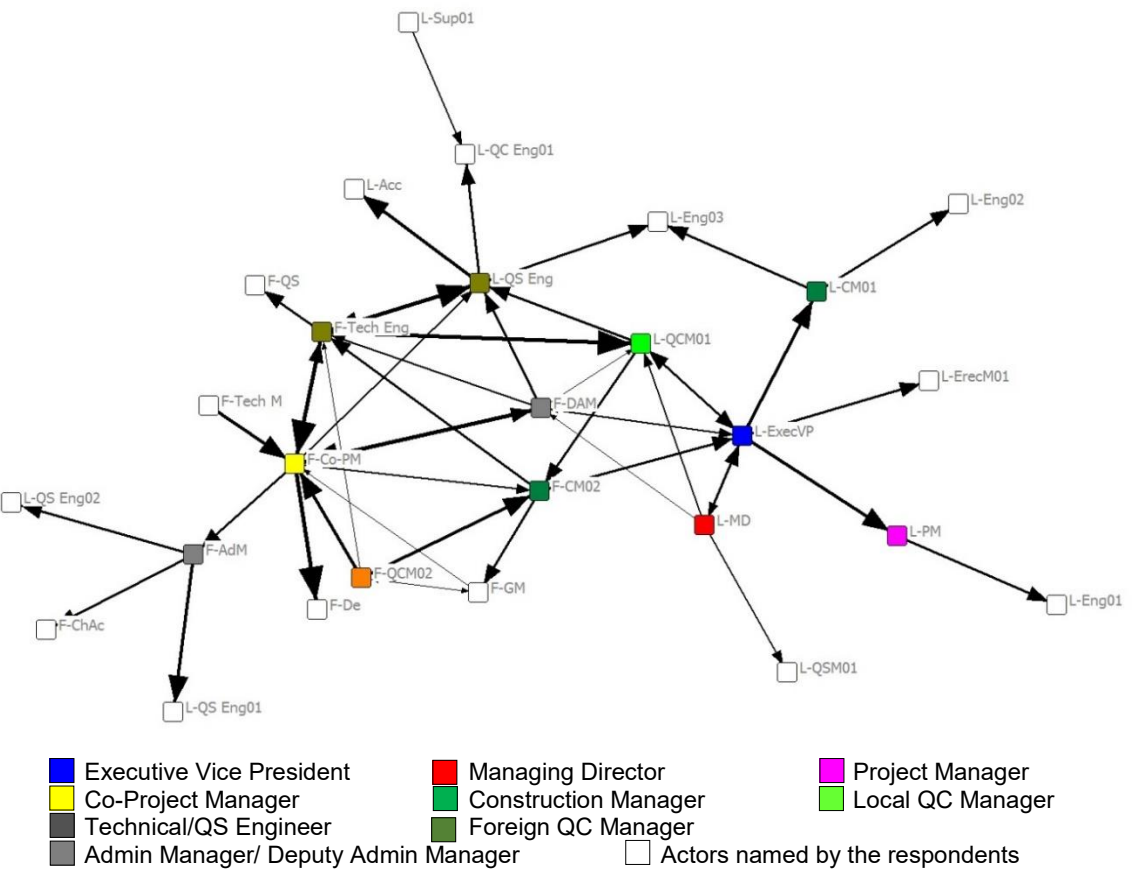


Figure 6.24 Sociogram showing knowledge sharing according to position (ICJV Project-2C)

The collaborative network, network structure and strength of the ties between the nodes developed by the collected ICJV project-2C are shown in Figure 5.23 and the expertise of different stakeholders in various positions in the collaborative network is indicated in Figure 6.24. An arrow represents the existence of collaboration between two firms. The direction of the link is from the recipient to the knowledge source and the weight of the links between the nodes indicates the frequency with which knowledge was transferred between two actors. It can be seen that the stronger the tie is, the more often they exchanged knowledge.

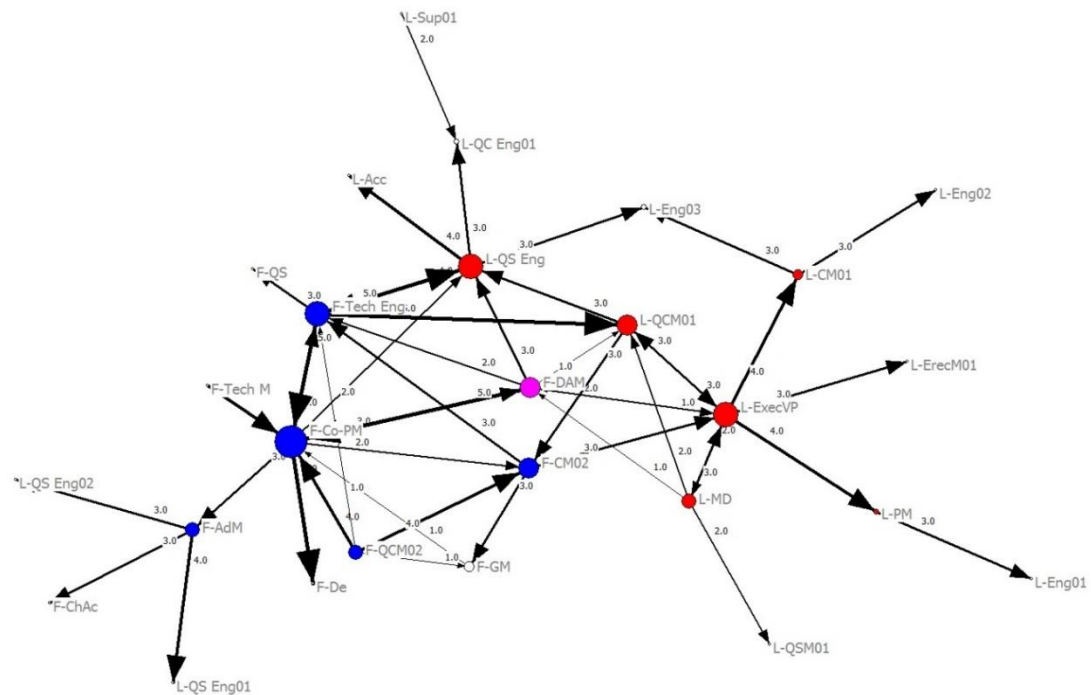


Figure 6.25 Sociogram showing network density (ICJV Project-2C)

Six foreign actors participated in this collaborative network and were involved in this ICJV Project, e.g. F-DAM, F-Co-PM, F-Tech Eng, F-QCM02, F-CM02, and F-DAM. F-DAM was a local actor employed by a foreign firm as a Deputy Administration Manager. As can be seen from Figure 6.25, there was a good connection between the foreign and local actors, e.g. F-Tech Eng, F-CM02, F-DAM, L-QS Eng, L-QCM01, and L-ExecVP. They communicated with other actors from various disciplines in this international project once a day or more than once a day. Based on the collaborative network in Figure 6.25, most of the foreign staff preferred to seek advice from F-Co-PM and most of the local and foreign staff was likely to seek advice from L-QS Eng, L-QCM01 and L-ExecVp.

Moreover, based on Figure 6.25, Deputy Admin Manager (F-DAM) was the focal point of this network; hence, it can be assumed that it was organised around him. F-DAM was a marketer with more than 20 years of experience and a local actor who was employed by the foreign firm to be a Deputy Admin Manager between the partners in this ICJV Project. Moreover, it can be assumed that F-DAM was in a position where he was relied upon to manage the cooperation between the foreign and local actors in this project. F-Co-PM usually asked for advice for F-DAM and F-CM02, whereas, F-DAM acquired knowledge from F-Tech

Eng, L-QS Eng, L-QCM01, and L-ExecVP to improve the KT processes in this international project.

This confirms that KT processes were made between F-Co-PM, F-DAM, F-Tech Eng, L-QS Eng, L-QCM01 and L-ExecVP, who may have been experts in this ICJV project. As a result, it could be argued that these actors could be regarded as the key players in terms of receiving and providing knowledge on the construction works of the Mass Transit System Project. Therefore, this result indicates that the Co-project manager, Deputy Admin Manager, Technical Engineer, QS Engineer, QC Manager and Executive Vice President were potential links between the team members in this ICJV project. It seems that the success of the KT Processes did not depend on job positions, but the motivation of different actors to transfer the knowledge.

According to the data gathered from the UCINET 6.0, the network density is 0.204 with a standard deviation of 0.802. Hence, 20.40% of the potential links exist between the actors. Scott (2012) argues that the network density would be 1.00 (100%) if every actor in the team were connected. The network density in this possible case was 0.204, which is a low value; therefore, it can be deduced that all the connections possible in this network were not made. The analysis indicates that the network density in this ICJV Project was rather small compared to ICJV Project-2A but rather large compared to ICJV Project-2B.

However, it is important to analyse the centrality measures in this study in order to identify the key actor who was more central and more strongly linked than others with regard to transferring knowledge in the ICJV project. The centrality measures are provided in the next section. Additionally, it is vital to explore the kinds of knowledge that were exchanged throughout this ICJV Project.

b) Degree of Centrality and Betweenness Centrality

The network map with differently-sized nodes is shown in Figure 6.26. The node sizes are based on the actors' average degree of centrality. The larger nodes are more central in terms of knowledge transferred within the team. The most central actors for out-degree and in-degree centrality are shown in Table 6.37. The in-degree and out-degree values of this case study are shown in Table 6.37.

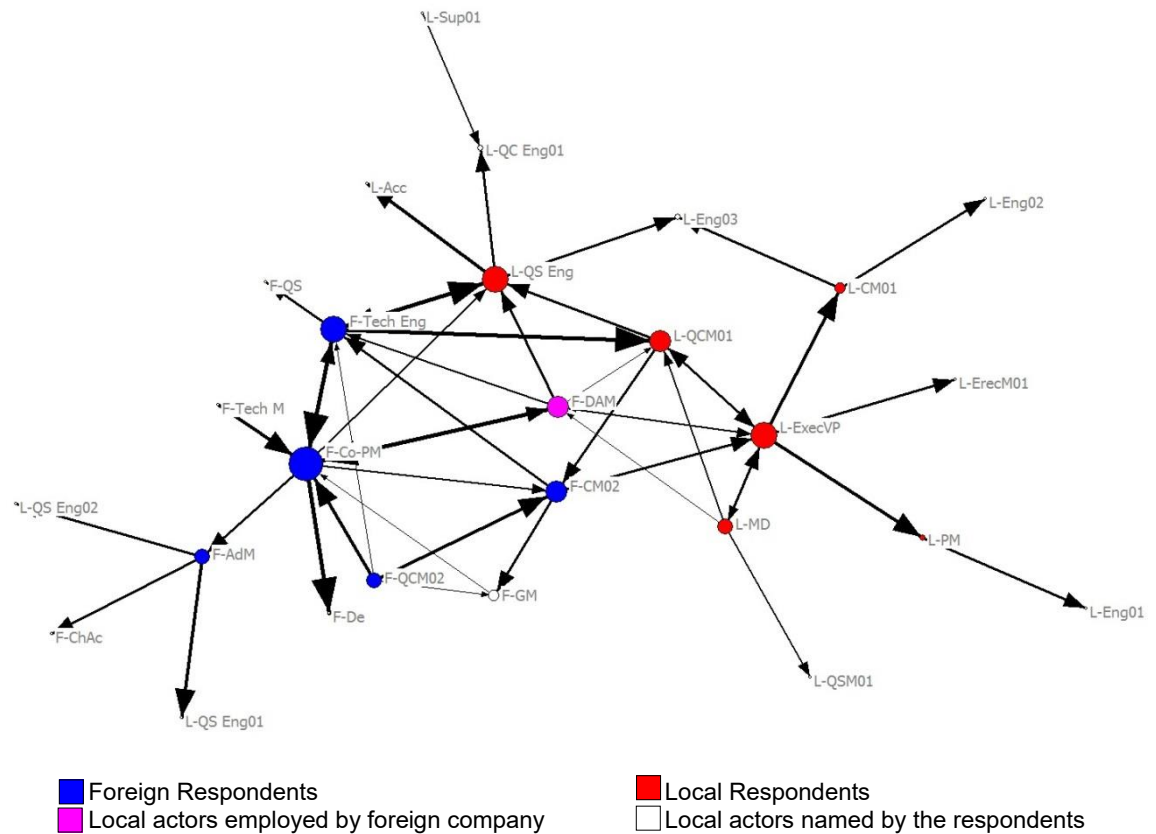


Figure 6.26 Knowledge transfer network (ICJV Project-2C)

Table 6.37 Degree of Centrality (ICJV Project-2C)

Actor	Position	Years of experience	Age group	Out-Degree Value (Knowledge consumers)	In-Degree Value (Perceived experts)
F-Co-PM	Co-Project Manager	> 20	51-60	18 (1)	19 (1)
F-Tech Eng	Technical Engineer	> 20	41-50	18 (1)	13 (2)
L-ExecVP	Executive Vice President	15-20	41-50	17 (2)	11
L-QS Eng	QS Engineer	6-15	31-40	14	13 (2)
*F-DAM	Deputy Admin Manager	> 20	41-50	13	5
F-AdM	Administrative Manager	15-20	31-40	10	3
F-QCM02	QC Manager	15-20	31-40	10	1
L-QCM01	QC Manager	15-20	31-40	9	11
F-CM02	Construction Manager	15-20	41-50	9	9

According to Table 6.37, F-Co-PM had a slightly higher in-degree centrality than the next actors, F-Tech Eng (Technical Engineer of the foreign partner) and L-QS Eng (QS Engineer of the local partner). This classified F-Co-PM (Co-Project Manager of a foreign firm) as a perceived expert who could answer any queries in the whole network, followed by F-Tech Eng and L-QS Eng. F-Co-PM and F-Tech Eng not only had high in-degree centrality, but also high out-degree centrality. These two actors had more out-degree centrality than the next actor, who was L-ExecVP. This classified F-Co-PM and F-Tech Eng as knowledge consumers. Therefore, these results indicate that F-Co-PM and F-Tech Eng were considered to be knowledge brokers in this project. The surveys results in this case study reveal that the key players from the foreign partner received and disseminated knowledge in this project. Hence, F-Co-PM (Co-Project Manager of a foreign firm) and F-Tech Eng (Technical Engineer of the foreign partner) were

found to be knowledge holders and also the actors from whom their colleagues sought advice in this ICJV project.

Based on these results, it seems that F-Co-PM (Project Manager with more than 20 years of experience) was regarded as an expert in this project, followed by F-Tech Eng (Technical Engineer with more than 20 years of experience). Hence, the number of years' experience and age were found to be inhibiting factors in the process of acquiring and transferring knowledge in this project. This outcome could indicate that Project Manager (F-Co-PM) was regarded as a knowledge broker in this project in terms of receiving and disseminating knowledge and the person to contact with any queries, together with Technical Engineer (F-Tech Eng). It seems that F-Co-PM (Co-Project Manager of a foreign firm) and F-Tech Eng (Technical Engineer of a foreign partner) were regarded as experts, since they had 20 years' experience of construction projects and were motivated to share their knowledge and experience of innovative subway and railway construction.

Table 6.38 Betweenness Centrality Measures (ICJV Project-2C)

Actor	Betweenness
F-Co-PM	91.000
L-ExecVP	72.833
F-Tech Eng	43.667
F-CM02	41.333
F-AdM	33.000
*F-DAM	32.833
L-QS Eng	30.667
L-QCM01	29.833
L-GM	13.500
L-CM01	12.833
L-PM	11.000
L-MD	10.000
F-QCM02	4.500

F = Foreign actor

L = Local actor

*Thai actor employed by a foreign partner

As can be seen in Table 6.38, F-Co-PM (Co-Project Manager of a foreign firm) had the highest betweenness centrality score, followed by L-ExecVP (Executive Vice President), which implies that these two actors were regarded as the main gatekeepers in this network. Similarly, F-Co-PM (Co-Project Manager of a foreign firm) also had high in-degree and out-degree centrality values in the network. Hence, it may be said that F-Co-PM (Co-Project Manager of a foreign firm) was not only an expert, but he was also regarded as a gatekeeper in this project. This finding corresponds with that of [Borgatti, Everett, and Johnson \(2013\)](#), who considered that betweenness plays a gatekeeping role in this context. Nodes with high-betweenness are in a position to filter information and threaten the network with disruption of operations. The most likely explanation for this result is that F-Co-PM (Co-Project Manager of a foreign firm) played a broker role, since many nodes needed him to reach other nodes via efficient path. Therefore, his power lay in his ability to threaten to stop transmitting, forcing nodes to use less efficient paths to reach one another. It is useful to note that F-Co-PM (Co-Project Manager of a foreign firm) effectively discriminated between nodes and potentially correlated well with other nodes.

c) Cliques of the network/ Cluster Analysis

According to Table 6.39, there were 7 clusters in this network, each of which consisted of three or more members, and all cliques contained a mixture of local and foreign members.

Table 6.39 Cluster Analysis (ICJV Project-2C)

N	Cluster
1*	F-CM02 F-Co-PM F-QCM02 F-Tech Eng
2*	F-Co-PM F-DAM L-QS Eng F-Tech Eng
3*	F-CM02 F-Co-PM F-GM F-QCM02
4*	F-DAM L-ExecVP L-MD L-QCM01
5*	F-CM02 L-ExecVP L-QCM01
6*	F-DAM L-QCM01 L-QS Eng F-Tech Eng
7*	F-CM02 L-QCM01 F-Tech Eng

* = Mixture of local and foreign partners

 = The most active cliques

Figure 6.27 Hierarchical Clustering of Overlap Matrix (ICJV Project-2C)

Moreover, based on Figure 6.27, F-CM02, F-Co-PM, F-QCM02, F-DAM, L-QCM01 and F-Tech Eng were the most active actors in the first highest number of cliques, while L-ExecVP, L-MD and F-GM were the most active in the second level. [Borgatti, Everett, and Johnson \(2013\)](#) propose that a co-membership clique matrix with larger values indicates a stronger link. Moreover, it is also clear from Figure 6.27 that F-CM02, F-Co-PM, F-QCM02, F-DAM, L-QCM01 and F-Tech Eng were in many different cliques together, indicating that these actors were important within the group and were likely to have occupied some kind of leadership role in this project. Moreover, it is indicated in Table 6.39 that cliques 1, 2, 3, and 6 were the most active cliques with a strong link in the subgroup, since they each consisted of more than three members. As a result, it should be noted that F-CM02, F-Co-PM, F-QCM02, F-DAM, L-QCM01 and F-Tech Eng must have been perceived to have sufficient knowledge to close the knowledge gap between the partners because they were the actors who were most active in all the different cliques.

4) Relationships between Key Actors, knowledge Transfer Methods, and Mechanisms, and Tie contents

a) Source of Knowledge

The factors that underpinned the actors' roles and the relationship between the knowledge source and the receiver are further explored in this section, as well as why particular actors were chosen to seek and share knowledge in this ICJV project. The results of a content analysis are presented in Tables 6.40 - 6.42.

Table 6.40 Knowledge Source and receiver (ICJV Project-2C)

No	Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Boss	16	2	18	31.58
2	Partner	1	3	4	7.02
3	Working colleague	3	19	22	38.60
4	Consultant	1	0	1	1.75
5	Subordinate	3	9	12	21.05
	Total	24	33	57	100.00

Table 6.41 Communications between knowledge source and receiver (ICJV Project-2C)

No	Communications between Knowledge Source and receiver	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Telephone	0	0	0	0.00
2	E-mail	2	0	2	3.51
3	Face-to-Face	17	30	47	82.46
4	Social Network	0	0	0	0.00
5	Telephone and F2F	2	0	2	3.51
6	E-mail and F2F	1	0	1	1.75
7	F2F and Social Network	0	0	0	0.00
8	All types of communication	2	3	5	8.77
9	Others	0	0	0	0.00
	Total	24	33	57	100.00

Table 6.42 Why this person was chosen to seek and share knowledge (ICJV Project-2C)

No	Reasons for receiving and sharing	Count of Knowledge Source	Count of Knowledge Receivers	Total	%
1	Decision making	1	0	1	1.64
2	He has potential to be reliable staff	0	1	1	1.64
3	He is expertise in QS	1	0	1	1.64
4	His experience and character	1	0	1	1.64
5	His position is my boss	4	0	4	6.56
6	Knowledgeable	1	0	1	1.64
7	Management policy	1	0	1	1.64
8	Reliable designer	1	0	1	1.64
9	Responsibility	0	27	27	44.26
10	Their knowledge and experience/ Experience and skill	7	0	7	11.48
11	To solve the problem at a time/ situation	0	1	1	1.64
12	Trust and their experience	15	0	15	24.59
	Total	32	29	61	100.00

Based on Tables 6.40 to 6.42, knowledge could be stored in many different repositories, depending on its type. The research participants provided these findings for 57 knowledge transfers, as shown in Table 6.40. The most common knowledge source and receiver in this project was a work colleague with 22 counts (38.60%), while the second most common was a boss with 18 counts (31.58%). Most of the participants stated that they considered their colleagues to be reliable sources of knowledge. This correlates well with the research of [Kivrak et.al. \(2008\)](#) who found that colleagues were the most important knowledge source in firms. Moreover, Face-to-Face communication (82.46%) was the most essential way for the actors in this project to communicate, as shown in Table 6.41.

Additionally, the most important reason for receiving and sharing knowledge and experience in this project was responsibility (44.26%), followed by trust and their knowledge and experience (24.59%), their knowledge, experience and skill (11.48%), and his position as my boss (6.56%) (See more details in Table 6.42). This may be due to the fact that responsibility, trust and their knowledge and experience may have been proper reasons or that some of the participants may have thought that these were likely to enable them to capture and convert tacit knowledge to explicit knowledge, especially from a partner in the ICJV project. Moreover, the key actors were asked about the mechanisms they used to transfer knowledge within their project.

b) Knowledge Transfer Methods and Mechanisms

The methods and mechanisms used to transfer knowledge within an ICJV project are important factors of success. Various methods and mechanisms were used to seek and receive the required knowledge in this ICJV project, as shown in Figure 6.28.

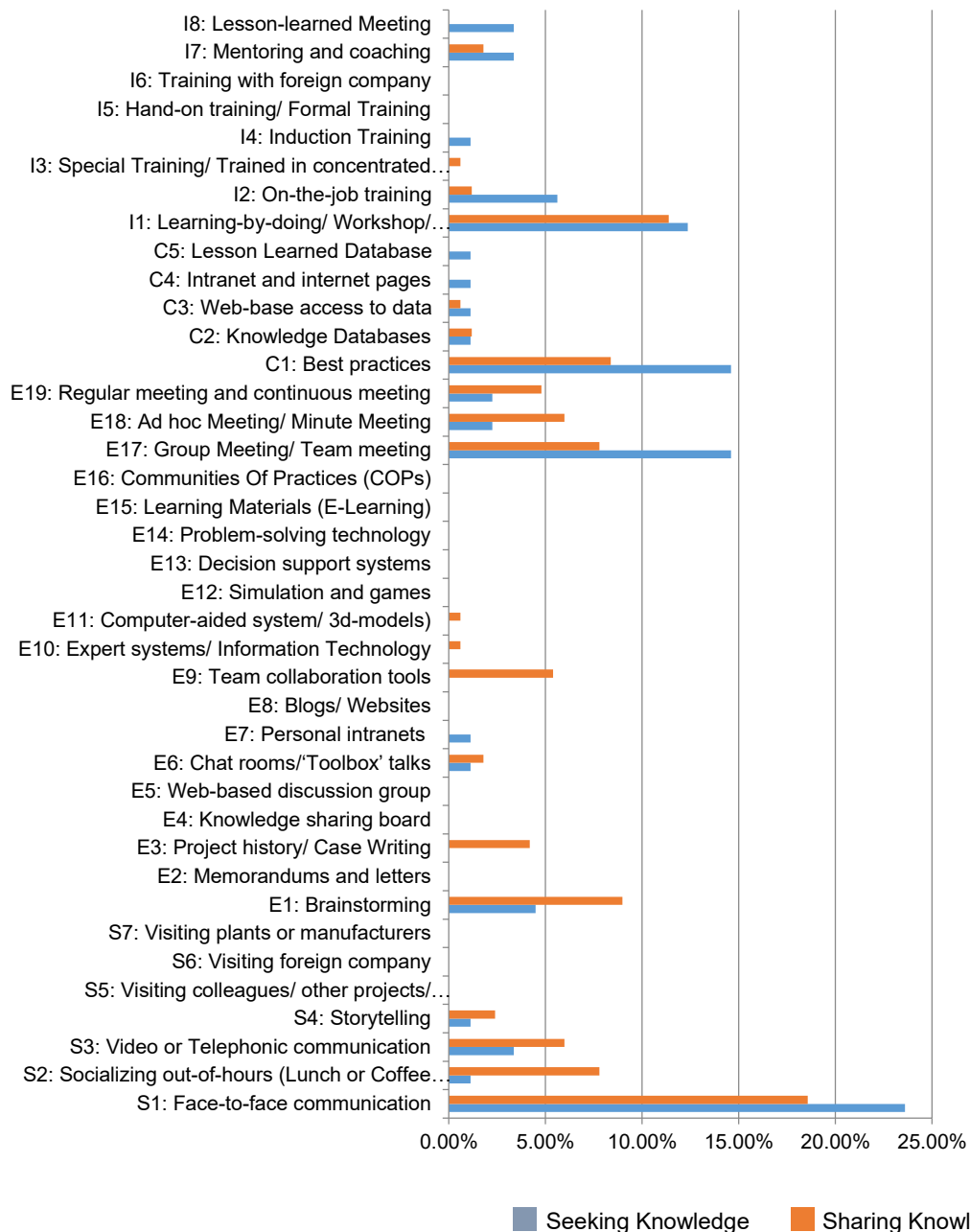


Figure 6.28 KT Methods and Mechanisms when seeking and sharing knowledge (ICJV Project-2C)

According to Figure 6.28, the participants in this ICJV project usually used (S1) face-to-face communication as a mechanism to acquire knowledge, followed by (E17) group meetings, (C1) best practice and (I1) learning-by-doing respectively. In terms of sharing knowledge, the methods most used were (S1) face-to-face communication, followed by (I1) learning-by-doing, (E1) brainstorming, (C1) best practice, (E17) group meetings and (S2) socialising out-of-hours (lunch or coffee breaks) respectively.

Therefore, several participants in this ICJV project preferred to use (S1) face-to-face communication, (E17) group meetings, (C1) best practice, and (I1) learning-by-doing to exchange their knowledge and skills. The types of knowledge flow between actors are presented in the next section.

c) Tie Characteristics and Tie Contents

The tie contents in the KT processes when actors in this ICJV project sought and shared knowledge are shown in Figure 6.29. The survey results revealed that management expertise was the most important knowledge exchanged among actors. The second most common types of knowledge were local conditions and culture, technical expertise, safety expertise, economic, marketing and financial expertise, construction resources and design knowledge and skills. In contrast, they very rarely exchanged knowledge and experience of quality assurance and control expertise, training programmes and technological expertise. Hence, it seems that these tie contents did not exist in this ICJV project.

Moreover, the main types of knowledge exchanged within this ICJV project are shown in Figure 6.29. The practitioners in this case study considered construction knowledge (B2), followed by construction techniques (B1), project management (C1), procurement system (C6), employment of subcontractors in international projects, safety standards (G1), project resource management (C3) and subcontracting arrangements and management (C7). Conversely, they were likely to share their knowledge of local customers (J6), followed by construction techniques (B1), transfer and movement of materials and manpower or equipment manufacturing capacity (B4), project planning and control (C2), procurement system (C6), and safety standards (G1) respectively.

These findings show that several of the participants within ICJV project were likely to discuss and exchange their knowledge of construction techniques (B1), procurement systems (C6) and safety standards (G1).

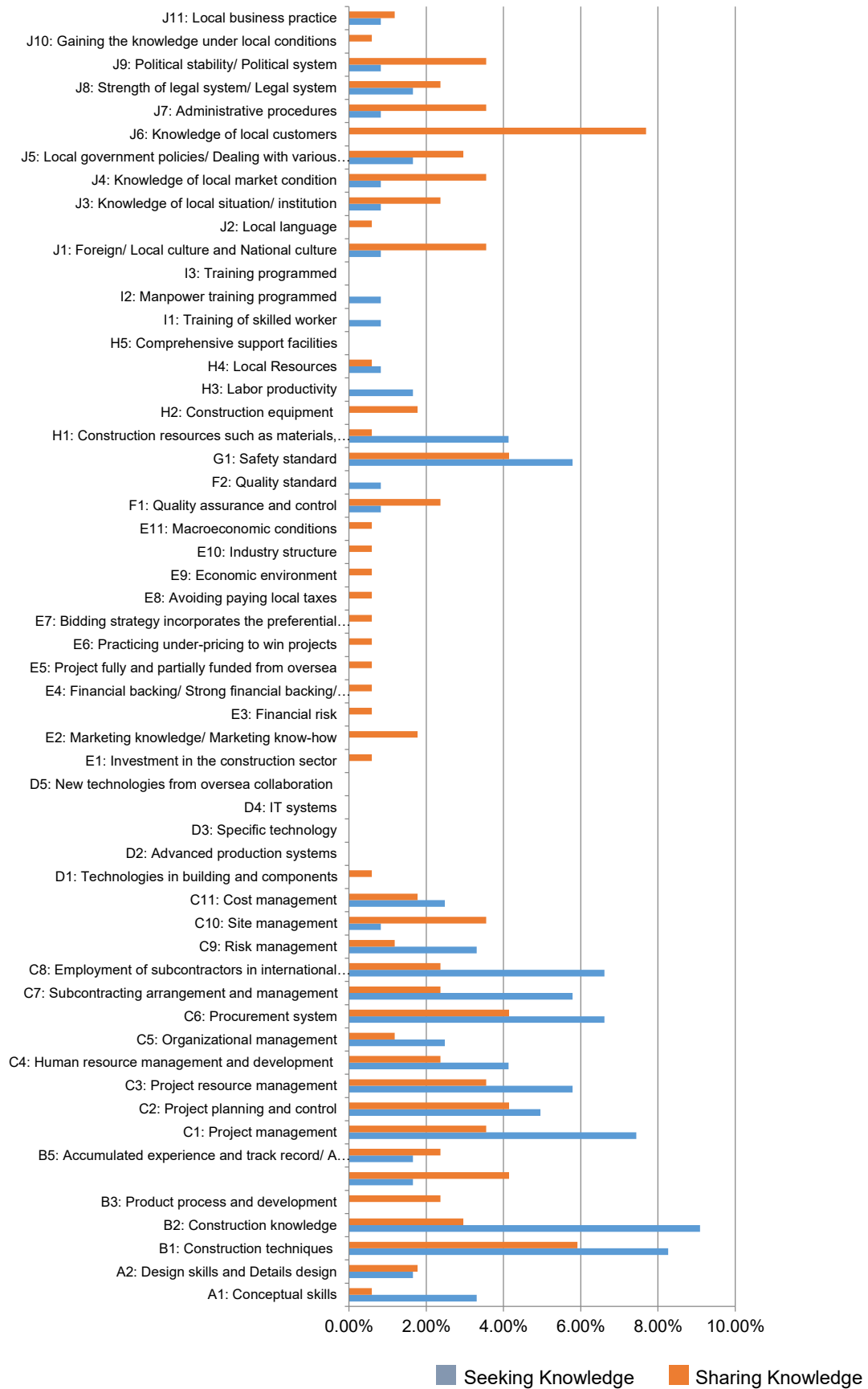


Figure 6.29 Tie contents of Knowledge Transfer when seeking and receiving knowledge (ICJV Project-2C)

Table 6.43 presents the relationship between the actors' attribute and social network characteristics of key actors in this ICJV project.

Table 6.43 SNA between key actors (ICJV Project-2C)

Actor	Position	Expert	Knowledge Consumer	Knowledge Broker	Gatekeeper	Focal Point	Co-membership
F-Co-PM	Co-Project Manager	X(1)	X(1)	X(1)	X(1)		X
F-Tech Eng	Technical Engineer	X(2)	X(2)	X(2)			X
L-QS Eng	QS Engineer	X(3)					
L-ExecVP	Executive Vice President		X(3)		X(2)		
L-QCM01	QC Manager						X
F-CM02	Construction Manager						X
*F-DAM	Deputy Admin Manager					X	X

F = Foreign actor

L = Local actor

*Thai actor employed by a foreign partner

Expert = a high in-degree centrality value

Knowledge Consumer = a high out-degree centrality value

Knowledge Broker = a high in- and out-degree centrality value

Gate Keeper = a high betweenness centrality value

Focal point = This network is organised around this actor

Co-membership of cliques = The most active actor in the first highest number of cliques

Table 6.44 Knowledge sharing between key actors (ICJV Project-2C)

Actors		F-Co-PM	F-Tech Eng	L-QS Eng	L-ExecVP	L-QCM01	F-CM02	*F-DAM
F-Co-PM	Received		X					X
	Shared							
F-Tech Eng	Received	X						
	Shared			X				
L-QS Eng	Received	X	X			X		X
	Shared		X					
L-ExecVP	Received							
	Shared					X		
L-QCM01	Received		X		X			
	Shared			X	X		X	
F-CM02	Received	X						
	Shared		X		X			
*F-DAM	Received	X			X			
	Shared	X	X	X	X	X		

Table 6.45 Knowledge exchange between key actors (ICJV Project-2C)

Actors	Position	Received				
		From	Relationship	How often	How to communicate	Why
F-Co-PM	Co-Project Manager	F-Tech Eng	Subordinate	More than once a day	F2F	He is expertise in QS
		F-DAM	Subordinate	More than once a day	F2F	His experience and character
F-Tech Eng	Technical Engineer	F-Co-PM	Boss	Less than once a week	F2F	Trust and their experience
L-QS Eng	QS engineer	F-Co-PM	Boss	Once a week	F2F	Trust and their experience
		F-Tech Eng	Boss	More than once a day	E-mail, F2F	Trust and their experience
		L-QCM01	Partner	Less than once a week	Telephone and F2F	Trust and their experience
		F-DAM	Boss	More than once a week	F2F	Trust and their experience
L-QCM01	QC Manager	F-Tech Eng	Colleague	More than once a day	F2F	Trust and their experience
		L-ExecVP	Boss	More than once a week	F2F	Trust and their experience
F-CM02	Construction Manager	F-Co-PM	Boss	Once a week	F2F	Experience and skill
F-DAM	Deputy Admin Manager	F-Co-PM	Boss	More than once a week	F2F	Trust and their experience
		L-ExecVP	Boss	Less than once a week	F2F	Trust and their experience

Actors	Position	Shared				
		To	Relationship	How often	How to communicate	Why
F-Tech Eng	Technical Engineer	L-QS Eng	Colleague	More than once a week	F2F	He has potential to be reliable staff
L-QS Eng	QS engineer	F-Tech Eng	Boss	Once a week	F2F	Responsibility
L-ExecVP	Executive Vice President	L-QCM01	Subordinate	More than once a week	Telephone, E-Mail and F2F	Responsibility
L-QCM01	QC Manager	L-QS Eng	Partner	More than once a week	F2F	Responsibility
		L-ExecVP	Boss	More than once a week	F2F	Responsibility
		**CM02	Partner	More than once a week	F2F	Responsibility
F-CM02	Construction Manager	F-Tech Eng	Colleague	More than once a week	F2F	Responsibility
		L-ExecVP	Partner	More than once a week	F2F	Responsibility
*F-DAM	Deputy Admin Manager	F-Co-PM	Boss	Once a week	F2F	Responsibility
		F-Tech Eng	Colleague	Once a week	F2F	Responsibility
		L-QS Eng	Colleague	More than once a week	F2F	Responsibility
		L-ExecVP	Colleague	Once a week	F2F	Responsibility
		L-QCM01	Colleague	Less than once a week	F2F	Responsibility

Table 6.46 KT methods and mechanisms and tie contents received between key actors (ICJV Project-2C)

Actors	Received from	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-Co-PM	F-Tech Eng	S1	E19				B4	C6-C7							
	*F-DAM	S1	E17										H4		J1 J3 J4 J5 J5 J7 J8 J9 J1 1
F-Tech Eng	F-Co-PM	S1	E2 E17 E18 E19				B2 B4	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11				G1			
L-QS Eng	F-Co-PM	S1	E17				B2	C6-C7				G1	H1		
	*F-DAM	S1	E17				B2	C9							J8
	F-Tech Eng	S1	E17				B2 B5	C3 C6 C7 C8 C9							
	L-QCM01	S1	E17			A2	B1								
L-QCM01	L-ExecVP	S1	E3			A1	B1	C1 C2 C3 C4 C5 C8	D1				H1		
	F-Tech Eng	S1	E17				B2 B5	C3 C6 C7 C8 C9							
F-CM02	F-Co-PM	S1	E1 E3 E17				B2	C6 C7				G1	H1		
*F-DAM	F-Co-PM	S1	E1 E3 E17			A1	B1	C1 C2 C6			F1	G1			
	L-ExecVP	S1	E3	C1	I1-I2		B1		D1						

Table 6.47 KT methods and mechanisms and tie contents shared between key actors (ICJV Project-2C)

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-Tech Eng	L-QS Eng	S1	E17 E18 E19		I7			C2 C6 C7 C8 C11							
L-QS Eng	F-Tech Eng	S1	E9	C1	I1			C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11							
L-ExecVP	L-QCM01	S1 S2 S3	E6 E17			A2	B1	C6			F1				
L-QCM01	F-CM02	S1	E1												J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11
	L-ExecVP	S1	E1 E17 E18 E19					C2 C3				G1			J6
	L-QS Eng	S1	E1 E17 E18 E19					C2 C3				G1			J6
F-CM02	*F-DAM	S1 S2 S3 S4	E1 E3 E17 E18 E19				B1 B1 B2 B3 B4 B5	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11				G1			

Actors	Shared to	Methods and Mechanisms				Type of Knowledge									
		S	E	C	I	A	B	C	D	E	F	G	H	I	J
F-CM02	L-ExecVP	S1	E1					C1 C10							J1 J4 J6
*F-DAM	F-Co-PM	S1 S2	E1 E3	C1 C2	I1 I2			C4							J3 J5 J6 J8 J9
		S1 S2	E1 E3	C1 C2	I1 I2			C1 C10							J1 J4 J6
		S1 S2	E1 E3	C1	I1 I7			C6					H1 H2		J6 J7
		S1	E1 E3	C1	I1			C2 C3				G1			J6
	L-ExecVP	S1	E1 E3	C1	I1										J6
	L-QCM01	S1	E1 E3	C1	I1		B2								J6 J7

The KT methods and mechanisms and types of knowledge that influenced the KT processes between the key actors in this ICJV project are indicated in Tables 6.46 and 6.47. Most of the key actors in this ICJV project preferred to use (S1) face-to-face communication, followed by (I1) learning-by-doing, (E17) group meetings/team meetings, (C1) best practice, (E1) brainstorming, (E3) project history/case Writing, (S2) socialising out-of-hours (lunch or coffee breaks), (E7) personal intranets, (E19) regular meetings/continuous meetings, (E9) team collaboration tools, and (E18) minutes of meetings as KT methods and mechanisms to seek advice and share their knowledge. Only some of the key actors were likely to use (S3) telephonic communication, (I2) on-the-job training, (E6) chat rooms/ 'toolbox' talks, (I7) mentoring and coaching, and (I8) lesson-learned meetings, and only one of them (F-CM02) used (S4) storytelling to share his experience with F-DAM. F-Tech Eng used (E2) memoranda and letters to ask for advice from F-Co-PM, and F-DAM used (C2) knowledge databases to share his experience with F-Co-PM and F-Tech Eng.

Moreover, the results indicated that several KT methods and mechanisms were not used in this ICJV project, namely, socialisation (e.g.(S5) visiting colleagues/ other projects/companies, (S6) visiting foreign company, (S7) visiting plants or manufacturers), externalisation (e.g. (E4) knowledge-sharing boards, (E5) web-based discussion groups, (E7) personal intranets, (E8) blogs/websites, (E9) team collaboration tools, (E10) expert systems/information system/information technology, (E11) computer-aided systems/3d-models, (E12) simulation and games, (E13) decision support systems, (E14) problem-solving technology, (E15) learning materials (e-learning), and (E16) communities of practice (COPs)), combination (e.g. (C3) web-based access to data, (C4) Intranet and internet pages, and (C5) lesson learned database), and internalisation (e.g. (I3) special training/trained in concentrated courses, (I4) induction training, (I5) hands-on training/formal training, (I6) training with foreign company, and (I8) lesson-learned meetings).

The choice of these KT methods and mechanisms gives a further indication of the tie contents in the development of the conceptual framework. This argument is also supported by

the following statement made by F-Co-PM, the Co-project manager, who was perceived to be an expert, knowledge consumer, knowledge broker, gatekeeper and co-member in the network for enhancing the KT processes in this project;

[...] “We discussed any issues in this ICJV project in weekly meetings, face-to-face communication and e-mail respectively. We also had a discussion every morning using Toolbox Talk, especially in terms of safety in construction.

[...] “Employees in the construction industry are often exposed to physically heavy workloads and there is a high level of absenteeism. With this in mind, our project encouraged construction workers to take part in 10 minutes’ exercise in the morning to get their blood circulating at the start of their working day. The daily exercise routine was developed with the help of a professional trainer, to benefit the construction workers and warm up their cold muscles before the day started”

L-ExecVP also made the following comment;

[...] “we used an inspection of work equipment in this ICJV project to check the condition of the machinery every month or every two months (e.g. check-sheet of scaffolding) to ensure that the equipment could be operated, adjusted and maintained safely.”

In terms of the type of knowledge exchanged, the research results indicate that the key actors mainly exchanged knowledge and skills of (C6) the procurement system, followed by (C2) project planning and control, (C3) project resource management, (C7) subcontracting arrangements and management/corporate commitment and ability to assess, (J6) knowledge of local customers, (B2) construction knowledge, (C1) project management, (C8) employment of subcontractors in international projects, (G1) safety standards, (B1) construction techniques, (C9) risk management, (C4) human resource management and development, (C10) site management, (C5) organisational management, (C11) cost management, (H1) construction resources, (J1) foreign/local culture and national culture, (J4) knowledge of local market conditions, (J5) local government policies/dealing with various government bureaucracies, (J7) administrative procedures (J8) strength of legal system/ legal system.

However, only some of them shared their knowledge of (B4) transfer and movement of materials and manpower or equipment manufacturing capacity, (B5) accumulated experience and track record/a good track record, (D1) technologies in buildings and components, (J3) knowledge of local situation/institutions, (J9) political stability/political system, (A1) conceptual skills, (A2) design skills and design details, (F1) quality assurance and control, and (J11) local business practice.

Moreover, the findings indicate that only F-CM02 shared his experience of (B3) product processes and development, while F-DAM was the only actor who shared his experience of (H2) construction equipment and (H4) local resources, and only L-QCM01 shared his experience of (J2) local language. This indicates that F-CM02 was regarded as the most knowledgeable actor in this ICJV project in terms of answering any queries about (B3) product

process and development, F-DAM was regarded as the most knowledgeable actor who could answer any queries about (H2) construction equipment and (H4) local resources, while F-CM02 was perceived as being the most knowledgeable actor who could answer any queries about (B3) product processes and development in this ICJV project.

Furthermore, the research results indicate that the key actors were lacking in skills, knowledge and experience of (D) technological expertise (e.g. (D2) advanced production systems, (D3) specific technology, (D4) IT systems, and (D5) new technologies from overseas collaboration) and that knowledge of (E) economic, marketing and financial expertise and (I) training programmes did not exist in this ICJV project.

The choice of this type of knowledge gives further indications of the tie contents in the development of the conceptual framework. This argument is supported by the following statements of F-Co-PM, the Co-project manager;

[...] "There is a need to up-skill the staff involved in ICJV projects because our company has a clear procedure for safety and environmental factors, especially the management of hygiene, dust and sound."

[...] "...It is important that we continue to reduce fatalities and injuries on building sites and improve our health and safety culture throughout international projects. As construction specialists, we have an in-depth understanding of health and safety, and the environmental needs of the construction industry. Our consultants have extensive knowledge and expertise of working on building sites and complying with all legal duties, as well as substantial experience of working with businesses of all sizes in the sector"

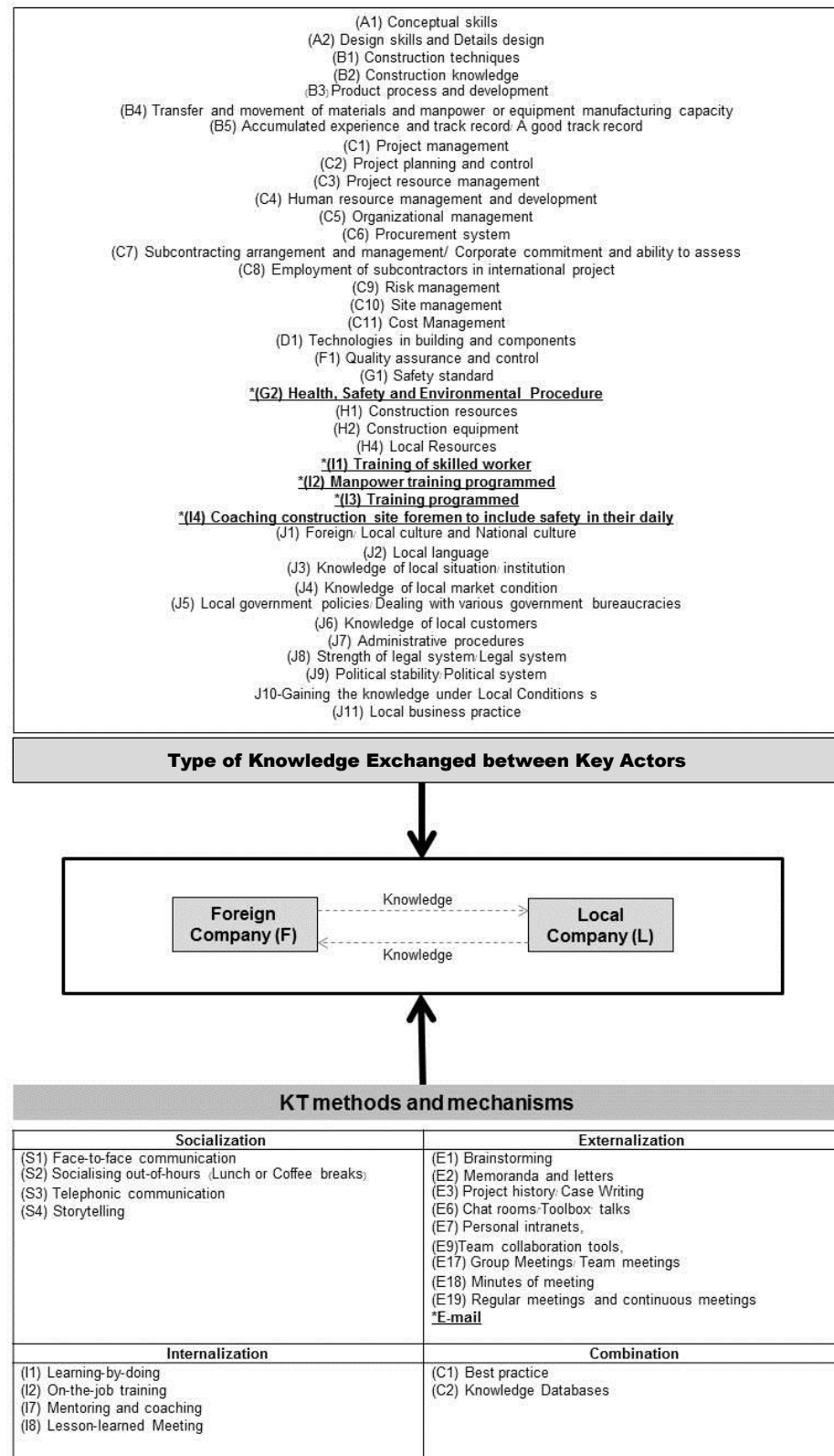
[...] "...our company has policies to deal with safety and environmental matters, from air and water pollution to the protection of endangered species, in every international project. This makes a difference in how our staffs deal with these matters. We take our environmental responsibilities seriously based on advice from environmental consultants.

Moreover, F-Tech Eng recommended that;

[...] "...all staff should have a good understanding of their work environment and the instructions of their supervisor. They always pay attention to the emergency telephone numbers posted on the notice board in the site office"

[...] "...construction workers need to be properly trained and educated on the task or job before working, which will help to prevent injury and death. There are many methods of training construction workers. One is coaching the construction site foremen to include safety in their daily verbal exchanges with workers to reduce work-related accidents."

The KT methods and mechanisms most used to exchange knowledge and experience in this ICJV project can be seen in Figure 6.30.



*Results from interviews with key actors

Figure 6.30 Type of knowledge flow and KT methods and mechanisms influencing KT (ICJV Project-2C)

It was confirmed in the last section that the transfer of knowledge is the most important advantage for ICJV Projects. The key findings of ICJV Project-2C will be presented in this section and the enabling and inhibiting factors that were found to influence the knowledge

transfer processes from a foreign to a local partner will also be discussed. The analysis of the interviews in which the key actors in this ICJV project were asked to describe the main enabling and inhibiting factors that influenced their KT processes is shown below.

The Co-project manager of a foreign partner (F-Co-PM) described the key enabling and inhibiting factors that influenced the KT processes in this ICJV as follows;

[...] "...knowledge transfer is likely to be more successful when all the team members perceive trust as the key enabling factor of a successful knowledge transfer.

Moreover, the QS Engineer (L-QS Eng) defined the key enabling and inhibiting factors that influenced the KT processes in the ICJV, as follows;

[...] "...partners' experience was essential for effective KT in this ICJV project; for example, highly experienced and competent foreign partners were able to disseminate significant knowledge of HR management, process management, etc...."

[...] "...best practice was vital for successful knowledge transfer.

Moreover, he is also asserted that;

[...] "... the successful transfer of knowledge greatly depends on the willingness and openness of partners.

The data collection involved a number of interviews with key knowledge actors from this ICJV project using open-ended questions. The interviewees were briefed on the background of the research, as well as the framework used to analyse the transfer of knowledge. These key actors described the key enabling and inhibiting factors that influenced the KT processes in this ICJV project. The most important enabling factor was defined as trust, as well as partners' experience. Best practice was also said to be vital for a successful transfer of knowledge. Moreover, the key actors emphasised that a successful knowledge transfer highly depends on the willingness and openness of the partners.

6.4 SUMMARY OF CASE STUDY TWO

This section contained an analysis of the three ICJV projects in case study two (ICJV Project-2A, ICJV Project-2B, and ICJV Project-2C). It was noted that the sample size in ICJV Project-2A was much smaller than the other two projects, which led to a rather limited comparison; hence, some of the conclusions were only derived from ICJV Projects-2B and -2C). The data was analysed and reflected by linking the empirical data to the main constructs of the conceptual framework and the purpose of the study using the analytical generalisation described in Chapter 3.

Actors' Attributes and Knowledge Sources

With regard to the data gathered in case study two, as mentioned above, it has to be recognised that the sample of ICJV Project-2A was much smaller than the sample in the other two projects. This may be because ICJV Project-2A was completed almost 17 years ago in 2000; hence, it was impossible to collect the data from some of the team members. As a result,

the comparison between these three ICJV projects was fairly limited. Additionally, the managerial and professional staff from these ICJV projects who participated in this study was Thai, Japanese, German and Filipino, while most of the research participants were Thai staff. Project Managers (from foreign partners), Technical Engineers and QS Engineers were perceived as experts in ICJV Project-2A. Project Managers (from foreign partners) and Technical Engineers were also regarded as knowledge consumers and knowledge brokers. Moreover, Project Managers (from foreign partners) were also perceived as gatekeepers in this project. Project Managers was perceived as experts in ICJV Project-2B, whereas the Co-site manager was regarded as a knowledge consumer, knowledge broker and gatekeeper. Meanwhile, Technical Advisors, Quality Controllers and Supervisors were perceived as experts in ICJV Project-2C. Quality Controllers were also identified as knowledge consumers, knowledge brokers and gatekeepers. Although Supervisors were not perceived to be experts, they were regarded as gatekeepers in this project.

Moreover, the results reveal that the majority of the key actors in this case study were Project Managers, Technical Engineers, QS Engineers, Co-Site Managers, Technical Advisors, Quality Controllers and Supervisors. Therefore, they were likely to have operated the knowledge transfer processes in these ICJV projects. Additionally, the findings indicate that the key knowledge actors in these projects were a combination of local and foreign members (e.g. German, Filipino, and Japanese), most of whom had >20 years' experience of construction projects and were aged 41-50, followed by 51-60, > 60 and 31-40. In terms of their experience of training and visiting, the findings indicate that most of the key actors had prior experience of training and visiting foreign companies or projects. Therefore, the vast majority of the key actors had experience of training and visiting their JV partners. Only five of them (e.g. Co-project Managers, Project Engineers, Co-site Managers and QS Engineers) had no such experience.

Influence of Social Network Analysis

In terms of SNA, ICJV Project-2A was found to have a higher network density (0.733), followed by ICJV Project-2C (0.204) and ICJV Project-2B (0.180). Hence, it seems that 73.30% of the potential links existed between the actors in ICJV Project-2A compared to ICJV Project-2B and ICJV Project-2C. In fact, the network density in ICJV Project-2B was only 0.180 (18%), which is a low value, thereby suggesting that not all the possible connections were made in this network.

KT Processes/ Methods and Mechanisms

With regard to the contents and reasons for exchanging knowledge, the vast majority of the key knowledge actors in these case studies indicated that 'work colleagues' were most frequently considered as a source of knowledge, followed by 'boss', 'partner' and subordinate. Moreover, most of the participants thought that trust, partners' experience, coaching and sharing, and responsibility enabled experts and staff in the case studies to transfer knowledge. Various types of technical knowledge were transferred to local actors from foreign partners, such as German, Filipino and Japanese, using different KT methods and mechanisms during the multiple ICJV Projects in case study two. It was found that the ICJV staffs at multiple disciplines and levels in

ICJV Project-2A were able to access and learn new knowledge in a fertile atmosphere. However, the transfer of knowledge was challenging in most ICJV projects. Firstly, it was clear from the interviews conducted with key actors in each project that tacit knowledge was relatively difficult to acquire compared to explicit knowledge. Face-to-face interaction was considered to be a vital KT method and mechanism to transfer tacit knowledge, followed by telephonic communication, brainstorming, group meetings, minutes of meetings, continuous meetings, learning-by-doing, mentoring and coaching, and lessons-learned meetings. These KT methods and mechanisms, as well as socialising out-of-hours, enabled the ICJV Projects' team to have smoother and better access to knowledge of partners.

According to the data collected from case study two, the key participants in ICJV Projects-2A and -2C stated that openness and willingness to learn and trust played critical roles in KT, since most of them enjoyed transferring knowledge and regarded it as an opportunity to develop and upgrade their knowledge and skills, as well as to learn from partners' experience. In contrast, the key participants in ICJV Project-2B stated that the different languages of foreign and local partners caused a big problem. Therefore, language is considered to have been one of the main barriers to transfer knowledge between local and foreign staff. Additionally, the interviewees in case study two said that they had attempted to maintain a good relationship and organisational distance between the partners based on commitment and effective communication. Moreover, these key actors indicated that the agreement between the top management of each partner was the most important factor of a good relationship, friendship and sincerity between the actors in a project. Therefore, the top management of all parties must feel that they are the same company and they need to acknowledge the potential of their staff. Thai staff tends to respond better to encouragement than pressure. The interviewees further considered that trust was the most important indicator in an ICJV project, as well as partners' experience. Best practice was also vital for a successful transfer of knowledge. Moreover, the key actors indicated that a successful knowledge transfer highly depended on the willingness and openness of the partners. These factors all enabled the individuals in this case study to access critical knowledge. However, many of the key actors suggested that the cultural distance between organisations was one of the key challenges of KT.

A within-case analysis was used to investigate each case study independently and, hence, become more familiar with each of the studied organisations and their individual experience of transferring knowledge in ICJV Projects. The analysis was structured by linking the empirical data to the main constructs of the conceptual research framework and the purpose of the study. Based on the with-in case analysis presented in Chapter 5 and this chapter, a cross-case analysis will be made in the next chapter in order to identify the similarities and differences of the issues related to the key enabling and inhibiting factors that influenced the KT processes and successful knowledge transfer in the ICJV Projects across the case studies. The key findings will be discussed in the next chapter and a revised framework will be proposed for transferring knowledge in ICJV Projects in Thailand.

7. DISCUSSION OF KEY FINDINGS

7.1 INTRODUCTION

The aim of this research was to acquire a deeper understanding and make a more holistic analysis to identify the key concepts in the area of knowledge transfer and social networks, as well as, to identify the key enabling and inhibiting factors that influence KT processes in ICJV Projects.

The previous chapter contained an analysis of the results of three case studies and the purpose of this chapter is to provide a cross-case analysis and a discussion of the key findings in order to facilitate a more comprehensive understanding of the key enabling and inhibiting factors that affect the success of knowledge transfer processes in ICJVs. A cross-case synthesis can bring together the key issues and insights from the six ICJV projects examined in this study. [Miles and Huberman \(1994\)](#) suggest that a cross-case analysis provides a deeper understanding and explanation that that derived from studying isolated cases and, therefore, generates more sophisticated descriptions. This argument is also supported by [Hartley \(2004\)](#) and [Yin \(2008\)](#), who propose that the aim of cross-case synthesis is to build a general explanation that fits each case study; as such, it is a valuable technique for highlighting the differences and similarities between the cases.

This chapter consists of four sections, including this introduction. Section 7.2 contains a cross-case analysis of six ICJV Projects and a discussion of the results, followed by a proposal for a revised conceptual framework for knowledge transfer processes in ICJV Projects in Thailand in Section 7.3. The use of this framework in practice is explained in Section 7.4. A theoretical discussion of the findings is provided in each section.

7.2 DIFFERENCES AND SIMILARITIES OF CASE STUDIES

The collected data and the analyses of the six ICJV projects in case studies one and two are presented in this section. These observations were considered and reflected in the conceptual framework. The types of knowledge (tie contents) transferred in these six ICJV projects were identified by examining the actors' attributes, social networking characteristics and the methods and mechanisms they used in the transfer process. A total of 79 questionnaire surveys were undertaken with selected team members from six ICJV projects as shown in Table 7.1 below.

Table 7.1 Comparison of the sixth ICJV PROJECTS

Description	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
Project	Track Rehabilitation Project (Phase 1 and 2)	Track Rehabilitation Project (Phase 5)	Extra doses Crossing Bridge	Bang Na Expressway (BNE)	Chaloem Ratchamongkhon line of Metropolitan Rapid Transit Authority (MRTA)	Mass Transit System Project (Purple Line).
Completed	2002	2012	2016	2000	2004	2014
Joint Venture Company	Thai-Thai-France	Thai-France	Thai-Japan	Thai-German	Thai-German-Japan	Thai-Japan
(%) of holding	55-10-35	60-40	40-60	35-65	25-35-40	75-25
Participants	11 (Thai 7, Foreign 4)	19 (Thai 18, Foreign 1)	15 (Thai 9, Foreign 6)	9 (Thai 6, Foreign 3)	13 (Thai 7, Foreign 6)	12 (Thai 7, Foreign 5)

Most of the data of these six ICJV projects was collected from a head office and the office of the construction site in Bangkok, Thailand. The managerial and professional staff who participated in this study were Thai, French, German, Japanese and Filipino, but most of the research participants were Thai employees. Only one foreign employee who worked on ICJV Project-1B participated in this research. It should also be noted that the sample size of ICJV Project-2A (ICJV Company Two) was much smaller than that of the other two ICJV Projects. This was mainly due to the fact that this project was completed almost 17 years ago; hence, it was not possible to access many of the team members at this late date.

7.2.1 Actors' Attributes and Social Networking Characteristics

The social networking characteristics that influenced the transfer of knowledge in these case studies were discussed earlier. A Social Network Analysis (SNA) was used to identify the key actor(s) in these ICJV projects and the knowledge source and transfer methods and mechanisms were examined based on actor centrality, and tie characteristics and tie contents. The sources of knowledge were identified using social network indices, such as the degree of centrality, betweenness centrality and network cliques. Actors who were regarded as experts, knowledge consumers, knowledge brokers, gatekeepers and co-members in the subgroup in these projects were identified based on the survey results. According to Table 7.2, most of the key actors in these two case studies were Project Managers, followed by Construction Managers, Co-Project Managers, QS Engineers, Supervisors, Co-Construction Managers, Co-Site Managers, Project Engineers and Engineers. The key knowledge actors in these ICJV projects were either local or foreign staff (e.g. French, Filipino, Japanese and German). Most of them had >20 years' experience in construction projects, followed by 16-20 and 6-15 years' experience and were aged 41-50, followed by 51-60, 31-40, >60 and 26-30. In terms of experience of training and visiting, the findings indicated that most of the key actors had prior experience of training and visiting other foreign companies or projects. Only eleven actors lacked this experience.

Table 7.2 Comparison of the attributes of key actors in the ICJV PROJECTS

	Key Actors	Position	Nationality	Company	Years of experience	Age group	Experience of being trained by a foreign company	Experience of visiting foreign projects
ICJV Project-1A	LC01-Sup01	Supervisor	Thai	Local	> 20	51-60	YES	YES
	F-PM03	Project Manager	French	Foreign	6-15	31-40	YES	YES
	LC01-PM02	Project Manager	Thai	Local	6-15	31-40	NO	NO
	LC02-QS01	Quality Surveyor	Filipino	Local	> 20	41-50	YES	NO
	LC01-SVP	Senior Vice President	Thai	Local	> 20	51-60	YES	YES
ICJV Project-1B	LC01-PM01	Project Manager	Thai	Local	6-15	31-40	NO	NO
	L-Sup02	Supervisor	Thai	Local	> 20	51-60	YES	YES
	L-P Eng02	Project Engineer	Thai	Local	6-15	31-40	NO	NO
	L-S Eng01	Senior Engineer	Thai	Local	> 20	51-60	YES	YES
	L-PM5	Project Manager	Thai	Local	16-20	41-50	YES	NO
	L-Eng09	Engineer	Thai	Local	6-15	26-30	NO	NO
	F-PM01	Project Manager	French	Foreign	6-15	31-40	YES	YES
	L-Eng08	Engineer	Thai	Local	6-15	26-30	NO	NO
ICJV Project-1C	F-PM01	Project Manager	Japanese	Foreign	> 20	51-60	NO	NO
	L-CM01	Construction Manager	Thai	Local	16-20	41-50	YES	YES
	F-QS Eng01	QS Engineer	Filipino	Foreign	> 20	41-50	YES	NO
	*F-CoM	Coordinate Manager	Thai	Foreign	> 20	41-50	YES	YES
	*F-QS Eng02	QS Engineer	Thai	Foreign	6-15	31-40	NO	YES
	F-CM02	Construction Manager	Japanese	Foreign	16-20	41-50	YES	YES
ICJV Project-2A	F-QA/QCM	QA/QC Manager	Japanese	Foreign	16-20	41-50	YES	YES
	F-ADV	Technical Advisor	German	Foreign	> 20	51-60	YES	YES
	L-QC	Quality Control	Thai	Local	> 20	51-60	YES	YES
	L-Sup01	Supervisor	Thai	Local	> 20	41-50	YES	YES
	L-Co-PM	Co-Project Manager	Thai	Local	> 20	>60	YES	NO
	L-Co-CM01	Co-Construction Manager	Thai	Local	> 20	>60	YES	NO
	L-Co-SM	Co-Safety Manager	Thai	Local	> 20	51-60	YES	YES
ICJV Project-2B	F-CM	Construction Manager	German	Foreign	> 20	51-60	YES	YES
	F-Co-PM02	Co-Project Manager	Japanese	Foreign	> 20	51-60	NO	NO
	L-Co-SM02	Co-Site Manager	Thai	Local	> 20	51-60	YES	YES
	L-P Eng	Project Engineer	Thai	Local	16-20	41-50	NO	NO
	*F3-AdM	Administrative Manager	Thai	Foreign	16-20	41-50	YES	YES
	L-Co-SM01	Co-Site Manager	Thai	Local	16-20	41-50	NO	NO
	F1-CM	Construction Manager	German	Foreign	> 20	>60	YES	YES
	F2-QS Eng	QS Engineer	Filipino	Foreign	16-20	41-50	YES	NO
ICJV Project-2C	L-Co-PM01	Co-Project Manager	Thai	Local	> 20	>60	YES	YES
	L-Co-CM	Co-Construction Manager	Thai	Local	16-20	41-50	YES	YES
	F-Co-PM	Co-Project Manager	Japanese	Foreign	> 20	51-60	NO	NO
	F-Tech Eng	Technical Engineer	Filipino	Foreign	> 20	41-50	YES	NO
	L-QS Eng	QS Engineer	Thai	Local	6-15	31-40	NO	NO
	L-ExecVP	Executive Vice President	Thai	Local	16-20	41-50	YES	NO
	L-QCM01	QC Manager	Japanese	Foreign	16-20	31-40	YES	YES
	F-CM02	Construction Manager	Japanese	Foreign	16-20	41-50	YES	YES
	*F-DAM	Deputy Admin Manager	Thai	Foreign	> 20	41-50	YES	YES

F = Foreign actor

L = Local actor

*Thai actor employed by a foreign partner

Table 7.3 Key Findings of Social Network Characteristics in Two Case Studies

Influencing SN Characteristics	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
Number of nodes	42	71	28	15	29	27
Number of ties	62	116	62	46	54	49
Network Density	0.099	0.005	0.249	0.733	0.180	0.204
Number of Clique	8	24	16	14	14	7
Knowledge source	Working colleagues Partners Bosses	Working colleagues Bosses	Working colleagues Bosses	Working colleague Boss Partner	Working colleague Boss Subordinate Partner	Working colleague Boss Subordinate
Way of communications	Face-to-Face	Face-to-Face Telephone	Face-to-Face	Face-to-Face	Face-to-Face Face-to-Face and Telephone	Face-to-Face
Reasons to exchange knowledge	Sharing knowledge and experience Their knowledge and experience Trust and their knowledge Responsibility	Teamwork Their knowledge and experience	Responsibility Trust and their knowledge	Coaching and sharing knowledge Trust and their experience Their knowledge and experience	Responsibility Their knowledge and experience Trust and their experience He is a partner so he is really to know the local knowledge	Responsibility Trust and their experience
Experts	LC01-Sup01 (Supervisor) F-PM03 (Project Manager) LC01-PM02 (Project Manager)	L-Sup02 (Supervisor) L-P Eng02 (Project Engineer) L-S Eng01 (Senior Engineer) L-PM05 (Project Manager) L-P Eng01 (Project Engineer)	F-PM01 (Project Manager) L-CM01 (Construction Manager) F-QS Eng01 (QS Engineer)	F-ADV (Technical Advisor) L-QC (Quality Control) L-Sup01 (Supervisor)	F2-Co-PM02 (Co-Project Manager) L-Co-SM02 (Co-Site Manager) L-P Eng (Project Engineer) *F3-AdM (Administrative Manager)	F-Co-PM (Co-Project Manager) F-Tech Eng (Technical Engineer) L-QS Eng (QS Engineer)
Knowledge consumers	LC01-Sup01 (Supervisor) LC01-PM02 (Project Manager) LC01-PM01 (Project Manager)	L-P Eng02 (Project Engineer)	F-QS Eng01 (QS Engineer) F-PM01 (Project Manager) F-QS Eng02 (QS Engineer)	L-Co-PM (Co-Project Manager) L-Co-CM02 (Co-Construction Manager) L-QC (Quality Control)	L-Co-SM02 (Co-Site Manager) F1-CM (Construction Manager)	F-Co-PM (Co-Project Manager) F-Tech Eng (Technical Engineer) L-ExecVP (Executive Vice President)
Knowledge broker	LC01-Sup01 (Supervisor) LC01-PM02 (Project Manager)	L-P Eng02 (Project Engineer)	F-PM01 (Project Manager)	L-QC (Quality Control)	L-Co-SM02 (Co-Site Manager)	F-Co-PM (Co-Project Manager) F-Tech Eng (Technical Engineer)
Gatekeeper	LC01-Sup01 (Supervisor)	L-P Eng02 (Project Engineer) L-Sup02 (Supervisor) L-S Eng01 (Senior Engineer)	F-QS Eng01 (QS Engineer) F-PM01 (Project Manager) L-CM01 (Construction Manager)	L-Sup01 (Supervisor) L-QC (Quality Control) L-Co-SM (Co-Site Manager)	L-Co-SM02 (Co-Site Manager) L-Co-PM01 (Co-Project Manager) L-Co-CM (Co-Construction Manager)	F-Co-PM (Co-Project Manager) L-ExecVP (Executive Vice President)
Focal actors	LC02-QS01 (Quality Surveyor)	L-PM05 (Project Manager)	F-CoM (Coordinate Manager)	L-Co-CM01 (Co-Construction Manager)	L-Co-CM (Co-Construction Manager)	*F-DAM (Deputy Admin Manager)

Influencing SN Characteristics	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
Co-membership in subgroup	F-PM03 (Project Manager) LC01-SVP (Senior Vice President)	L-P Eng02 (Project Engineer) L-Eng09 (Engineer)	F-QA/QCM (QA/QC Manager) F-PM01 (Project Manager) F-CM02 (Construction Manager) F-CoM (Coordinate Manager)	F-ADV (Technical Advisor) L-QC (Quality Control) L-Co-SM (Co-Site Manager) F-CM (Construction Manager)	L-Co-SM01 (Co-Site Manager) L-Co-PM01 (Co-Project Manager) L-P Eng (Project Engineer) *F3-AdM (Administrative Manager) F1-CM (Construction Manager) F2-QS Eng (QS Engineer)	F-Co-PM (Co-Project Manager) F-Tech Eng (Technical Engineer) L-QCM01 (QC Manager) F-CM02 (Construction Manager) F-DAM (Deputy Admin Manager)
Key actors in ICJV projects	LC01-Sup01 (Supervisor) F-PM03 (Project Manager) LC01-PM02 (Project Manager) LC01-PM01 (Project Manager) LC02-QS01 (Quality Surveyor) LC01-SVP (Senior Vice President)	L-Sup02 (Supervisor) L-P Eng02 (Project Engineer) L-S Eng01 (Senior Engineer) L-PM05 (Project Manager) L-Eng09 (Engineer) L-P Eng01 (Project Engineer) L-Eng08 (Engineer)	F-PM01 (Project Manager) L-CM01 (Construction Manager) F-QS Eng01 (QS Engineer) F-CoM (Coordinate Manager) F-QS Eng02 (QS Engineer) F-CM02 (Construction Manager) F-QA/QCM (QA/QC Manager)	F-ADV (Technical Advisor) L-QC (Quality Control) L-Sup01 (Supervisor) L-Co-PM (Co-Project Manager) L-Co-CM01 (Co-Construction Manager) L-Co-CM02 (Co-Construction Manager) L-Co-SM (Co-Site Manager) F-CM (Construction Manager)	F2-Co-PM02 (Co-Project Manager) L-Co-SM02 (Co-Site Manager) L-P Eng (Project Engineer) *F3-AdM (Administrative Manager) L-Co-SM01 (Co-Site Manager) F1-CM (Construction Manager) F2-QS Eng (QS Engineer) L-Co-PM01 (Co-Project Manager) L-Co-CM (Co-Construction Manager)	F-Co-PM (Co-Project Manager) F-Tech Eng (Technical Engineer) L-QS Eng (QS Engineer) L-ExecVP (Executive Vice President) L-QCM01 (QC Manager) F-CM02 (Construction Manager) F-DAM (Deputy Admin Manager)

According to Table 7.3, ICJV Project-2A had a higher network density (0.733), followed by ICJV Project-1C (0.249), and ICJV Project-2C (0.204). This indicates that 73.30% of the potential links exist between the actors in this ICJV project-2A had been made, which signified a successful knowledge transfer process. On the contrary, the network density in ICJV Project-1B was only 0.005 (0.50%), which is a very low value. This implies that all the connections that could have been made in ICJV Project-1B had not been made, indicating an unsuccessful transfer of knowledge.

In terms of the knowledge source and reasons to exchange knowledge, the vast majority of the key knowledge actors in these six ICJV projects indicated that 'work colleagues' were more frequently considered to be a source of knowledge in these two ICJV companies, followed by 'boss', 'partner' and 'subordinate', whereas partners were not considered to be knowledge sources in ICJV Project-1B, ICJV Project-1C and ICJV Project-2C. Additionally, the majority of the participants stated that they considered their work colleagues to be a reliable source of knowledge in ICJV contexts. This result correlates well with the research of [Kivrak et al \(2008\)](#), who found that colleagues were the most important source of knowledge for most employees.

In response to the question of how they communicated with team members, the survey participants indicated that they considered face-to-face interaction as the best mechanism to seek and share knowledge, followed by telephonic communication. This result is supported by [Hajidimitriou and Rotsios \(2009\)](#) and [Al-Salti \(2011\)](#), who found that personal exchanges and face-to-face communication are important mechanisms for members of an alliance to identify and understand the knowledge that needs to be transferred between them. The participants from these six ICJV projects also provided the reasons for exchanging their knowledge and experience with alliance members to facilitate learning: 1) Sharing knowledge and experience, 2) Their knowledge and experience, 3) Trust and their knowledge, 4) Responsibility, 5) Teamwork, 6) Coaching and sharing knowledge, and 7) He is a local partner, so he really knows about local knowledge. Specifically, the participants from ICJV Project-1A, ICJV Project-1B, ICJV Project-2A, and ICJV Project-2B argued that "Their knowledge and experience" was considered to be the most important reason for transferring knowledge. This result is also supported by [Kivrak et al \(2008\)](#), who found that 'personal experience' is considered to be an important reason for learning.

Moreover, the findings indicate that 'Trust and their knowledge' were regarded as significant reasons for transferring knowledge in five ICJV projects, excluding ICJV Project-1B. All the respondents considered 'trust' to be an important and fundamental enabler of knowledge transfer. Previous researchers of inter-organisational knowledge transfer, such as [Strach and Everett \(2006\)](#), [Hajidimitriou and Rotsios \(2009\)](#) and [Al-Salti \(2011\)](#), suggested that 'trust among individuals (partners)' was considered to be a key factor of the motivation to transfer knowledge. Trust bestows certain significance on the transferred data, information and knowledge. However, the key participants also proposed that trust was not the only factor that influenced KT in ICJV Projects, but teamwork, responsibility, coaching and sharing knowledge

and experience also had an impact on KT processes. The empirical findings are in line with those of [Carrillo \(1996\)](#) who found that 'teamwork' was the best way to transfer knowledge and technology in an integrated joint venture.

In terms of expatriate experts, the survey results and SNA showed that the key actor in these two case studies was the Project Manager, followed by the Construction Manager, Co-Project Manager, QS Engineer, Supervisor, Co-Construction Manager, Co-Site Manager, Project Engineer and Engineer respectively. This result is supported by [Landaeta \(2008\)](#) and [Park \(2011\)](#), who found that Project Managers are relied upon to implement KT methods that are aligned with the content and context of the project. In transferring knowledge across projects, they are faced with both opportunities and challenges, as are top managers and technicians. However, the results showed that Project Managers were not the only key actors who played an important role in the transfer of knowledge in ICJV Projects, but also Quality Surveyors, Project Managers, Co-Construction Managers, Coordination Managers and Deputy Admin Managers. This result is consistent with that of [Wadeechareon \(2015\)](#), who argues that a Moderator or Project Coordinator can drive cooperation and knowledge transfer processes between IJV partners. Based on the data collected for this study, the position of Coordination Manager (CoM) is regarded as an extremely important one in an ICJV project. It could be argued that a foreign partner needs to engage a Project Coordinator with the same nationality as the local partner in order to coordinate the relationship between the two partners. Therefore, ICJV partners must have the same orientation in order to achieve their mutual goals and objectives and complete a successful project. The most interesting finding, which was noted earlier, is that the key actors in this study did not consider 'technicians' as the key to successful KT in ICJV Projects. However, this result is contrary to the finding of [Park \(2011\)](#) that technicians play a pivotal role and are positively associated with the acquisition of knowledge and transfer of technology between foreign and local partners in joint ventures. Therefore, this finding emphasises the need to pay attention to the transfer of knowledge between technicians in ICJV Projects.

In addition, the findings indicated that the key knowledge actors in these ICJV projects were both local and foreign (e.g. Filipino, French, German and Japanese), which corresponds with [Park \(2011\)](#), who proposes that the transfer of knowledge from foreign expatriates could help local employees to understand it better and make foreign knowledge easier to transfer. [Park \(2011\)](#) also suggests that foreign experts play a pivotal role in providing local actors with an opportunity to meet foreign experts in ICJV projects and discuss issues with them, which often has a positive effect on knowledge acquisition in the learning of an international project.

7.2.2 KT methods and mechanisms

Four KT methods and mechanisms were used to transfer knowledge by the foreign and local partners in this study: socialisation (tacit-tacit), externalisation (tacit-explicit), combination (explicit-explicit) and internalisation (explicit-tacit). The key actors in the six ICJV projects stated that they especially used socialisation (tacit-tacit) and externalisation (tacit-explicit) to transfer tacit knowledge between partners.

The KT methods and mechanisms these key actors used to transfer knowledge and experience between the partners in the six ICJV Projects is shown in Tables 7.4 and 7.5. They stated that (S1) face-to-face communication, (E1) brainstorming, (E18) ad hoc meetings/minutes of meetings, (E19) regular/continuous meetings, (I1) learning-by-doing and (I7) mentoring and coaching were the KT methods and mechanisms they most used, while (S3) video or telephonic communication, (E2) memoranda and letters, (E17) group meetings/ team meetings, (I2) on-the-job-training and (I8) lessons-learned meetings were the second most-used KT methods.

These results are supported by [Kivrak et al \(2008\)](#) and [Hajidimitriou and Rotsios \(2009\)](#), who found that 'face-to-face interaction' was the main technique used to exchange knowledge. They are also consistent with the results of [Landaeta \(2008\)](#), [Kivrak et al \(2008\)](#) and [Hajidimitriou and Rotsios \(2009\)](#), who found that meetings play an important role in the knowledge transfer processes across projects. [Kivrak et al \(2008\)](#) also found that telephone calls and teleconferencing, informal chatting and storytelling were the three mechanisms most used to share knowledge and experience within projects. The results shown in Tables 7.4 and 7.5 also indicate that (S4) storytelling, (S5) visiting colleagues/other projects/companies, (S6) visiting foreign company and (S7) visiting plants or manufacturers were not used to acquire or exchange knowledge in these ICJV Projects. It is interesting to note that these results do not correlate with the research of [Wende and Haghirian \(2009\)](#), who found that 'storytelling' played a vital role and had a strong positive effect on exchanging complex idea and disclosing knowledge.

Additionally, the findings indicate that some of the actors in these ICJV projects preferred to use (S2) socialising out-of-hours (lunch or coffee breaks), as well as (S1) face-to-face communication, to exchange knowledge, and [Carrillo \(1996\)](#) supports the notion that socialising out-of-hours is an effective mechanism to transfer knowledge. This may be explained by the fact that the hierarchical attitude of the team members disappears when socialising out-of-hours and a more relaxed atmosphere is conducive to a discussion of prior experience.

Table 7.4 Comparison of KT methods and mechanisms in ICJV Projects

KT methods and mechanisms	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
(S) Socialisation (Individual to Individual)	(S1) Face-to-face communication (S3) Telephonic communication	(S1) Face-to-face communication (S4) Storytelling	(S1) Face-to-face communication (S2) Socialising out-of-hours (Lunch or Coffee breaks) *Social Network Application (e.g. Line)	(S1) Face-to-face communication (S3) Telephonic communication	(S1) Face-to-face communication (S2) Socialising out-of-hours (Lunch or Coffee breaks) (S3) Telephonic communication	(S1) Face-to-face communication (S2) Socialising out-of-hours (Lunch or Coffee breaks) (S3) Telephonic communication (S4) Storytelling
(E) Externalisation (Individual to Group)	(E1) Brainstorming (E2) Memoranda and letters (E17) Group / Team meetings (E18) Minutes of meeting (E19) Regular/ continuous meetings	(E1) Brainstorming *(E6) Chat rooms/'Toolbox' talks (E19) Regular/ continuous meetings *Daily report	(E1) Brainstorming (E2) Memoranda and letters (E3) Project history/ Case Writing (E9) Team collaboration tools (E17) Group / Team meetings (E18) Minutes of meeting (E19) Regular/ continuous meetings *Presentation	(E1) Brainstorming (E2) Memoranda and letters (E17) Group Meetings/ Team meetings (E18) Minutes of meeting (E19) Regular meetings and continuous meetings	(E1) Brainstorming (E3) Project history/ Case Writing (E17) Group Meetings/ Team meetings (E18) Minutes of meeting (E19) Regular meetings and continuous meetings *E-mail *Performance Report *Learn from the other projects from other contractors	(E1) Brainstorming (E2) Memoranda and letters (E3) Project history/ Case Writing (E6) Chat rooms/'Toolbox' talks (E7) Personal intranets, (E9) Team collaboration tools, (E17) Group Meetings/ Team meetings (E18) Minutes of meeting (E19) Regular meetings and continuous meetings *E-mail
(C) Combination (Group and Organisation)	(C1) Best practice		(C2) Knowledge Databases		(C1) Best practice	(C1) Best practice (C2) Knowledge Databases
(I) Internalisation (Individual to Group and Organisation)	(I1) Learning-by-doing (I2) On-the-job training *(I3) Special Training *(I4) Induction Training *(I5) Hand-on training/ Formal Training *(I6) Training with foreign company (I7) Mentoring and coaching	*(I3) Special Training *(I6) Training with foreign company (I7) Mentoring and coaching	*(I1) Learning-by-doing (I2) On-the-job training (I7) Mentoring and coaching (I8) Lesson-learned Meeting	(I1) Learning-by-doing (I2) On-the-job training (I3) Special Training (I4) Induction Training (I5) Hand-on training /Formal Training (I6) Training with foreign company (I7) Mentoring and coaching (I8) Lesson-learned Meeting	(I1) Learning-by-doing (I2) On-the-job training (I7) Mentoring and coaching (I8) Lesson-learned Meeting *Training from foreign suppliers *In-house training *Visiting the factory or manufacturer of the suppliers. *Discuss with the patentee (knowledge holder) from the supplier companies	(I1) Learning-by-doing (I2) On-the-job training (I7) Mentoring and coaching (I8) Lesson-learned Meeting

*KT Methods and mechanisms derived from the empirical data

Table 7.5 Comparison of KT Methods and Mechanisms of the ICJV PROJECTS

KT Methods and Mechanisms	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
(S) Socialization (Tacit to Tacit)						
1. Face-to-face communication/ Face-to-face meetings	X	X	X	X	X	X
2. Socializing out-of-hours (Lunch or Coffee breaks)	X		X	X	X	X
3. Video or Telephonic communication		X			X	X
4. Storytelling					X	
5. Visiting colleagues/ other projects/ companies					X	
6. Visiting foreign company						
7. Visiting plants or manufacturers	X	X				
*8. Social Network Application (e.g. Line)						
(E) Externalization (Tacit to Explicit)						
1. Brainstorming	X	X	X	X	X	X
2. Memorandums and letters	X		X	X		X
3. Project history/ Case Writing			X		X	X
4. Knowledge sharing board						
5. Web-based discussion group						
6. Chat rooms/ 'Toolbox' talks		X				X
7. Personal intranets						X
8. Blogs/ Websites... (e.g. YouTube)		X				
9. Team collaboration tools			X			X
10. Expert systems/ Information system/ Information Technology						
11. Computer-aided system/ 3d-models)						
12. Simulation and games						
13. Decision support systems						
14. Problem-solving technology						
15. Learning Materials (E-Learning)						
16. Communities of Practices (COPs)						
17. Group Meeting/ Team meeting	X		X	X	X	X
18. Ad hoc Meeting/ Minute Meeting	X		X	X	X	X
19. Regular meeting and a continuous meeting	X	X	X	X	X	X
*20. Daily report		X				
*21. Presentation			X			
*22. Email					X	X
*23. Performance report					X	
(C) Combination (Explicit to Explicit)						
1. Sharing best practice/ Best practices/ A share best practice database	X		X		X	X
2. Knowledge Databases						X
3. Web-based access to data						
4. Intranet and internet pages						
5. Lesson Learned Database						
(I) Internalization (Explicit to Tacit)						
1. Learning-by-doing/ Workshop/ Apprenticeships	X	X	X	X	X	X
2. On-the-job training	X		X	X	X	X
3. Special Training/ Trained in concentrated courses	X			X		
4. Induction Training	X			X		
5. Hand-on training/ Formal Training	X			X		
6. Training with a foreign company	X	X		X		
7. Mentoring and coaching	X	X	X	X	X	X
8. Lesson-learned Meeting	X		X	X	X	X
*9. Training from foreign suppliers					X	
*10. In-house training					X	
*11. Learning from the knowledge holder from the supplier companies					X	

*KT Methods and mechanisms derived from the empirical data

Furthermore, it seems that most of the key actors in these ICJV projects were likely to have used (I7) mentoring and coaching as a method and mechanism to transfer knowledge across their companies. [Landaeta \(2008\)](#) and [Stevens \(2010\)](#) also found that most of their respondents utilised 'mentoring and coaching' as a method of passing on knowledge across projects. In contrast, the key actors in ICJV projects-1A and -1C commented that they preferred to transfer knowledge based on 'learning-by-doing' during the construction process. This correlates well with research conducted in North Africa and South East Asia by [Carrillo \(1995\)](#), as a result of which, [Carrillo \(1996\)](#) reported that all construction contractors praised the merits of '(I1) learning-by-doing' as the most effective KT mechanism, as well as 'on-the-job training' and 'training with the foreign company' ([Carrillo, 1995 and Stevens, 2010](#)).

However, another important finding was that the key actors in ICJV project-1B suggested that 'presentations', 'daily reports' and 'performance reports' were also key tools to exchange knowledge. This is supported by [Kivrak et al \(2008\)](#), who observe that reports and the reporting process are considered as the most frequent tools used to accumulate and store knowledge gained in projects.

As noted earlier, the most interesting finding was that the key participants in this study did not emphasise the use of ICTs in (E) externalisation (tacit to explicit; e.g. knowledge-sharing boards, web-based discussion groups, chat rooms/'toolbox' talks, personal intranets, blogs/websites, e.g. YouTube), team collaboration tools, expert systems, computer-aided systems/3d-models, simulation and games, decision support systems, problem-solving technology, learning materials (E-Learning), communities of practice (COPs)) and (C) combination (explicit to explicit; e.g. sharing best practice, knowledge databases, web-based access to data, intranet and internet pages and lessons-learned databases) as key tools to transfer knowledge between them. This seems to contradict many published research papers, in which the role played by ICTs in inter-organisational knowledge transfer is highlighted. Based on this finding, actors in international construction projects need to pay greater attention to the use of ICTs to transfer knowledge. Further proof of the advantages of using ICTs to acquire and transfer knowledge is provided below.

7.2.3 Tie contents

The characteristics or type of knowledge was found to play an important role in the transfer of knowledge in ICJV Projects. This finding provides further support for prior research on the impact of characteristics or types of knowledge on the successful transfer of knowledge among organisations. The knowledge flow between the key actors in these ICJV projects is shown in Table 7.6.

Table 7.6 Comparison of the knowledge flow between key actors in the ICJV PROJECTS

Type of knowledge	Case Study One			Case Study Two		
	ICJV Project-1A	ICJV Project-1B	ICJV Project-1C	ICJV Project-2A	ICJV Project-2B	ICJV Project-2C
A. Design Knowledge and Skills						
1. Conceptual skills	X	X	X	X	X	X
2. Design skills and Details design		X		X	X	X
B. Technical Expertise						
1. Construction techniques	X	X	X	X	X	X
2. Construction knowledge	X	X	X	X	X	X
3. Product process and development	X	X	X	X	X	X
4. Transfer and movement of materials and manpower	X	X	X	X	X	X
5. Accumulated experience and track record						
C. Management Expertise						
1. Project management	X	X	X	X	X	X
2. Project planning and control	X	X	X	X	X	X
3. Project resource management	X	X	X	X	X	X
4. Human resource management	X	X	X	X	X	X
5. Organizational management	X	X	X		X	X
6. Procurement system	X	X	X		X	X
7. Subcontracting arrangement and management	X	X	X		X	X
8. Employment of subcontractors in international project	X	X	X	X	X	X
9. Risk management			X		X	X
10. Site management	X	X	X	X	X	X
11. Cost management						
D. Technological Expertise						
1. Technologies in building and component		X	X	X	X	X
2. Advanced production systems		X		X	X	
3. Specific technology	X	X		X	X	
4. IT systems		X				
5. New technologies from overseas collaboration	X	X		X	X	
E. Economic, Marketing and Financial Expertise						
1. Investment in the construction sector	X			X	X	
2. Marketing knowledge/ Marketing know-how				X	X	
3. Financial risk	X			X	X	
4. Financial backing/ Financial support					X	
5. Project fully and partially funded from overseas					X	
6. Practicing under-pricing to win projects					X	
7. Bidding strategy incorporates the preferential margin scheme	X			X	X	
8. Avoiding paying local taxes					X	
9. Economic environment					X	
10. Industry structure					X	
11. Macroeconomic conditions					X	
F. Quality Assurance and Control Expertise						
1. Quality assurance and control		X	X	X	X	X
2. Quality standard		X		X		
G. Safety Expertise						
1. Safety standard			X	X	X	X
*2. Health, Safety, and Environment						X
H. Construction Resources						
1. Construction resources	X	X	X	X	X	X
2. Construction equipment	X	X	X	X		X
3. Labor productivity		X	X			
4. Local Resources		X	X		X	X
5. Comprehensive support facilities		X				
I. Training Programmes						
1. Training of skilled worker, their migration for overseas jobs and domestic construction			X			X
2. Manpower training programmed						X
3. Training programmed						X
*4. Coaching construction site foreman to include safety in their dairy						X
J. Local Condition and Culture						
1. Foreign/ Local culture and National culture			X	X	X	X
2. Local language				X		X
3. Knowledge of local situation/ institution				X	X	X
4. Knowledge of the local market condition	X		X	X	X	X
5. Local government policies					X	X
6. Knowledge of local customers	X		X	X	X	X
7. Administrative procedures			X		X	X
8. The strength of legal system/ Legal system			X		X	X
9. Political stability/ Political system			X		X	X
10. Gaining the knowledge under local conditions						X
11. Local business practice			X	X	X	X

*Type of knowledge mentioned by the key actors in the interview

All the key participants in the six ICJV projects noted that they had exchanged (A) design knowledge and skills (e.g. (A1) conceptual skills), (B) technical expertise (e.g. (B1) construction techniques, (B2) construction knowledge, (B3) product process and development, (B5) accumulated experience and track record, (C) management expertise (e.g. (C1) project management, (C2) project planning and control, (C4) human resource management, (C8) employment of subcontractors in an international project, (C10) site management, (C11) cost management), and (H) construction Resources (e.g. (H1)). Therefore, it seems that construction resources were the most important type of knowledge and experience transferred between partners, while (B) technical expertise (e.g. (B3) product process and development), (C) management expertise (e.g. (C3) project resource management, (C5) organisational management, (C6) procurement systems, (C7) subcontracting arrangement and management, and (C9) risk management), (D) technological expertise, (e.g. (D1) building technologies and components, (F) quality assurance and control expertise (e.g. (F1) quality assurance and control, and (H) construction resources, (e.g. (H1) construction resources, (H2) construction equipment, (H4) knowledge of local market conditions and (H6) knowledge of local customers were secondary types of knowledge that flowed between the key actors in these ICJV Projects.

The most interesting finding is that the key participants in ICJV Project-1B, ICJV Project-1C and ICJV Project-2C of this study did not highlight (E) economic, marketing and financial expertise as significant knowledge to transfer in their project. Moreover, the results showed that the key actors in ICJV Project-1A did not exchange knowledge of (F) quality assurance and control expertise or (G) safety expertise. The key actors in ICJV Project-1B also indicated that they had not exchanged knowledge of (G) safety expertise. Another interesting finding is that most of the key participants in these ICJV Projects did not highlight the use of (I) training programmes to acquire knowledge. Only the key actors in ICJV Project-2C used (I) training programmes (e.g. (I1) training of skilled migrant workers for overseas and domestic construction, (I2) manpower training programmes and (I3) training programmes. Moreover, they suggested that 'coaching the construction site foreman to include safety in his daily verbal exchanges' was an important component of the ICJV Project. This finding corresponds with the assertion of Pete et al (2010) that coaching construction site foremen to include safety in their daily verbal exchanges with workers has a significantly positive and lasting effect on safety levels. Since this is a proximal estimate of work-related accidents, it is recommended that coaching construction site foremen to include safety in their daily verbal exchanges with actors should be an essential component of an ICJV construction project.

Another interesting finding, which was noted earlier, was that none of the key participants in ICJV Project-1B mentioned that knowledge of (J) local conditions and cultures was important. This is contrary to many published research papers, in which the importance of (J) local conditions and cultures is highlighted in inter-organisational knowledge transfer. Therefore, this finding emphasises the need for greater attention to be paid to the knowledge of local conditions and cultures in the context of international construction projects.

7.3 REVISED CONCEPTUAL FRAMEWORK

Based on the evidence from the cross-case analysis presented and discussed in the previous section, the original conceptual framework on KT processes in ICJV Projects was further developed by making an extensive review of the literature of the main ICJV performance and success factors, knowledge facilitators, key enabling and inhibiting factors, types of knowledge and knowledge transfer methods and mechanisms. Further details of the development of the original framework were provided in Chapter 3. The original framework presented in Figure 3.1 was tested in practice through case studies. As a result, the revised conceptual framework provides a more holistic understanding of the key enabling and inhibiting factors that influence knowledge transfer processes in ICJV Projects in Thailand. This framework, which is shown in Figure 7.1, suggests that a successful transfer of knowledge depends on four factors.

Firstly, the type of knowledge involved affects the success of transferring it. The transfer of different types of knowledge between actors in ICJV organisations requires the establishment of efficient KT methods and mechanisms.

Secondly, the methods and mechanisms utilised to transfer crucial knowledge from one partner to another have been found to be essential for the success of KT processes. The four KT methods and mechanisms used to transfer knowledge between foreign and local partners in this study, namely, socialisation (tacit-tacit), externalisation (tacit-explicit), combination (explicit-explicit) and internalisation (explicit-tacit), played a pivotal role in the successful transfer of knowledge in these six ICJV projects. The participants noted that they had all used these four types of mechanisms, especially to transfer tacit knowledge (e.g. socialisation (tacit-tacit) and externalisation (tacit-explicit)) between the partners.

Thirdly, the performance and success factors of the ICJV determine the effectiveness and efficiency of a successful knowledge transfer. These factors consist of ICJV management, ICJV project performance, ICJV project-related and partners' performance. Therefore, it could be argued that a successful transfer of knowledge in ICJV projects depends on attention being paid to the management of time, costs and quality to complement the contractual arrangements, as well as the partners' level of commitment and willingness to allocate adequate time to sustaining their relationship by transferring various types of business knowledge between them.

Fourthly, knowledge facilitators are also considered to be important in order to establish a more effective and efficient transfer of knowledge. The empirical findings also suggest that a successful knowledge transfer cannot be achieved unless partners are open and transparent. Partners' willingness and openness are considered to be a key factor in determining the amount and quality of knowledge that could be transferred by their staff during the ICJV project. Willingness and openness reflect the degree to which foreign partners spontaneously and openly transfer knowledge to team members of local organisations.

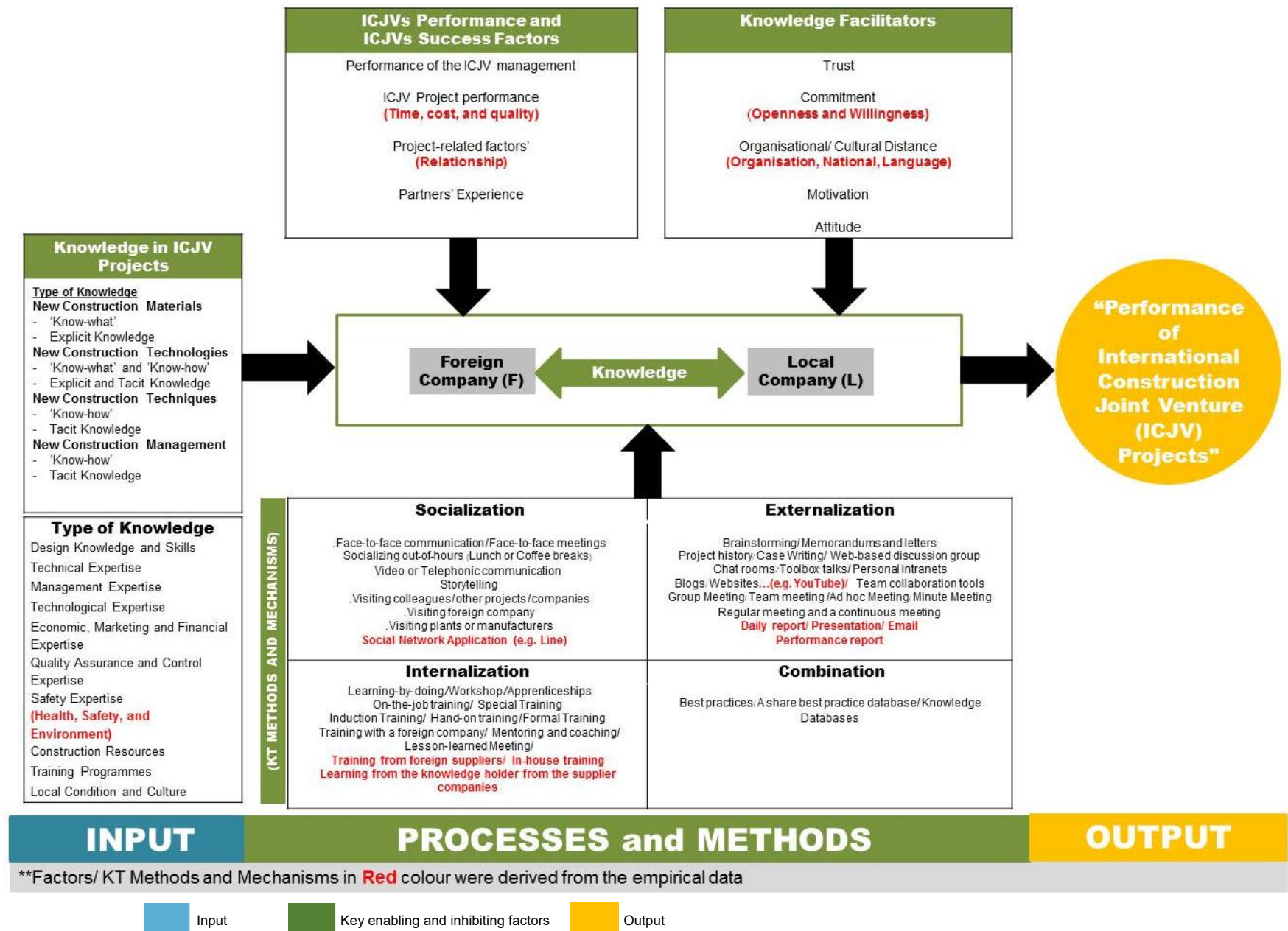


Figure 7.1 Revised conceptual framework for KT processes in ICJV projects

7.4 HOW TO USE THE FRAMEWORK IN PRACTICE

Conceptual frameworks are recommended as a mechanism to apply theory to enhance implementation endeavours. Therefore, the purpose of this framework is to facilitate a better understanding of the critical factors that influence the success of ICJVs and enhance the transfer of knowledge in ICJV Projects in Thailand.

The results of this study are expected to be useful for key actors who need to make critical management decisions with regard to the transfer of knowledge. The conceptual framework provides general guidelines for practitioners in ICJV projects in Thailand to construct effective KT processes, although it could also be applied to other construction projects or businesses. The framework has been designed in such a way that it could be used in any project environment by simply replacing the type of knowledge in ICJV projects with other kinds of knowledge that need to be transferred in a project team. In summary, this framework can be seen as a management tool to support and enhance the transfer of essential knowledge in ICJV projects. The capacity of team members to absorb the transferred information also needs to be enhanced to maximise the benefits of KT in ICJV projects. The results of this study suggest that the team members in these ICJV projects had accumulated and absorbed sufficient new knowledge and experience to achieve a superior KT outcome.

A number of significant contributions and valuable implications for practice were clearly made in this study, e.g. type of knowledge, key enabling and inhibiting factors, and KT methods and mechanisms in ICJV projects. The findings of this study suggest that improving the transfer of knowledge from key actors e.g. project managers, supervisors, construction managers, senior engineers, project engineers, and etc. will enhance the KT processes in ICJV projects. Effective KT is a complex process that requires key actors, especially project managers, to consider issues on several levels. A balance of the main factors that influence KT processes is also essential. Key actors in ICJV projects could utilise this knowledge framework in each specific construction project and promote it within their teams and partners. The process of using the knowledge transfer framework in an ICJV project is described below.

Firstly, the various types of knowledge that need to be transferred must be considered and matched to the process to be used to make the transfer so that the knowledge flow can be specifically adapted to each ICJV project. This involves the project manager and/or the construction managers (from both the local and foreign partner) cooperating with the coordination manager and deputy admin managers who are employed to complete special projects to organise and coordinate the information required for the project.

Secondly, the key actors should define the main factors that enable or inhibit the ICJV performance and success, knowledge facilitators, and KT methods and mechanisms. The top management of the ICJV Project should design features (training, workshop, or apprenticeships) for their teams to be aware of the main enabling and inhibiting factors that influence KT processes in ICJV Projects. Moreover, a high level of knowledge facilitators,

especially trust, is needed between the team members in the ICJV projects. Teamwork should be strongly emphasised and cross-functional work teams should be regularly formed within the in the projects. Commitment between partners and the behaviours of leaders also need to be based on a philosophy of openness and willingness. A strong culture of experimentation, together with a high level of trust and collaboration and a co-operative climate must exist in order to increase the propensity of the organisations' members to share knowledge and information with each other. Furthermore, this conceptual framework is designed to make them more aware of choosing the potential KT methods and mechanisms for each knowledge consumers. Hence, a wider selection of KT methods and mechanisms can be provided by this knowledge transfer framework in the workshop. Moreover, organisations should also continually examine and assess the structured of processes to facilitate KT.

As a result, certain organisational design features need to be addressed in order to increase the understanding and awareness of the specific types of knowledge needed in particular projects. Organisations must ensure that both of the parties in the transfer process have the necessary knowledge base to learn from and understand each other. In addition, this study highlights the importance of utilising the appropriate KT methods and mechanisms that are available to ICJV Projects in the local partner in an ICJV project to receive knowledge from a foreign partner. It appears that different methods and mechanisms are associated with certain types of knowledge. In summary, this framework can be used to support and enhance the KT processes in ICJV projects.

In summary, this knowledge transfer framework was found to be very useful during this Ph.D. research in terms of helping to maintain a focus on the main aim and objectives of the research throughout the literature review. Moreover, it is also supported the design of the questionnaire, the data collection and it guided the data analysis process. Most importantly, it is hoped that the results of this study will encourage the key actors in ICJV projects to pay closer attention to KT processes. It is also emphasised in this study that it is critical for a local organisation to design a comprehensive KT processes and strategies that enable their staff to access to knowledge and maximise their level of interaction of their staff with that of the foreign partners in order to facilitate more effective and efficient KT in ICJV projects. As a result, the framework is not only able to be applied in practice to ICJV projects, but it can also help researchers to holistically examine KT processes. The findings of the study are expected to serve as a valuable reference for construction companies to utilise KT processes in ICJV projects to their competitive advantage.

8. CONCLUSION

8.1 INTRODUCTION

The achievements of the research and its contribution to knowledge will be discussed in this chapter, as well as its limitations. The scope for future research will also be proposed at the end of the chapter.

The rationale for this study was derived from an unprecedented change in the nature of the global business environment in today's knowledge economy, in which the ability to deliver new products and services to the market ahead of rivals is the key to achieving a sustainable competitive advantage. One of the ways to address this unprecedented change in today's knowledge economy is for multinational organisations in developed and developing countries to transfer and share their knowledge of IJV projects. Joint ventures between multinational organisations in developed and developing countries are considered to be a successful strategy for them to benefit from international market opportunities in this globalised world. The continued intensity of global competition increasingly makes knowledge a crucial strategic resource, which is regarded as a key factor, not only of the successful completion of projects, but also as a critical asset for an organisation to achieve a competitive advantage. Success in today's competitive business environment is strongly related to an organisation's ability to build its capacity based on the acquisition and utilisation of knowledge. Knowledge transfer (KT) is an important process whereby organisations identify and learn from specific knowledge that exists in another organisation. As a result, it is also recognised as one of the major factors of the successful implementation of all types of projects. Thailand's economic and infrastructure development have risen significantly and rapidly in recent years and the construction industry continues to play an essential role in this development. As a result of many construction activities being undertaken to meet the high demands of an expanding market, a number of international construction firms have entered Thailand to assist these sophisticated projects. Hence, it is important to better understand how knowledge is transferred between firms and adopted in International Construction Joint Venture (ICJV) projects. Therefore, since the purpose of this study was to integrate knowledge transfer and social networks to conceptualise and explain how knowledge is successfully transferred in ICJV projects in Thailand, its main aim were as follows;

"To identify and evaluate the processes of transferring knowledge in International Construction Joint Venture (ICJV) projects in Thailand"

It was necessary to accomplish the following objectives in order to achieve this aim;

- To identify the key concepts in the area of knowledge transfer and social networks.
- To identify the key enabling and inhibiting factors that influences the transfer of knowledge in ICJVs.
- To develop a conceptual framework based on these key concepts and factors.

- To validate the conceptual framework in practice using fieldwork data.
- To develop a knowledge transfer framework for joint venture partnerships for Thai construction companies and makes recommendations for its application.

8.2 ACHIEVEMENT OF THE RESEARCH OBJECTIVES

Identification of the key concepts in the area of knowledge transfer and social networks

The first objective was achieved based on a review and discussion of the literature on the knowledge transfer processes in Joint Ventures (JVs), International Joint Ventures (IJVs), International Construction Joint Ventures (ICJVs), Knowledge Management (KM), Knowledge Transfer (KT) and the Social Network (SN) Theory. The literature review began with an overview of Joint Ventures (JVs) and International Joint Ventures (IJVs) related to construction projects, which provided valuable information about the way in which knowledge is transferred between the partners in these types of project. It was confirmed that construction firms are able to exploit business opportunities and enter new markets abroad by forming ICJVs and this was a means to fully understand various emerging International Construction Joint Venture Projects (ICJV Projects) and their advantages. Moreover, a key aspect that was highlighted was the relevance of the domain of knowledge management, such as knowledge locations, knowledge types and knowledge transferred in adding a knowledge perspective to collaborative project processes. Secondly, the review involved an overview of Social Network Analyses (SNAs). The importance of key characteristics such as the size of the network, network structure, network density, degree of centrality, betweenness centrality and network cliques was examined. A Social Network Analysis in the context of knowledge transfer was conducted in order to identify the key actors in each project.

Knowledge gaps in the key enabling and inhibiting factors that influence the transfer of knowledge in ICJVs

The transfer of knowledge in ICJV Projects is characterised by many definitions and is plagued by many limitations. The first gap in the literature concerns the absence of the factors that impact a successful knowledge transfer in a more comprehensive way. There is a lack of research that provides an analysis of the key enabling and inhibiting factors that influence the knowledge transfer process. Prior researchers seem to have only focused on the type of knowledge transferred, the source, the recipient or the relationship between the source and the recipient of the knowledge. No researcher has examined all of these factors simultaneously in the context of inter-organisational knowledge transfer. Therefore, there is still a limited understanding of what contributes to successful knowledge transfer processes in ICJV Projects. Moreover, an extensive review of the literature indicated that, although a large number of previous researchers have examined knowledge transfer processes, little is known about how knowledge is transferred from a foreign partner to a local partner in the context of ICJVs. Another important gap that was identified is that, despite the growing number of studies related to ICJV projects, limited research has been conducted in developing countries. Hence, the importance of this study is that it overcomes this weakness by filling these gaps in the literature

and responding to the above insufficiency by providing an analysis of how knowledge is successfully transferred from a foreign to a local actor in the context of ICJV Projects in a developing country.

Development of a conceptual framework based on these key concepts and factors

A literature review of the key constructs related to the phenomenon being studied and the relationship assumed to exist between them was undertaken in order to achieve the second objective. The conceptual framework of this research consists of the knowledge input, KT processes and knowledge output revealed in prior literature related to ICJV projects. As the key contribution of the research to existing knowledge, it was used to explore how knowledge is transferred between the actors in selected ICJV projects by integrating the key enabling and inhibiting factors involved in the KT processes in ICJV projects. This framework not only includes the key KT methods and mechanisms that influence KT processes in ICJV projects that international construction companies need to note, but it also paves the way for future additional research on how to identify the key actors in ICJV projects.

Validation of the conceptual framework in practice using fieldwork data

In order to achieve the fourth objective, the validation of the conceptual framework was strengthened by a clear and detailed explanation of the aims and the main objectives of the research when arranging the appointments and at the beginning of the interviews. Therefore, the findings and conclusions of the study are likely to be more accurate and convincing because this explanation raised more lines of inquiry and multiple measures of the studied phenomenon. Moreover, the initial draft of each case study report and the integrated conceptual framework were e-mailed to some of the key participants in order to verify their accuracy and invite comments for amendments, as well as further feedback and clarification, where necessary.

Development of a knowledge transfer framework for joint venture partnerships for Thai construction companies and recommendations for its application

In order to achieve this objective, the original conceptual framework of KT processes in ICJV projects was developed based on an extensive literature review of the key areas of ICJV performance and success factors, knowledge facilitators, key enabling and inhibiting factors, types of knowledge, and methods and mechanisms used to transfer knowledge. A more detailed description of the development of the original framework was provided in Chapter 3. The original conceptual framework, which was presented in Figure 3.7, was tested in practice through case studies, and the revised version was presented in Figure 7.1 in Chapter 7. This knowledge transfer framework facilitates a more holistic understanding of the key enabling and inhibiting factors that influence knowledge transfer processes in ICJV Projects in Thailand.

Having achieved the five research objectives, the analysis of the interviews and validation of the key participants are discussed below.

Firstly, according to the literature review, international construction projects are high-risk ventures that require enormous financial backing. Therefore, they need actors with various specialised skills, which include technical and management expertise and, most significantly, they require an efficient knowledge transfer mechanism for the key actors to acquire and

exchange essential information. Specifically, the main areas in which local companies lack expertise and need to learn from their foreign partners are project management, project planning, and expertise in high-speed grouting technology and high levels of quality control. These were the areas derived from the empirical data and used to develop the knowledge transfer framework. Based on the interview results and validation of the key participants, 'Health, Safety and the Environment' is another essential component of an international construction project.

Secondly, KT methods and mechanisms were found to be critical in transferring partners' crucial knowledge. The participants from the six ICJV projects noted that they had used four types of mechanisms to transfer knowledge between them, especially for tacit knowledge (e.g. socialisation (tacit-tacit) and externalisation (tacit-explicit)). Most of them used KT methods and mechanisms such as face-to-face communication, brainstorming, ad hoc meetings/minutes of meetings, regular/continuous meetings, especially weekly meetings, learning-by-doing, and mentoring and coaching as the most important means to transfer knowledge and experience between partners. On the other hand, storytelling, visiting colleagues/other projects/companies, visiting a foreign company and visiting plants or manufacturers were never used in these ICJV projects, neither were ICT collaboration tools (e.g. expert systems, decision support systems, COPs, etc.).

Thirdly, according to the review of the key performance and success factors of ICJVs in the literature, the performance of strategic alliances is measured in terms of 1) 'project performance'; 2) 'performance of IJV management'; 3) 'partner's performance'; 4) 'partner's satisfaction'; 5) 'host country conditions' and 6) 'project-related factors'. In addition, many researchers found that successful knowledge transfer processes in joint venture projects depend on seven factors: 1) preparation, 2) finance, 3) JV formation, 4) society and culture, 5) technical and technological input, 6) services and 7) human resources and employment. Therefore, a knowledge transfer framework should consist of factors that define the performance of ICJV management, ICJV project performance, ICJV project-related and partners' performance. According to the data gathered from the ICJV projects in this study, the performance of the IJVs' management played a critical role in determining the effectiveness and efficiency of the knowledge transfer processes within the project. Secondly, the ICJV project performance was the measure of how well the targets had been met, including the completion of the project on time, within budget and with good quality. Thirdly, the project-related or relationship between the partners played an important role in the success of these ICJV projects generally, and the transfer of knowledge in particular. Fourthly, the key findings from the six ICJV projects indicated that the partners' performance and experience played a critical role in KT processes in ICJV projects.

Fourthly, based on a review of the literature to identify the knowledge facilitators in projects, trust, commitment, cultural distance, prior experience and communication were found to be important components of effective and efficient knowledge transfer processes. Therefore, the development of the knowledge transfer framework consisted of key knowledge facilitators

found in these ICJV Projects, such as trust, commitment, organisational/cultural distance, motivation and attitude. The majority of the participants emphasised the critical importance of 'trust' as the foundation of successful KT. Trust was considered to be one of the most effective factors to foster team members' level of knowledge transfer and learning in ICJV projects. Most of the key actors asserted that a relationship based on commitment facilitated fruitful collaboration, which led to better and faster access to crucial knowledge. Moreover, partners' openness and willingness were perceived to be essential for determining the quality of knowledge transferred by the actors in the six ICJV projects. Moreover, the empirical findings from these six ICJV projects clearly demonstrated that organisational distance (including organisational and national cultural distance) has a huge impact on the success of transferring knowledge. The organisational distance between partners was generally challenging for the ICJV relationship, but particularly KT. Motivation was also identified as an important factor of the transfer of knowledge between partners. The project managers and construction managers of all six ICJV projects agreed that motivation contributed to the overall ICJV performance as a vital enabling factor in the successful transfer of knowledge between ICJV actors. Attitude was found to be another knowledge facilitator. Actors' attitude was constantly cited as an important factor of knowledge transfer across the cases. It was found that the vast majority of actors in the ICJV projects in the two case studies were eager to learn new knowledge, skills and competencies from partners. Attitude was frequently emphasised by many of the participants as a key enabler of successful knowledge transfer.

8.3 KEY FACTORS INFLUENCING KNOWLEDGE TRANSFER PROCESSES

8.3.1 KEY findings from the literature

The key factors that influence knowledge transfer processes will be examined in this section based on six main themes, i.e. performance and success factors of ICJVs, knowledge facilitators, key enabling and inhibiting factors of the transfer of knowledge in ICJVs, and knowledge transfer methods and mechanisms.

1) Key Findings from the review of the Performance and Success Factors of ICJVs

It emerged from the literature review that the measurement of the performance of strategic alliances has long been an important topic of research in the international management field. The key performance and success factors of ICJVs identified from the literature are defined as 1) 'project performance' or the extent to which predefined project objectives have been achieved; 2) 'performance of the IJV management' or the effectiveness of control of the IJV operation; 3) 'partners' performance' or the extent to which the current company's objectives have been achieved as a result of undertaking a project based on an IJV; 4) 'partners' satisfaction with the overall performance of the IJV', which is one of the most frequently-used subjective means of measuring an IJV performance; 5) 'host country conditions' and 6) 'project-related factors', which refer to the client's completion of payment, the relationship with other parties in the project, the clarity of the project definition and the effectiveness of

project management functions, such as planning, monitoring and control. Additionally, a great many researchers have identified seven factors that influence a successful knowledge transfer process in joint venture projects: 1) preparation, 2) finance, 3) JV formation, 4) society and culture, 5) technical and technological, 6) services and 7) human resources and employment. Therefore, based on the review of the literature gathered for this research, it is clear that a successful construction project greatly depends on the quality of the competent humans in the organisations and their ability to work as a team in a joint venture.

2) Key Findings from the review of Knowledge Transfer Processes

Organisations' success in today's competitive business environment is strongly related to their ability to utilise knowledge and build their capacity. Effectively managing their knowledge and capacity can enable organisations to maintain their position in an increasingly crowded commercial field. Knowledge is perceived to be the most valuable resource for organisations and the ability of IJV companies to transfer knowledge within and between them plays a significant role in enabling them to fully benefit from their new international relationship. In summary, the successful transfer of knowledge is an important factor for organisations to increase their competitive advantage in a rapidly changing business environment. KT, which refers to the transfer of global expertise between firms, plays a critical role in the long-term existence of organisations, as well as being recognised as one of the key factors of success in the implementation of any kind of project. It is strategically important to organisations for several reasons, which include its status as social capital in construction management, the role it plays in new knowledge creation, learning organisations, technology transfer and communities of practice, as well as its ability to significantly enhance the management of construction projects. Previous researchers have suggested that three factors are likely to influence KT, namely, the source and the recipient, the type of knowledge and the knowledge facilitators in the environment in which the transfer takes place.

3) Key Findings from the review of The Source and The recipient

It emerged from the literature review that the knowledge exchanged between the source and the recipient enables firms that aspire to increase their international business activities to develop new knowledge and skills that are essential to complete international projects. Both the flow and the transfer of knowledge are strategically important to organisations for several reasons. Knowledge flows between two key actors, namely, the knowledge holder and the knowledge receiver, who are responsible for the transfer and acquisition of knowledge respectively. The effectiveness of learning in IJVs does not solely rest on the intention and capability of local members to learn; it also depends on the source of the knowledge, since the process of transferring and acquiring knowledge involves two key players, namely, the knowledge holder (foreign partner) and the knowledge receiver (local partner). Therefore, foreign personnel who work at contact points with a local partner must be sufficiently knowledgeable to plug the gap in the knowledge between the source and the recipient.

4) Key Findings from the review of Types of knowledge transferred in ICJVs

It was found from the literature review that there has been a growing interest in the acquisition of managerial knowledge by firms in developing countries, particularly by establishing an international strategic alliance with firms from developed countries. International construction projects require actors, who possess various knowledge and skills, including technical expertise and management expertise, as well as sufficient financial backing to absorb the huge risk involved; more significantly, they require the efficient transfer of knowledge between foreign and local firms. The main areas where local companies lack expertise and need to learn from their foreign partners are project management, project planning, high-speed grouting technology and high-level quality control. All of these types of knowledge were identified as flowing between the actors from local and foreign partners in international construction projects in the literature review. Therefore, local partners who wish to enter an emerging market and secure a long-term competitive advantage in this new environment need to quickly develop the required resources. Hence, it is essential to understand how new knowledge can be transferred and adopted by partners in ICJV projects.

5) Key Findings from the review of Knowledge Facilitators

A literature review was undertaken to identify the state-of-the-art of knowledge facilitators and it was found that the context in which knowledge is transferred, which includes elements such as trust, commitment, cultural distance, prior experience and communication, can strengthen or weaken the flow of knowledge within projects. **Trust** plays a major role in the success of an ICJV and has an enormous impact on the way in which partners work together. As a result, trust determines the degree of knowledge transferred and the efficiency and effectiveness of the KT process. Hence, trust is one of the most significant elements of an inter-partner relationship. **Commitment** involves the willingness of IJV partners to make an effort to exchange information on behalf of the IJV. The **cultural distance** between partners is one of the distinctive contextual factors that play an important role in IJV learning based on the literature. However, the difference or distance between two cultures has little relevance until those cultures interact. In an IJV, the cultural distance can produce friction when the parent firms interact with each other at various stages of the IJV's lifecycle. The **prior experience** of the partners can serve as evidence to avoid or justify risky steps; moreover, a **prior relationship** indicates a history of repeated interaction, which may lead to relational advantages and stability. **Communication** is also imperative for a good inter-partner relationship in ICJV projects. It also enables the partners to have a mutual understanding of the goals of the alliance and the roles and responsibilities of the actors. All of these factors are recognised as key knowledge facilitators that influence the knowledge transfer processes in ICJV Projects.

6) Key Findings from the review of Knowledge transfers methods and mechanisms.

The successful transfer of knowledge is considered to be the key to successful projects and organisations. KT is a systematic and integrative process of coordination within the organisation based on the use and implementation of tools, systems and processes to improve

the acquisition, creation, storage, sharing and use of knowledge. There are four modes of knowledge conversion; 1) socialisation, 2) externalisation, 3) combination and 4) internalisation. The various KT methods and mechanisms that can be used to transfer and adopt knowledge between local and foreign partners in ICJV projects were described in the previous section and these were utilised to collect the data to identify the methods and mechanisms that were used by the actors in the studied ICJV projects.

8.3.2 Key factors influencing knowledge transfer processes

The two case studies involved the use of KT methods by foreign and local partners in ICJV construction projects to acquire and exchange knowledge and experience. It was found that knowledge transfer was the most important advantage for ICJV projects. However, the actors in the six ICJV projects in the two case studies were found to lack the necessary knowledge and expertise to manage, implement and maintain their business alliance and complete the project. The key findings that emerged from the analysis will be further examined in this section with a focus on the different ways in which knowledge was transferred in these six ICJV projects. The findings of each case study were presented in Chapters 5 and 6 and a summary of both of them was provided in this chapter. The purpose of this section is to present and discuss the enabling and inhibiting factors that were found to influence the transfer of knowledge from a foreign to a local partner in an ICJV project as explained by the key actors in the interviews.

1) Knowledge Factors

The first factor that influenced the success of the knowledge transfer process between the partners in these six ICJV Projects was “the characteristics of knowledge and type of knowledge”. All of the actors in these ICJV projects maintained that these two elements played a vital role in their KT processes. The characteristic of knowledge and type of knowledge was regarded as an important factor to determine the efficiency and effectiveness of the knowledge transfer process. It was challenging for a foreign partner to transfer tacit knowledge, such know-how embedded in the experience of individuals, to a local partner; therefore, tacit to tacit knowledge was transferred by face-to-face communication, socialisation out of hours and personal contact (e.g. telephonic communication) between individuals, while tacit to explicit knowledge was transferred from individuals to groups by brainstorming, memoranda and letters, project history or case writing, meeting reports, minutes of meetings and weekly meetings, presentations, daily reports, technical terms and statements in ICJV Projects. On the other hand, explicit knowledge was the transfer of tacit to explicit knowledge between individuals and groups. The transfer of explicit-explicit knowledge was based on best practice between the key factors, whereas explicit-tacit knowledge was transferred by learning-by-doing and training sessions (e.g. induction training, on-the-job training, and training by the foreign partner).

These findings provide further support for previous researchers, who found that the characteristic of the knowledge was an important factor that contributed to the success (or failure) of the knowledge transfer process. The transfer of tacit knowledge was challenging for learners, whereas explicit knowledge was relatively easy to acquire and understand. However, the complexity of some types of knowledge (e.g. technical and technological knowledge) also

inhibited many local actors in the ICJV construction projects from acquiring knowledge and learning from foreign partners. This finding is consistent with that of previous researchers, such as Hajidimitriou and Rotsios (2009) and Al-Salti (2011), who argued that the characteristic of knowledge or characteristic of the task and procedure plays a critical role in facilitating successful KT. However, the transfer of such knowledge requires the establishment of KT methods and mechanisms to exchange knowledge between actors in ICJV organisations. As a result, KT methods and mechanisms also influence the success of KT in ICJV Projects.

2) KT methods and mechanisms

The second factor that was found to be critical in transferring crucial knowledge between partners in ICJV projects was “KT methods and mechanisms”, four of which were used by the foreign and local partners in this study to transfer knowledge, namely, socialisation (tacit-tacit), externalisation (tacit-explicit), combination (explicit-explicit) and internalisation (explicit-tacit). All the participants from the six ICJV projects noted that they had used all four types of mechanisms to transfer knowledge between the partners, but especially socialisation (tacit-tacit) and externalisation (tacit-explicit) to transfer tacit knowledge. They further acknowledged that all four methods had played a pivotal role in the successful knowledge transfer processes in these ICJV projects. The majority of the key participants identified face-to-face communication, brainstorming, ad hoc meetings/minutes of meetings, regular/continuous meetings (especially weekly meetings), learning-by-doing, and mentoring and coaching as the most important KT methods and mechanisms for the transfer of knowledge and experience between the partners. Moreover, some of them proposed that video or telephonic communication, memoranda and letters, group meetings/team meetings, on-the-job-training and lessons-learned meetings were also crucial for the effective transfer of knowledge.

As explained above, KT methods and mechanisms play a vital role in the transfer of knowledge, skills and experience between foreign and local partners in ICJV projects. This correlates well with the research of Landaeta (2008), Kivrak et al (2008) and Hajidimitriou and Rotsios (2009), who found that ‘face-to-face interaction’ and meetings played an important role in the process of transferring knowledge across projects. Kivrak et al (2008) also suggest that phone calls, teleconferencing, informal chatting and storytelling are the four methods most used for sharing knowledge and experience within projects. Additionally, the findings of this study indicated that actors in some ICJV projects preferred to use socialising out-of-hours (lunch or coffee breaks) to exchange knowledge, especially in projects that were undertaken as a joint venture with a Japanese partner. Carrillo (1996) also argues that socialising out-of-hours is an effective KT mechanism. This may be because socialising out-of-hours offers a more relaxed atmosphere, which is more conducive to a discussion of prior experience, since there is no hierarchy of team members in social settings. However, the interviewees in this study indicated that they had not used KT mechanisms such as storytelling, visiting colleagues/other projects/companies, visiting foreign companies and visiting plants or manufacturers in their ICJV projects. Interestingly, these results did not correlate with the research of Wende and Haghirian (2009), who found that ‘storytelling’ played a vital role and had a strong positive effect on exchanging complex ideas and disclosing knowledge.

Another important finding was that the use of ICT collaborative tools (e.g. expert systems, decision support systems, COPs, etc.) to transfer knowledge in these ICJV projects was not mentioned by the actors in this study. This contradicts many published research papers, in which ICTs are acknowledged as being important KT methods and mechanisms in international KT processes. Therefore, this finding highlights the need for greater attention to be paid to the use of ICTs to transfer knowledge in international construction projects as a beneficial mechanism to acquire knowledge, find solutions and make decisions, especially when the knowledge to be transferred is complex.

3) ICJV Performance and Success Factors

The third set of factors that influences the KT processes in ICJV projects is “ICJV Performance and Success Factors”, which are the characteristics that define the ICJV management, ICJV project performance, ICJV project-related and partners’ performance.

The first factor is the ‘performance of the ICJV management’, which, according to the data gathered in these ICJV case studies, played a critical role in the effective and efficient transfer of knowledge in the ICJV projects. The performance of the IJV management is defined as the level of effectiveness of the management’s control of the ICJV’s organisational structure, processes and operation. The key participants from the six ICJV projects defined the performance of the management of the IJV as consisting of the management and control of the project. The performance of the top management in each project affected the success of the IJV and the KT processes.

Prior researchers of international construction joint ventures have highlighted the importance of the performance of the IJV management to successful ICJV projects in certain conditions ([Ozorhon et al., 2007](#), [Ozorhon et al., 2008](#) and [Ozorhon et al., 2011](#)). It could be argued that the success of KT processes in ICJV projects greatly depends on the effectiveness of the organisational structure and processes, as well as the operation of the top management in each project. Hence, the top management of an ICJV project plays a critical role in its performance based on the implementation of strategic decisions.

The second factor in this set of performance and success factors is ‘project performance’, which can be defined as an objective indicator of the extent to which the objectives of the project have been achieved in terms of schedule (time), cost and quality. Since IJV construction projects are essentially formed to execute project-based activities, part of their operational success can be defined in terms of a successful project.

The empirical findings correspond with those in many previous studies, in which the impact of project performance on international projects was emphasised ([Ozorhon et al. \(2007\)](#), [Ozorhon et al. \(2008\)](#) and [Ozorhon et al. \(2011\)](#)). Many researchers have found that the project performance can be measured by the achievement of the project targets, including the completion of the project on time, within budget and of good quality. Hence, it could be argued that the efficient management of time, cost and quality should complement the contractual arrangements in successfully transferring knowledge in ICJV projects.

The third factor in this set of performance and success factors is ‘ICJV Project-related’, which plays a significant role in the transfer of knowledge in ICJV projects, especially in terms of

relationships. The relationship between the actors was one of the main factors highlighted by most of the case study participants as being imperative for the success of knowledge transfer processes in ICJV projects. Based on the interview data, the effectiveness and efficiency of the transfer of knowledge between the parties greatly depended on certain components of their relationship. The relationship between the parties was one of the most frequently-mentioned factors that affected the transfer of knowledge in international projects. It was found that the top management of both local and foreign firms were very keen to establish a cooperative relationship based on effective communication and commitment. The quality of the relationship between the parties was consistently cited by all the participants as being essential for collaboration and the communication of knowledge. Most of the key actors suggested that a fruitful collaboration was based on commitment and effective communication, which facilitated better and faster access to crucial knowledge. In other words, the closer the parties' relationship, the more willing they were to share better quality knowledge. Additionally, it was found that an ICJV relationship based on commitment increased all the parties' willingness to devote extra time and invest more resources to support the transfer of knowledge. The key participants in this study agreed that their ability to easily access critical knowledge depended on the parties' level of commitment and willingness to allocate adequate time and much-needed resources to the ICJV relationship.

This finding is consistent with the empirical results of [Ozorhon et al. \(2010\)](#), [Keung and Shen \(2013\)](#), [Tan \(2014\)](#), and [Ti and Chao-chen \(2015\)](#), who found that managing the relationship between partners in an ICJV project enabled internal staff to better access and monitor foreign knowledge, expertise and technologies. Hence, it could be argued that the establishment of a cooperative relationship between the partners plays an important role in the success of ICJV projects generally, and knowledge transfer in particular. It was also found that the length of time the partners worked together had a significant impact on the success of knowledge transfer. It was further found by interpreting the interviews and the documentary data that the partners in ICJVs sustained their relationship over time and this enabled their staff to communicate and transfer knowledge more effectively.

The fourth factor in this set of performance and success factors is 'partners' performance' or 'partners' experience'. This consists of the key factors that explain the characteristics of the partner who is the source of the knowledge. The findings from the six ICJV projects indicated that the partners' performance and experience played a critical role in the KT processes in these projects. They emphasised that the previous experience of the partner who possessed significant operational capabilities (e.g. process management, HR management) could generate value and lead to a successful transfer of knowledge. High-performance and experienced partners enabled the ICJV actors in the six ICJV projects to exchange and appreciate new knowledge and skills. The key participants from the six ICJV projects defined foreign experts as well-trained professionals who possess up-to-date knowledge.

The importance of partners' performance in an ICJV project was emphasised in prior studies ([Ozorhon et al., 2007](#), [Ozorhon et al., 2008](#) and [Ozorhon et al., 2011](#)), in which it was argued that partners' performance and experience plays a pivotal role in the success of ICJV projects. Many inter-organisational knowledge transfer studies also support this finding by

indicating that prior experience is vital for increasing the amount of knowledge acquired by the recipient. As a result, it could be argued that partners' performance and their experience play a pivotal role in the type of knowledge and business knowledge transferred between ICJV partners.

4) Knowledge Facilitators

The fourth factor in the set of performance and success factors is 'knowledge facilitators', who are also considered to be important to more effectively and efficiently transfer knowledge. Knowledge facilitators consist of the main factors that describe the characteristics of the organisations in the ICJV project (and the expatriates within them) and their effect on the ICJV performance and knowledge transfer.

The first knowledge facilitator is 'Trust', which another key was enabling factor identified by the key actors of the six ICJV projects as influencing their KT processes. The majority emphasised that 'trust' between the parties was critical for successful KT. Trust has been found to be one of the most effective factors in fostering ICJV projects, particularly within team members' level of knowledge transfer and learning, by prior researchers, who have acknowledged the significance of trust in both intra- and inter-organisations in ICJVs ([Girmscheid and Brockmann, 2010](#)). Trust tends to foster the access to and acquisition of valuable knowledge. This argument was also supported by [Lubang and Haidong \(2014\)](#), [Zhong, \(2014\)](#) and [Yannis Hajidimitriou \(2012\)](#) who found that 'trust' is an important and fundamental enabler of KT in ICJV projects. In addition, [Strach and Everett \(2006\)](#) and [Al-Salti \(2011\)](#) suggested that the development of trust was expected to influence the effectiveness and efficiency of KT and [Girmscheid and Brockmann \(2010\)](#) summarised the strengths and weaknesses of approaches to trust. However, the key actors interviewed in this study did not highlight the approaches to trust in their ICJV project; hence, it could be argued that the parties in ICJV projects need to pay greater attention to approaches to trust and use trust in the transfer of knowledge in their ICJV project.

The second knowledge facilitator is 'commitment', which has been found to facilitate a more effective and efficient flow of knowledge between ICJV partners. Commitment to maintaining a healthy relationship and intensive communication has been found to foster cooperative behaviour that enhances the transfer of knowledge in ICJV projects. Most of the key actors claimed that a relationship based on commitment and effective communication facilitated fruitful collaboration and, hence, better and faster access to crucial knowledge. This finding is consistent with the empirical results of [Ozorhon et al. \(2008\)](#), who found that commitment should complement contractual arrangements to achieve a successful transfer of knowledge. They defined commitment as the willingness of IJV partners to exert an effort on behalf of the IJV. Successful KT was also perceived to be affected by the willingness of IJV partners by the key actors in these six ICJV projects. Moreover, they considered that the partners' willingness was a key element in determining the quality of knowledge transferred in all six ICJV projects. These key actors in six ICJV projects demonstrated their ability to more easily transfer new technical and technological knowledge when the partners' level of willingness and openness

was high. Prior researchers of inter-organisational knowledge transfer failed to pay sufficient attention to the importance of partners' commitment, willingness and openness as facilitators. The most likely explanation for this finding is that committed partners are likely to be interested in creating and maintaining a good relationship with other parties because they are more likely to consider the long-term advantages of KT rather than short-term gains.

The third knowledge facilitator is 'organisational distance', which includes organisations' cultural distance and the national cultural distance. This was defined as having a major impact on the successful knowledge transfer between foreign and local partners by the actors in the six ICJV cases in this study. The organisations' cultural distance engendered some challenges to the relationship between the ICJV partners in general, and KT in particular, since it was perceived by the majority of the key actors in the six ICJV projects to be an obstacle to the success of KT processes. According to the data gathered from the case studies, incompatible organisational characteristics of local and foreign partners were particularly responsible for the failure of KT initiatives.

Moreover, the impact of national cultural distance on the successful transfer of knowledge was also investigated in this study and it was also found to have an impact on an ICJV relationship due to a large number of participants from various countries, although the main actors were Thai. The different cultural backgrounds and languages were perceived to have a significant effect on the transfer of knowledge during these ICJV projects. Many participants in this study claimed that the national cultural distance had a huge impact on relationships within the project. When they were asked about their experience of working with individuals from different cultures, they reported that, although cultural differences sometimes disrupted communication, they rarely limited knowledge transfer and learning.

Hence, it is suggested by the empirical evidence of the impact of national cultural distance on KT processes in ICJV projects that different cultural backgrounds, beliefs, norms and languages may relatively disrupt ICJV relationships, but they rarely inhibit KT success. To a certain extent, this finding contradicts many ICJV researchers, who emphasised that an incompatible national culture and language pose challenges and lead to miscommunication and misunderstandings in ICJV projects, which results in the limited transfer of knowledge. Prior researchers of inter-organisational knowledge transfer (e.g. [Adnan and Moreledge, 2003](#) and [Hua and Evangelista, 2007](#)) also pointed out that the national cultural distance between the source and the recipient is one of the key obstacles to successful KT.

The organisational cultural distance was also empirically examined in this study and the results showed that it was difficult for both foreign and local partners who had incompatible work behaviour, styles of management, working practices and technology to establish a smooth cooperation that facilitated KT. It was recognised that the greater the distance between the parties' organisational culture, the less consistent was the communication environment and the less likelihood there was of individuals forming a social bond that was sufficient to facilitate effective KT. On the contrary, the more compatible were the organisational culture and business practices of the foreign and local partners, the more likely the foreign partner was to effectively

transfer necessary knowledge and not only explicit knowledge, but also tacit knowledge, to the local firm.

The fourth knowledge facilitator is 'motivation', which was identified by the key actors in the six ICJV projects in this study as an important factor of the transfer of knowledge between partners. All the Project Managers and Construction Managers agreed that motivation was an enabling factor in motivating ICJV staff to transfer knowledge and hence, contribute to the ICJV performance. Therefore, motivation is a vital component of a successful transfer of knowledge.

The results of this study are also supported by [Argote et al \(2003\)](#) and [Al-Salti \(2011\)](#), who found that motivation was perceived as a major facilitating factor of job performance and KT. However, evidence from the key actors in the six ICJV projects suggest that local staff tended to be more proactive when engaging in KT activities that contribute to the enhancement of their professional development.

Prior researchers of ICJV projects also highlighted the importance of motivation ([Wong and Lam, 2012](#)). They found that motivation was a key element of learning from KT. Therefore, motivation is deemed to influence the success of KT, particularly when the knowledge is tacit. Hence, it is vital for ICJV organisations to strongly promote KT and learning by offering greater rewards and incentives to facilitate effective KT and boost the overall ICJV performance, as well as creating a motivational environment based on interactional activities in ICJV projects.

Attitude is another knowledge facilitator, which has been constantly cited across cases as an important factor in the transfer of knowledge. Individuals with a more positive attitude tend to be more proactive in exploiting opportunities for knowledge transfer in an ICJV environment. It was found that the vast majority of the actors in the organisations of the two ICJV projects were eager to learn from partners to develop new knowledge, skills and competencies; for example, by focusing on how partners' technical teams solved problems. Another example of the importance of attitude is that the actors in the two ICJV organisations were able to transfer knowledge more effectively when they took more responsibility for the ICJV project and worked side-by-side with partners' teams.

Many researchers (e.g. [Tsang, 2002](#), [Ozorhon et al, 2008](#) and [Al-Salti, 2011](#)) emphasise that attitude is a critical factor that facilitates a more effective transfer of inter-organisational knowledge. It was also found in this study that an attitude to seek and acquire potentially useful knowledge is an important factor and a driving force that needs to be consistently maintained by the ICJV staff of the local organisation. Attitude was frequently mentioned by many of the participants as a key enabler of a successful knowledge transfer.

8.4 RESEARCH CONTRIBUTION AND IMPLICATIONS

The contributions of this research to knowledge can be classified into four main groups; theoretical, methodological, practical and publications.

8.4.1 Theoretical Contribution

The main theoretical achievement of this study is the development of a conceptual framework for the transfer of knowledge in ICJV projects, as presented in Chapter 3 (Figure 3.1) and the development of a knowledge transfer framework for ICJV projects in Thailand that can be used in practice. This knowledge transfer framework was validated through multiple case studies and revised in Chapter 7 (Figure 7.1) based on the findings.

Hence, this study makes an important contribution to the growing body of research that seeks to understand how knowledge is transferred in the context of ICJV projects. As noted in Chapter 2, it closes the gap identified by various authors. Prior researchers have only focused on the type of knowledge transferred, the source, the recipient or the relationship between the source and the recipient (Szulanski, 1996, Gupta and Govindarajan, 2000, and van Wijk et al., 2008). Hence, the understanding of what contributes to the success of knowledge transfer processes and the success of ICJV projects is still limited due to the lack of a holistic and thorough examination in prior studies. This integrative and coherent framework is particularly important based on the increasing interest in the fundamental enabling and inhibiting factors of the success of transferring knowledge in ICJV Projects, since it can be used as the basis for the development of knowledge transfer processes in ICJV projects in Thailand. To the best of the author's knowledge, this research is the first of its kind in comparing KT processes in ICJV Projects in Thailand. However, this framework is not only able to be used by construction teams, but can also be used to develop other businesses and industries in Thailand.

8.4.2 Methodological contribution to knowledge

The knowledge transfer framework is the most important contribution of this research in terms of both knowledge and practice. Hence, the establishment of a knowledge transfer framework of KT processes in ICJV Projects that facilitates the transfer of knowledge in ICJV Projects in Thailand is the main contribution of this study. It is one of only a very few that have employed a quantitative and qualitative approach to address the issue of international construction knowledge transfer in general, and it is believed to be the first to quantitatively and qualitatively address the phenomenon in the context of ICJV Projects in Thailand. As explained in Chapter 4 (Research Methodology), an interpretive multiple case-study approach was utilised to answer the research question. This approach facilitated a detailed investigation and understanding of the transfer of knowledge in ICJV Projects in Thailand from the perspective of the participants. This flexible method enabled close contact to be established with the people directly involved to the extent necessary to grasp the current activities in the field. Additionally, the multiple case study approach produced rich and descriptive accounts of relevant events, as well as an in-depth analysis to identify the key enabling and inhibiting factors that influence the complexities

of the knowledge transfer process. The quantitative data was analysed using a Social Network Analysis (SNA) based on the degree of centrality, betweenness centrality, and network cliques to identify the key actors. The interviews also allowed for in-depth discussions with the key actors in each project. The researcher was able to increase the likelihood of gaining accurate, honest and thorough responses by gaining access to the field and then establishing trust and building a deeper rapport with the participants in the two case studies.

The collection and analysis of the data in this study were guided by the initially proposed conceptual framework. This enabled the researcher to conduct the analysis with certain expectations based on prior theory, while also allowing the emergence of some unexpected issues and explanations. Finally, the findings confirmed that the use of the knowledge transfer framework had facilitated a thorough examination of the KT processes in ICJV Projects.

8.4.3 Practical contribution to knowledge

This study makes some significant contributions and valuable implications in practice, particularly for ICJV projects in Thailand. For instance, it provides some useful insights for Project Managers and key actors who often need to take critical decisions with regard to knowledge transfer when considering an ICJV project. Secondly, the conceptual framework also provides general guidance to structure effective knowledge transfer strategies for ICJV projects in Thailand and it also provides a way of making alternative choices in the selection of KT methods and mechanisms in ICJV projects.

8.4.4 Contribution in Terms of Publication Output

The main output of the research is this thesis, which includes the methodology, empirical data and key findings that influence the process of transferring knowledge in ICJV projects. During the study, knowledge was not only gained from general research skills, but also from writing and publishing. Further contributions in terms of publication output were made in the form of the following three conference papers;

Paper 1: “Factors Affecting Knowledge Transfer in International Construction Joint Venture Project”, presented at the 2016 International Conference on Civil, Architecture and Sustainable Development (CASD-2016), London, UK Dec.1-2, 2016

Paper 2: “Conceptual Framework Based on the Key Factors of Knowledge Transfer Processes in International Construction Joint Venture Projects”, presented at the International Conference on Innovative Research in Science, Technology and Management (ICIRSTM-17), National University of Singapore (NUS), Singapore, September 2017.

Paper 3: “Social Network Analysis of International Construction Joint Venture Project: A Case Study in Thailand”, presented at the COBRA 2018 Conference, RICS, London, UK, 23rd-24th April 2018.

Having completed the work, the focus will now turn to the potential to publish a number of high-quality referred journal articles.

8.5 LIMITATIONS OF THE RESEARCH

Two limitations are presented in this section.

Firstly, the sample in this study was restricted to one country (i.e. Thailand) and one sector (i.e. construction sector); consequently, the findings need to be interpreted with caution. Although the research context is quite specific, it is believed that the findings are relevant to other sectors and other countries. Future research of other kinds of business, organisations and different national environments would verify the findings of this study and may yield additional interesting and complementary insights. Conducting future studies of other businesses or organisations would enable researchers to obtain an overall picture of the phenomenon or compare the businesses and organisations.

Secondly, this study could be extended to investigate how Intellectual Capital (IC) may influence the flow of knowledge between partners in ICJV Projects. The issue of IC has seldom been examined by inter-organisational knowledge transfer scholars; therefore, it may bring additional new interesting insights to this area of research and allow for a better understanding of the phenomenon.

8.6 RECOMMENDATIONS FOR FUTURE RESEARCH

The aim of this study was to identify and evaluate the processes of transferring knowledge in International Construction Joint Venture (ICJV) projects in Thailand. Hence, it provided some new important insights and valuable lessons with regard to the process of transferring knowledge in ICJV projects and there were some limitations that left fruitful avenues open for future research.

Firstly, as mentioned above, the sample in this study was restricted to one country (Thailand) and two case studies of the construction of infrastructure. Despite this specific research context, it is believed that the findings are relevant to other countries. Therefore, future research of other types of projects and environments (i.e. buildings) or other businesses would verify the findings of this study and may yield additional interesting and complementary insights. Conducting future studies into other types of projects or businesses would enable researchers to obtain an overall picture of the phenomenon or compare other areas and aspects for a further examination.

Secondly, this study could be extended to investigate KT processes in ICJV projects in other developing and developed countries in the South East Asian region in order to develop a knowledge transfer framework for ICJVs in that region for further examination.

Thirdly, due to the very specific focus of a PhD, there were limitations in terms of time constraints and the number of foreign participants in each case study. This meant that most of the participants in this study were local actors. Therefore, future researchers should examine a balanced number of participants between foreign and local companies for better results.

Fourthly, this research was conducted based on a questionnaire survey and in-depth interviews with the key actors in six ICJV projects. Future researchers are recommended to

consider the use of observation in order to enlarge the data collection techniques, since this may improve the robustness of the current results.

Finally, this study could be extended to investigate how Organisation Learning (OL) and Intellectual Capital (IC) may influence the flow of knowledge between the partners in an ICJV project, especially national intangible capital. Since OL and IC are the intangible value of the business (covering its people, relationships and structure) as examined by inter-organisational knowledge transfer scholars, its inclusion may generate additional new and interesting insights to this area of research and allow for a better understanding of the phenomenon. Organisation Learning (OL) and Intellectual Capital (IC) broadly consist of firms' intangible assets, which comprise the skills and knowledge of employees, internal databases and processes, and the relationship with customers, among others.

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APPENDIX A: The participant information sheet

Participant Information Sheet (1)

Study title:

Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand.

You are being invited to take part in a research study on the topic of 'Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand'. Before you decide whether or not to take part, it is important for you to understand the process of the research, its importance and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

The aim of this study is to identify and understand the processes of knowledge transfer in International Construction Joint Venture (ICJV) projects in order to develop a knowledge transfer framework for joint venture partnerships. The study will also facilitate the development of a better understanding of critical factors that influence success of ICJVs, the problems and challenges facing joint ventures and the strategic knowledge assets driving a construction firm's capabilities in enhancing their competitive advantage in the Thai construction industry. Furthermore, there will be a practical contribution in the form of a framework and recommendations on how to use it for ICJV projects in Thailand.

This study integrates knowledge transfer theory and social networks theory to better conceptualize and explain how knowledge is successfully transferred in ICJV projects in Thailand. A literature review on key concepts in the area of knowledge transfer and social networks will be carried out. A case study approach will be adopted to undertake and to facilitate the investigation within the context of projects. Projects will be samples from the two ICJV companies. Two ICJV companies with the selected projects will be used to establish how knowledge is transferred in ICJV project and to identify key enabling factors that influence this process. The interviews within one pilot case study and three main case studies will be conducted with selected professionals and experts from the parent companies and the IJV partners. The interviewees should all be involved in contracting with foreign partners in ICJV projects. They will have key management expertise such as general manager, managing director, senior engineer, project manager and key construction workers. The number of participants will depend on the number of key actors, their relationships, network density and the extent of the network within which knowledge flows and is transferred.

A conceptual framework based on the key concepts and the key enabling and inhibiting factors that influence knowledge transfer will be developed through the literature review and a pilot case study. This conceptual framework will then be used to validate, revise and develop a knowledge transfer framework for joint venture partnerships in Thai construction companies through the main study. The data collection will run from 15th of March 2016 to the 15th of August 2016 in Bangkok, THAILAND. Final results will be a PhD thesis and a summary report for participants. There is also the possibility that the findings will be published in as academic journal papers.

Why have I been invited to participate?

- 1) You are important to this study as you are either having key management expertise or are a key construction worker in your organization.
- 2) Your company cooperates/ has joint-venture agreements in Thailand with foreign companies; your organizations and your individual contribution to this research will be very valuable and helpful.

You are a significant participant such as a vice president, managing director, general manager or project manager and can be considered as a key knowledge participant in at least one ICJV project in your company.

Do I have to take part?

It is entirely up to you to make the decision whether to participate or not. In case you do decide to take part in this research, you will be given this information sheet to keep and be asked to sign a consent form. Importantly, if you decide to participate in this study, you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

There are two stages of this research.

- 1) You will be one of key participants to be interviewed. You will not be asked to provide any sensitive information. You will be asked about your background, position, experiences, knowledge and skill related to the ICJV projects and practices in Thailand. The questionnaire will take approximately 30 minutes of your time. Questionnaires will be used to collect data on general organizational, actor attributes, and your knowledge transfer ties and to identify the experts involved in knowledge transfer. The questionnaire survey will take place at your place of work. If it

is necessary, we kindly ask you to seek permission from your supervisors at your organization. There is a Participant Information Sheet that you can give to them.

- 2) If you are identified as a key participant in the ICJV projects after the social network analysis, you will be asked to take part in an interview. The interview will take approximately 30-45 minutes of your time. You will not be asked to provide any sensitive information. You will be asked about your background, position, experiences, knowledge and skill related to the ICJV projects and practices in Thailand. Moreover, you will be asked information on the knowledge transfer methods, key enabling and inhibiting factors that influence knowledge transfer processes in ICJVs projects. If you give your consent, an audio of the interview will be recorded. Otherwise, authorized notes will be taken. The interviews will take place at your place of work. If it is necessary, we kindly ask you to seek permission from your supervisors at your organization. There is a Participant Information Sheet that you can give to them.

What are the possible benefits of taking part?

I hope that the questionnaire and interview will give you an opportunity to reflect on what is happening in Thailand regarding knowledge transfer within ICJV projects and how to develop a knowledge transfer framework for joint venture partnerships for Thai construction companies. Your participation will also be beneficial in determining important future research areas.

Will what I say in this study be kept confidential?

All information collected and all recorded interviews will be kept confidentially on Google Drive which Oxford Brookes University has a security agreement with. As the sample is small there may be legal limitations to the level of anonymity possible. Confidentiality, privacy and anonymity will be ensured in the collection, storage and publication of research material. Data generated by the study will be retained in accordance with the University's policy on Academic Integrity. Data generated in the course of the research will be kept securely in paper and electronic form for a period of ten years after the completion of a research. Moreover, the data that has already been collected but not yet analysed will be deleted if the participant withdraws from the study.

What should I do if I want to take part?

If you decide to take part of this study, please kindly send your response to achara.khamaksorn-2014a@brookes.ac.uk or call +66(0)-81-618-1910

What will happen to the results of the research study?

The research will be submitted to Oxford Brookes University, and graded as part of a requirement for completion of a Doctor of Philosophy (PhD) degree. Interviewees will have access to a summarized version of the findings upon their request. Anonymity of participants will be ensured in the publication of research material in any form but as the sample size may turn out to be small some implications for privacy/anonymity might occur. The data generated in the course of the research will be retained in accordance with the University's policy of Academic Integrity and must be kept securely in paper or electronic form for a period of ten years after the completion of a research project. Participants should be aware that there are legal limitations on data confidentiality and anonymity.

Who is organising and funding the research?

The research is being organized and undertaken by Achara Khamaksorn, a PhD research student in the School of the Built Environment, the Faculty of Technology, Design and Environment, Oxford Brookes University, UK. Professor Joseph H.M.Tah is the Director of Studies and Dr.Esra Kurul is the second supervisor. It is funded by the Chiang Mai University, Thailand.

Who has reviewed the study?

This research has been reviewed and approved by the University Research Ethics Committee, Oxford Brookes University.

If you have any concerns about the way in which the study has been conducted, you can contact the Chair of the University Research Ethics Committee on ethics@brookes.ac.uk

Contact for Further Information

For further information you can contact Achara Khamaksorn at achara.khamaksorn-2014a@brookes.ac.uk

Thank you for spending your valuable time to read the information sheet.

Achara Khamaksorn
March 2016

Participant Information Sheet (2)

Study title:

Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand.

You are being invited to take part in a research study on the topic of 'Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand'. Before you decide whether or not to take part, it is important for you to understand the process of the research, its importance and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

The aim of this study is to identify and understand the processes of knowledge transfer in International Construction Joint Venture (ICJV) projects in order to develop a knowledge transfer framework for joint venture partnerships. The study will also facilitate the development of a better understanding of critical factors that influence success of ICJVs, the problems and challenges facing joint ventures and the strategic knowledge assets driving a construction firm's capabilities in enhancing their competitive advantage in the Thai construction industry. Furthermore, there will be a practical contribution in the form of a framework and recommendations on how to use it for ICJV projects in Thailand.

This study integrates knowledge transfer theory and social networks theory to better conceptualize and explain how knowledge is successfully transferred in ICJV projects in Thailand. A literature review on key concepts in the area of knowledge transfer and social networks will be carried out. A case study approach will be adopted to undertake and to facilitate the investigation within the context of projects. Projects will be samples from the two case organizations. Two ICJV companies with the selected projects will be used to establish how knowledge is transferred in ICJV project and to identify key enabling factors that influence this process. The interviews within three case studies will be conducted with selected professionals and experts from the parent companies and the IJV partners. The interviewees should all be involved in contracting with foreign partners in ICJV projects. They will have key management expertise such as general manager, managing director, senior engineer, project manager and key construction workers. The number of participants will depend on the number of key actors, their relationships, network density and the extent of the network within which knowledge flows and is transferred.

A conceptual framework based on the key concepts and the key enabling and inhibiting factors that influence knowledge transfer will be developed through the literature review and a pilot case study. This conceptual framework will then be used to validate, revise and develop a knowledge transfer framework for joint venture partnerships in Thai construction companies through the main study. The data collection will run from 15th of March 2016 to the 15th of August 2016 in Bangkok, THAILAND. Final results will be a PhD thesis and a summary report for participants. There is also the possibility that the findings will be published in as academic journal papers.

Why have I been invited to participate?

- 1) You are important to this study as you are either having key management expertise or are a key construction worker in your organization.
- 2) Your company cooperates/ has joint-venture agreements in Thailand with foreign companies; your organizations and your individual contribution to this research will be very valuable and helpful.

You are a significant participant such as a senior engineer, project engineer, project architect, structure engineer, mechanical engineer, electrical engineer or a key construction worker and can be considered as a key knowledge participant in at least one ICJV project in your company.

Do I have to take part?

It is entirely up to you to make the decision whether to participate or not. In case you do decide to take part in this research, you will be given this information sheet to keep and be asked to sign a consent form. Importantly, if you decide to participate in this study, you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

There are two stages of this research.

- 1) You will be one of key participants to be interviewed. You will not be asked to provide any sensitive information. You will be asked about your background, position, experiences, knowledge and skill related to the ICJV projects and practices in Thailand. The questionnaire will take approximately 30 minutes of your time. Questionnaires will be used to collect data on general organizational, actor attributes, and your knowledge transfer ties and to identify the experts

involved in knowledge transfer. The questionnaire survey will take place at your place of work. If it is necessary, we kindly ask you to seek permission from your supervisors at your organization. There is a Participant Information Sheet that you can give to them.

- 2) If you are identified as a key participant in the ICJV projects after the social network analysis, you will be asked to take part in an interview. The interview will take approximately 30-45 minutes of your time. You will not be asked to provide any sensitive information. You will be asked about your background, position, experiences, knowledge and skill related to the ICJV projects and practices in Thailand. Moreover, you will be asked information on the knowledge transfer methods, key enabling and inhibiting factors that influence knowledge transfer processes in ICJVs projects. If you give your consent, an audio of the interview will be recorded. Otherwise, authorized notes will be taken. The interviews will take place at your place of work. If it is necessary, we kindly ask you to seek permission from your supervisors at your organization. There is a Participant Information Sheet that you can give to them.

What are the possible benefits of taking part?

I hope that the questionnaire and interview will give you an opportunity to reflect on what is happening in Thailand regarding knowledge transfer within ICJV projects and how to develop a knowledge transfer framework for joint venture partnerships for Thai construction companies. Your participation will also be beneficial in determining important future research areas.

Will what I say in this study be kept confidential?

All information collected and all recorded interviews will be kept confidentially on Google Drive which Oxford Brookes University has a security agreement with. As the sample is small there may be legal limitations to the level of anonymity possible. Confidentiality, privacy and anonymity will be ensured in the collection, storage and publication of research material. Data generated by the study will be retained in accordance with the University's policy on Academic Integrity. Data generated in the course of the research will be kept securely in paper and electronic form for a period of ten years after the completion of a research. Moreover, the data that has already been collected but not yet analysed will be deleted if the participant withdraws from the study.

What should I do if I want to take part?

If you decide to take part of this study, please kindly send your response to achara.khamaksorn-2014a@brookes.ac.uk or call +66(0)-81-618-1910

What will happen to the results of the research study?

The research will be submitted to Oxford Brookes University, and graded as part of a requirement for completion of a Doctor of Philosophy (PhD) degree. Interviewees will have access to a summarized version of the findings upon their request. Anonymity of participants will be ensured in the publication of research material in any form but as the sample size may turn out to be small some implications for privacy/anonymity might occur. The data generated in the course of the research will be retained in accordance with the University's policy of Academic Integrity and must be kept securely in paper or electronic form for a period of ten years after the completion of a research project. Participants should be aware that there are legal limitations on data confidentiality and anonymity.

Who is organising and funding the research?

The research is being organized and undertaken by Achara Khamaksorn, a PhD research student in the School of the Built Environment, the Faculty of Technology, Design and Environment, Oxford Brookes University, UK. Professor Joseph H.M.Tah is the Director of Studies and Dr.Esra Kurul is the second supervisor. It is funded by the Chiang Mai University, Thailand.

Who has reviewed the study?

This research has been reviewed and approved by the University Research Ethics Committee, Oxford Brookes University.

If you have any concerns about the way in which the study has been conducted, you can contact the Chair of the University Research Ethics Committee on ethics@brookes.ac.uk

Contact for Further Information

For further information you can contact Achara Khamaksorn at achara.khamaksorn-2014a@brookes.ac.uk

Thank you for spending your valuable time to read the information sheet.

Achara Khamaksorn
March 2016

APPENDIX B: The consent form



CONSENT FORM

Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand.

The research will be submitted to Oxford Brookes University, and graded as part of a requirement for completion of a Doctor of Philosophy (PhD) degree.

Principal Researchers

Professor Joseph H.M.Tah, jtah@brookes.ac.uk

Achara Khamaksorn, PhD Research Student, 14088967@brookes.ac.uk

Dr.Esra Kurul, ekurul@brookes.ac.uk

Department of Real Estate and Construction, Faculty of Technology, Design and Environment
Oxford Brookes University

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.
3. I agree to take part in the above study.

☐
☐
☐

Note for PI / Supervisory team:

The following statements should be included if appropriate.

If not, please delete from the consent form.

Please initial box

	Yes	No
4. I agree to the interview / focus group / consultation being audio recorded	☐	☐
5. I agree to the interview / focus group / consultation being video recorded	☐	☐
6. I agree to the use of anonymised quotes in publications	☐	☐
7. I agree that my data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and may be used for future research.	☐	☐

Name of Participant

Date

Signature

Achara Khamaksorn

Name of Researcher

Date

Signature

APPENDIX C: The questionnaire survey

NO.

Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand

This questionnaire is a part of a research project. The aim of this study is to identify and understand the processes of transferring knowledge in International Construction Joint Venture (ICJV) projects in Thailand in order to develop a knowledge transfer framework for joint venture partnerships for Thai construction companies. The focus is on finding out how to develop and improve the knowledge and capacity for Thai construction companies and how to develop a knowledge transfer framework for ICJV Projects in Thailand in order to become more internationally competitive.

Please see the participant information sheet provided to you by the researcher for more information and feel free to contact the researcher if you have any further questions.

Please read the following instructions carefully

This questionnaire will take approximately 30 minutes to complete. We would like you to find a time when you are less likely to be disturbed, and to answer all the questions in one session if possible.

Please return this questionnaire with your response, even if you are unable to answer all questions. Your participation is very important for this research and your cooperation is very much appreciated.

Your answer will be kept strictly confidential and anonymous, and will be used for academic purposes only. No names mentioned in the questionnaire will be disclosed to your employer or any other third party.

If you have any enquiries, please do not hesitate to contact me via email at achara.khamaksom-2014a@brookes.ac.uk or mobile phone +66 81618 1910

We would like to thank you for taking the time to participate in this research.

Contact for further information

Achara Khamaksom
PhD Student

School of the Built Environment
Oxford Brookes University

Questionnaire

Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand

Section A - Demographic Details

1. First name and Surname:

2. Gender: ☐ Male ☐ Female

3. Age group: ☐ Less than 25 years ☐ 26-30 years ☐ 31-40 years
☐ 41-50 years ☐ 51-60 years ☐ More than 60 years

4. Nationality: ☐ Thai ☐ Others (Please specify)

5. Educational Qualification

☐ No qualification ☐ High school or equivalent ☐ Diploma/Certificate
☐ Undergraduate ☐ Postgraduate ☐ Doctorate
☐ Others (If any)

6. How many years of experience do you have in the construction industry?

☐ Less than 5 years ☐ 6-15 years ☐ 15-20 years
☐ More than 20 years

Please specify:

Years	Company	Position

7. Which company do you work for?

☐ Local company (Host) ☐ Foreign company (Partner)

Name of your company:

8. Which of the following best describes your position in your company?

☐ President ☐ Vice President ☐ Director
☐ General Manager ☐ Project Manager ☐ Project Engineer
☐ Project Architect ☐ Supervisor ☐ Others (If any)

9. What is your primary discipline?

☐ Architectural ☐ Structural Engineer ☐ Civil Engineer
☐ Mechanical Engineer ☐ Electrical Engineer ☐ Others (If any)

10. Do you have experience of delivering projects in an International Construction Joint Venture (ICJV)?

Please specify:

Years	Company	Position

11. Do you have experience in training with local or foreign company?

☐ Yes, If Yes, please specify: ☐ No

.....

.....

12. Do you have experience in visiting the local or foreign company or visiting in any ICJV Project?

☐ Yes, If Yes, please specify: ☐ No

.....

.....

13. Please describe briefly your job role and responsibilities in this ICJV project

.....

.....

.....

.....

14. Who do you report to during this project and how often?

.....

.....

.....

.....

Section B - The Social Network Analysis

The following section of the questionnaire focuses on different relationships within your project. Each question requires you to estimate the amount of particular type of project team interaction that has occurred with each actor in the context of **THIS** project.

Section B-1: KNOWLEDGE YOU SEEK

15. Who do you go to for advice? Write the name, position, their years of experience and relation of each person in the space provided.

Person No.	First and last name	Position	Years of experience	Relation with this person (Working colleague, boss, supervisor, friend, etc.)
Example				
0	Mr. Aroon Sawasdee	Project Engineer	10-15	Colleague

Please use the table below to answer the following questions with regard to **KNOWLEDGE YOU SEEK** of others within this project for each person you listed in question no. 15.

Person No.	16. How often do you exchange knowledge with this person? (1=Less than once a week, 2=Once a week, 3=More than once a week, 4=Once a day, 5=More than once a day)					17. How do you communicate with this person? (a) Telephone, b) E-mail, c) Face-to-Face, d) Social Network, e) others)					18. Which type of knowledge do you discuss most with that person? (See details in Table 1)	19. Why do you go to this person? (Please specify)
	1	2	X	4	5	a	b	X	d	e		
0											C1, C2, D4, E1-2	Trust and his experiences
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		
	1	2	3	4	5	a	b	c	d	e		

22. Which **METHODS** are useful to **GET** knowledge within this project?

Experience in knowledge sharing/ knowledge transfer	Knowledge sharing tool	How useful do you think this tool is to access the knowledge/information that you get?				
		Not Useful	Somewhat Useful	Neutral	Useful	Extremely Useful
		1	2	3	4	5
(S) Socialization (Individual to Individual) (Sharing Knowledge and Experiences)	Face-to-face communication/meetings					
	Socializing out-of-hours					
	Video or Telephonic communication					
	Storytelling					
	Visiting colleagues/ other projects/ companies					
	Visiting foreign company					
	Visiting plants or manufacturers					
	Communities Of Practices (COPs)					
	Other (please specify)					
(E) Externalization (Individual to Group) (Codification and Documentation)	Brainstorming					
	Memorandums and letters					
	Project history/ Case Writing					
	Knowledge sharing board					
	Web-based discussion group					
	Chat rooms/'Toolbox' talks					
	Personal intranets					
	Blogs/ Websites					
	Team collaboration tools					
	Expert systems/ ICT					
	Computer-aided system/ 3d-models)					
	Simulation and games					
	Decision support systems					
	Problem-solving technology					
	Learning Materials (E-Learning)					
	Communities Of Practices (COPs)					
	Group Meeting/ Team meeting					
	Ad hoc Meeting/ Minute Meeting					
	Regular meeting/ continuous meeting					
	Other (please specify)					
(C) Combination (Group to Organization) (Best Practice, Expansion of Knowledge)	A share best practice database					
	Knowledge databases					
	Web-base access to data					
	Intranet and internet page					
	Lesson learned database					
	Other (please specify)					
(I) Internalization (Individual to Group to Organization) (Individualization of Experiences)	Learning-by-doing/ Workshop/ Apprenticeships					
	On-the-job training					
	Special Training/ Trained in concentrated course					
	Induction Training					
	Hand-on training/ Formal Training					
	Training with foreign company					
	Lesson-learned Meeting					
	Other (please specify)					

Section B-2: KNOWLEDGE YOU MIGHT SHARE

23. Please list below the people who seek knowledge from you. Write the name, position, year of experiences and relation of each person in the space provided.

Person No.	First and last name	Position	Years of experience	Relation with this person (Working colleague, boss, supervisor, friend, etc.)

30. Which **METHODS** are useful to **SHARE** knowledge within this project?

Experience in knowledge sharing/ knowledge transfer	Knowledge sharing tool	How useful do you think this tool is to access the knowledge/information that you need?				
		Not Useful	Somewhat Useful	Neutral	Useful	Extremely Useful
		1	2	3	4	5
(S) Socialization (Individual to Individual) (Sharing Knowledge and Experiences)	Face-to-face communication/meetings					
	Socializing out-of-hours					
	Video or Telephonic communication					
	Storytelling					
	Visiting colleagues/ other projects/ companies					
	Visiting foreign company					
	Visiting plants or manufacturers					
	Communities Of Practices (COPs)					
	Other (please specify)					
(E) Externalization (Individual to Group) (Codification and Documentation)	Brainstorming					
	Memorandums and letters					
	Project history/ Case Writing					
	Knowledge sharing board					
	Web-based discussion group					
	Chat rooms/'Toolbox' talks					
	Personal intranets					
	Blogs/ Websites					
	Team collaboration tools					
	Expert systems/ ICT					
	Computer-aided system/ 3d-models)					
	Simulation and games					
	Decision support systems					
	Problem-solving technology					
	Learning Materials (E-Learning)					
	Communities Of Practices (COPs)					
	Group Meeting/ Team meeting					
	Ad hoc Meeting/ Minute Meeting					
	Regular meeting/ continuous meeting					
	Other (please specify)					
(C) Combination (Group to Organization) (Best Practice, Expansion of Knowledge)	A share best practice database					
	Knowledge databases					
	Web-base access to data					
	Intranet and internet page					
	Lesson learned database					
	Other (please specify)					
(I) Internalization (Individual to Group to Organization) (Individualization of Experiences)	Learning-by-doing/ Workshop/ Apprenticeships					
	On-the-job training					
	Special Training/ Trained in concentrated course					
	Induction Training					
	Hand-on training/ Formal Training					
	Training with foreign company					
	Lesson-learned Meeting					
	Other (please specify)					

31. Which METHODS do you use most to RECEIVE knowledge from others within this project? (Please Specify)

32. Which METHODS do you use most to SHARE your knowledge with others in this project? (Please Specify)

Section C – Comments and recommendations

33. Do you have any suggestions on how to share experience within organization/ projects?

34. Any other comments and recommendations?

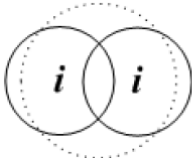
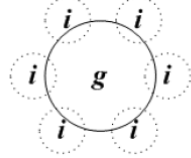
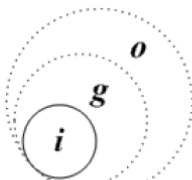
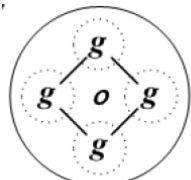
THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

**Table 1: Type of Knowledge flow between actors in ICJV projects
(For question no.18 and no.26)**

Type of Knowledge flow between actors
<u>A. Design Knowledge and Skills</u> 1. Conceptual skills 2. Design skills and Details design 3. Others (If any)
<u>B. Technical Expertise</u> 1. Construction techniques (Such as High-speed grouting of the piles, the high grade of concrete specified, Large concrete pours) 2. Construction knowledge 3. Product process and development 4. Transfer and movement of materials and manpower or equipment manufacturing capacity 5. Accumulated experience and track record/ A good track record 6. Others (If any)
<u>C. Management Expertise</u> 1. Project management 2. Project planning and control 3. Project resource management 4. Human resource management and development (Such as Disciplined and motivated workforce) 5. Organizational management 6. Procurement system 7. Subcontracting arrangement and management/ Corporate commitment and ability to assess 8. Employment of subcontractors in international project 9. Risk management 10. Site management 11. Cost management 12. Others (If any)
<u>D. Technological Expertise</u> 1. Technologies in building and components 2. Advanced production systems (Such as Prefabrication systems) 3. Specific technology (Such as Natural gas technology) 4. IT systems 5. New technologies from oversea collaboration 6. Others (If any)
<u>E. Economic, Marketing and Financial Expertise</u> 1. Investment in the construction sector 2. Marketing knowledge/ Marketing know-how 3. Financial risk 4. Financial backing/ Strong financial backing/ Financial support 5. Project fully and partially funded from oversea 6. Practicing under-pricing to win projects 7. Bidding strategy incorporates the preferential margin scheme 8. Avoiding paying local taxes 9. Economic environment 10. Industry structure 11. Macroeconomic conditions 12. Others (If any)
<u>F. Quality Assurance and Control Expertise</u> 1. Quality assurance and control 2. Quality standard 3. Others (If any)

Type of Knowledge flow between actors ('Con)	
<u>G. Safety Expertise</u>	
1. Safety standard	
2. Others (If any)	
<u>H. Construction Resources</u>	
1. Construction resources such as materials, equipment, tools and etc.	
2. Construction equipment (Such as Increase equipment, Materials or equipment manufacturing techniques and capacities)	
3. Labor productivity	
4. Local Resources	
5. Comprehensive support facilities	
6. Others (If any)	
<u>I. Training Programmes</u>	
1. Training of skilled worker, their migration for oversea jobs and their re-employment in domestic construction	
2. Manpower training programmed	
3. Training programmed	
4. Others (If any)	
<u>J. Local Condition and Culture</u>	
1. Foreign/ Local culture and National culture	
2. Local language	
3. Knowledge of local situation/ institution	
4. Knowledge of local market condition	
5. Local government policies/ Dealing with various government bureaucracies	
6. Knowledge of local customers	
7. Administrative procedures	
8. Strength of legal system/ Legal system	
9. Political stability/ Political system	
10. Gaining the knowledge under local conditions	
11. Local business practice	
12. Others (If any)	

Table 2: The Mechanism used for Knowledge Transfer
(For question no.20 and no.28)

(S) Socialization (Individual to Individual) (Sharing Knowledge and Experiences)  1. Face-to-face communication/ Face-to-face meetings 2. Socializing out-of-hours (Lunch or Coffee breaks) 3. Video or Telephonic communication 4. Storytelling 5. Visiting colleagues/ other projects/ companies 6. Visiting foreign company 7. Visiting plants or manufacturers	(E) Externalization (Individual to Group) (Codification and Documentation)  1. Brainstorming 2. Memorandums and letters 3. Project history/ Case Writing 4. Knowledge sharing board 5. Web-based discussion group 6. Chat rooms/ 'Toolbox' talks 7. Personal intranets 8. Blogs/ Websites 9. Team collaboration tools 10. Expert systems/ Information system/ Information Technology 11. Computer-aided system/ 3d-models 12. Simulation and games 13. Decision support systems 14. Problem-solving technology 15. Learning Materials (E-Learning) 16. Communities Of Practices (COPs) 17. Group Meeting/ Team meeting 18. Ad hoc Meeting/ Minute Meeting 19. Regular meeting and continuous meeting
(I) Internalization (Individual to Group and Organization) (Individualization of Experiences)  1. Learning-by-doing/ Workshop/ Apprenticeships 2. On-the-job training 3. Special Training/ Trained in concentrated courses 4. Induction Training 5. Hand-on training/ Formal Training 6. Training with foreign company 7. Mentoring and coaching 8. Lesson-learned Meeting	(C) Combination (Group and Organization) (Best Practice, Expansion of Knowledge)  1. Sharing best practice/ Best practices/ A share best practice database 2. Knowledge Databases 3. Web-base access to data 4. Intranet and internet pages 5. Lesson Learned Database

APPENDIX D: Interview schedule

Thank you for participating in this research project. As you might already know from the participant information sheet and the consent form, I am carrying out research in order to understand on Knowledge Transfer Processes in International Construction Joint Venture Projects in Thailand. You have been chosen for an interview because the analysis of the questionnaires has shown that you are an important team member for this specialised knowledge transfer. Your participation is very important for this research and your cooperation is very much appreciated. This interview will take about 45-60 minutes.

Interview Questions:

Part 1: About knowledge sharing and communication, ICJV performance and ICJV success factors

1. What type of knowledge do you most often discuss regarding to **THIS projects**? And why? (E.g. Design knowledge and skills, Technical and logistic expertise, Management expertise, Technological, Marketing and financial, Quality Assurance and control, Safety, Construction resources, Training programmes and Local condition and Culture)
2. Which way of communication is the most important in ICJV projects? And why? (E.g. Telephone, E-mail, Face-to-Face, Social Network or others) and how much time (in hours per week) does it take you approximately?
3. Do you feel that there is a need to up-skill staff involved in ICJV projects?
4. Do you feel that knowledge transfer and experience sharing between actors are needed in ICJV projects?
5. And what makes you decide on which method you are going to use to transfer knowledge?
6. What do you consider to be the main barriers/ enhancers to transfer this knowledge on ICJV projects?
7. What type of knowledge transfer methods and mechanisms have you been exposed to that helped and needed for ICJV project? And why?
8. Do you have the feeling you can access the knowledge on ICJV projects from other project participants at all times- can you elaborate?
9. What performance indicators are important in ICJV projects? And why?
10. What factors influence and are important in the successful delivery of ICJV projects? And why?

Part 2: About key enabling and inhibiting factors

11. What are the key enabling factors that influence knowledge transfer processes in ICJV projects? And why?
12. What are the key inhibiting factors that influence knowledge transfer processes in ICJV projects? And why?

Part 3: Suggestions and recommendations

13. Do you have any suggestions on how to make this knowledge transfer between project participants better?
14. Any other recommendations?

APPENDIX E: The details of Methods and Mechanisms and Type of Knowledge

Methods and Mechanism used for KT	Type of Knowledge flow between actors
<u>(S) Socialisation (Individual to Individual)</u> S1. Face-to-face communication/ Face-to-face meetings S2. Socialising out-of-hours (Lunch or Coffee breaks) S3. Video or Telephonic communication S4. Storytelling S5. Visiting colleagues/ other projects/ companies S6. Visiting foreign company S7. Visiting plants or manufacturers <u>(E) Externalisation (Individual to Group)</u> E1. Brainstorming E2. Memoranda and letters E3. Project history/ Case Writing E4. Knowledge sharing board E5. Web-based discussion group E6. Chat rooms/ 'Toolbox' talks E7. Personal intranets E8. Blogs/ Websites E9. Team collaboration tools E10. Expert systems/ Information system/ Information Technology E11. Computer-aided system/ 3d-models) E12. Simulation and games E13. Decision support systems E14. Problem-solving technology E15. Learning Materials (E-Learning) E16. Communities Of Practices (COPs) E17. Group Meetings/ Team meeting E18. Ad hoc Meetings/ Minutes of Meetings E19. Regular meetings and continuous meetings <u>(C) Combination (Group and Organisation)</u> C1. Sharing best practice/ Best practice/ A share best practice database C2. Knowledge Databases C3. Web-base access to data C4. Intranet and internet pages C5. Lesson Learned Database <u>(I) Internalisation (Individual to Group and Organisation)</u> I1. Learning-by-doing/ Workshop/ Apprenticeships I2. On-the-job training I3. Special Training/ Trained in concentrated courses I4. Induction Training I5. Hand-on training/ Formal Training I6. Training with foreign company I7. Mentoring and coaching I8. Lesson-learned Meeting	<u>A. Design Knowledge and Skills</u> A1-Conceptual skills A2-Design skills and Details design <u>B. Technical Expertise</u> B1-Construction techniques B2-Construction knowledge B3-Product process and development B4-Transfer and movement of materials and manpower or equipment manufacturing capacity B5-Accumulated experience and track record/ A good track record <u>C. Management Expertise</u> C1-Project management C2-Project planning and control C3-Project resource management C4-Human resource management and development C5-Organisational management C6-Procurement system C7-Subcontracting arrangement and management/ Corporate commitment and ability to assess C8-Employment of subcontractors in international project C9-Risk management C10-Site management C11-Cost management <u>D. Technological Expertise</u> D1-Technologies in building and components D2-Advanced production systems D3- Specific technology (Such as Natural gas technology) D4-IT systems D5-New technologies from oversea collaboration <u>E. Economic, Marketing and Financial Expertise</u> E1-Investment in the construction sector E2-Marketing knowledge/ Marketing know-how E3-Financial risk E4-Financial backing/ Financial support E5-Project fully and partially funded from overseas E6-Practicing under-pricing to win projects E7-Bidding strategy incorporates the preferential margin scheme E8-Avoiding paying local taxes E9-Economic environment E10-Industry structure E11-Macroeconomic conditions <u>F. Quality Assurance and Control Expertise</u> F1-Quality assurance and control F2-Quality standard <u>G. Safety Expertise</u> G1-Safety standard <u>H. Construction Resources</u> H1-Construction resources H2-Construction equipment H3-Labour productivity H4-Local Resources H5-Comprehensive support facilities <u>I. Training Programmes</u> I1-Training of skilled worker, their migration for overseas jobs and their re-employment in domestic Construction I2-Manpower training programmed I3-Training programmed <u>J. Local Conditions and Culture</u> J1-Foreign/ Local culture and National culture J2-Local language J3-Knowledge of local situation/ institution J4-Knowledge of local market condition J5-Local government policies/ Dealing with various government bureaucracies J6-Knowledge of local customers J7-Administrative procedures J8-Strength of legal system/ Legal system J9-Political stability/ Political system J10-Gaining the knowledge under Local Conditions J11-Local business practice