

Manuscript Title Social Networks and Knowledge Transfer in International Construction Joint Venture Project: A Case Study in Thailand

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EARLY VIEW

Social Networks and Knowledge Transfer in International Construction Joint Venture Projects: A Case Study in Thailand

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Abstract: International joint ventures (IJVs) are a specific type of strategic alliance between contractors from developed and developing countries and have been increasingly used. IJVs between multinational organisations are considered a successful strategy to benefit from international market opportunities in the globalised world. 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. The aim of this paper is to uncover the knowledge transfer (KT) practices in an ICJV using social network analysis (SNA). The case presented here is the pilot study. A total of 19 questionnaire surveys were undertaken with selected team members. UCINET 6.0, an SNA package, was used to analyse the collected data, and NetDraw was used to visualise the sociogram. This paper first presents the actors' attributes; then, social network characteristics, which consist of network structure, network density and degree of centrality and cliques of actors, are presented. This analysis will be used to identify the key actors that influence the KT processes in this case study.

Keywords: International construction, Joint venture projects, Key actors, Social network analysis, Knowledge transfer

INTRODUCTION

Globalisation has particularly strengthened over the last two decades. Strategic alliances have been widely discussed in the context of international businesses (Carrillo, 1996; Hong, Chan and Daniel, 2014). The joint venture company (JVC) is the most ordinary form of organisational structure where the parties wish to establish and operate a jointly owned business (V.V. et al., 2000; Scaringella and Burtschell, 2017; Chan, Tetteh and Nani, 2020). In recent years, companies around the world have been trying to expand internationally through collaborative agreements. International joint ventures (IJVs) are business arrangements for companies seeking to enlarge their international activities and business. The trend towards forming IJVs has become increasingly common since the 1970s (Ozorhon et al., 2007a; Ozorhon et al., 2008a; Ozorhon et al., 2008b; Ozorhon et al., 2010; Ozorhon et al., 2011). Construction firms can exploit business opportunities and enter new markets abroad through the formation of IJVs. ICJVs have become of

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significant interest as the global construction market continues to be integrated into a more competitive and turbulent business environment. The number of ICJVs is growing worldwide, especially in developing countries (Mohamed, 2003; Mohamed, 2010; Alashwal and Ann, 2019). A critical review carried out by Grimschseid and Brokmann (2010) and Adnan et al (2012) highlighted that an ICJV often faces a highly complex and dynamic environment. They 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; Abdul-Aziz and Cha, 2008). Moreover, the number of ICJVs is growing worldwide, especially in developing countries.

In this new era of globalisation, numerous firms have come to rely on alliances as a strategic necessity for sustaining competitive advantage and creating customer value through knowledge sharing and transfer. Many organisations have successfully shared and transferred expertise between individuals and units. Individuals share their knowledge to generate new knowledge (Tang, 2015; Zaidi and Davies, 2011). Actor 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. In this study, social network analysis (SNA) is carried out to map the ties that exist between the local company and the IJV partner. They are also analysed to establish how knowledge is transferred within ICJV projects and to identify the experts involved in KT. Thus, it was considered important to collect data on actor attributes such as the age, nationality, qualifications, job position, work experience, and attitude of the participants before referring to other information, such as their nationality, educational background and expertise to explore the influence of these attributes on the KT processes in ICJV projects.

To understand how successfully a team transfers knowledge, examining the process in more detail is crucial. Efficient knowledge flow in a team's development cycle frequently requires overcoming problems that affect the team, the relationship between the team and other functions inside and outside the organisation. Social networks among knowledge actors can be defined as *knowledge networks*. Therefore, the social network perspective should allow for analysing the KT between actors and groups. SNA has been used to generate, visualise and analyse networks of research collaboration. It focuses on the characteristics of ties within a set of social actors, such as persons, groups, organisations, activities and so on.

In this phase of globalisation, manufacturing is 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 to compete successfully, and they must also be able to manage knowledge in a strategic fashion. Therefore, the creation and transfer of knowledge creation 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 (SNs) 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 aim of this paper is to uncover KT practices in an ICJV using SNA. The findings reveal the relationships between each actor in the network and the key actors within ICJV projects in the context of KT. This study brings together the key concepts that relate to social network theory and KT in organisations. It discusses the key concepts and factors for effective transfer of knowledge in ICJV projects in Thailand and makes recommendations on how to use such knowledge. The contribution to new knowledge is made by identifying the key concepts and key factors that influence the knowledge transfer (KT) processes in ICJV projects and by identifying more generic implications for SNs on knowledge in Thai ICJV projects.

LITERATURE REVIEW

The concept of 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 instrument in various areas for analysing patterns of relationships and interactions between social actors in a network to discover the underlying social structure (Hoppe and Reinelt, 2010). SNA is a set of techniques used to understand more specific types of relations, such as firm alliances, international trades and friendships (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; 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; Some, 2013). SNA can be used to examine the structure of social relations in a group to expose the informal relationships 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 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 international projects and firm capabilities (ibid).

Since a SNA focuses on the characteristics of ties within a set of social actors (i.e., persons, groups, organisations, nations, human activities etc.), it is linked to the significance of the relationship between social actors and their behaviour, opinions and attitudes. The characteristics of social actors 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; Nieves and Osorio, 2013). There are two key measures of SNs: namely, network density and network centrality, which affect performance and can be derived from an SNA (Nonaka, 1991; Nonaka and Hirota, 1995). Network density is a measure of cohesion and shows the looseness of the relationship between network members. It is one of the extensively used key 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 that 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) indicated 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 include actors, groups or subgroups and relations.

Actors' Attributes and Relational Ties

Many organisations have successfully shared and transferred expertise between individuals and units (Argote, 1999). 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 (Zhang et al., 2013). A 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 among a group is described as relational. Ties include attitudes, social roles, kinship and the 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’ enable significant outcomes, such as efficiency and innovation, to be predicted. Moreover, ties can be directed (e.g., seeking advice from) or undirected (e.g., sharing information with). SNA addresses both directed and undirected networking. Directed ties can be one way or two way. Directed ties and undirected ties are ordinary indicators that identify a node’s status and the degree of power in a network (Park et al., 2011). Hence, it is considered important to collect information about the actors’ attributes, such as their age, gender, nationality, qualifications, job position, work experience and attitude, as well as the relation ties in the network before referring to other information, such as their educational background and expertise (ibid), to explore the influence of these attributes on KT processes in ICJV projects.

Network Centrality (Degree Centrality and Betweenness Centrality)

Centrality is a property of a node’s position in a network that 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 many 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 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, 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 to identify which actor is more central in the network. According to Park et al. (2011), there are various types of centrality, namely, degree centrality, betweenness centrality and closeness centrality. ‘Degree centrality’ can be divided into out-degree and in-degree centrality (Lin and Tan, 2014; 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 for measuring 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 refers to the number of nodes that supply directed relationships to a given node. Out-degree is 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; Khamaksorn, Tah, and Kurul (2020).

Clique of the network (Cluster)

A clique is a subset of actors in the network who are all close to each other and a highly bonded subgroup in the subset (Hoppe and Reinelt, 2010; Borgatti, Everett and Johnson, 2013). Identifying cliques or clusters is one of the most important applications of SNA (Hoppe and Reinelt, 2010). To improve 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). According to Zhang, He and Zhou (2013), network density, network centralisation and betweenness centralisation are regarded as the core indicators in SNA. 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.

To conclude, 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) and Kereri and Harper (2019) define the focus of an SNA as an examination of the relationships among the social actors within the group using a variety of statistical and visual analyses. Since this research involves an examination of how the KT 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 to facilitate the understanding of the social connections and knowledge flows within the group or network. When 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 isolate players to improve knowledge flows and raise awareness of the significance of informal networks. This is especially important in determining the knowledge and skills required for ICJV projects. Thus, network density, degree centralisation and cliques in the network were selected as the key indicators in this study.

Knowledge Transfer in International Construction Joint Venture Projects

KT is an important process by which an organisation learns specific knowledge that exists in another organisation or different parts of it. Moreover, KT has also been defined as the successful transfer of knowledge between local and foreign partners when local partners who wish to enter an emerging market and secure long-term competitiveness in this new environment need to develop the required resources rapidly. Hence, it is essential to better understand how knowledge is transferred and adopted in ICJV projects. Therefore, the purpose of this section is to identify the key factors that influence the KT process in an ICJV project and use them to develop a conceptual framework. According to Miles and Huberman (1994), a conceptual framework consists of the key constructs of the phenomenon being studied and the presumed relationships among them. Many researchers identify the research framework as the starting point of a case study since it underlies and provides the key research constructs. The conceptual framework for this research represents the knowledge input, KT processes and knowledge output related to ICJV projects from prior literature. It will be used to explain the way knowledge is transferred in selected ICJV projects. This conceptual framework is the key contribution of this research to existing knowledge since it consists of a combination of concepts from two domains: KTs and ICJVs. Many researchers suggest that understanding knowledge characteristics is key to understanding how it is transferred. The key concepts in the field of KT in this study, which have been demonstrated in prior literature to affect the process of transferring knowledge in ICJV projects, are explained in the next section.

Changes in the business environment due to increased globalisation have made organisational knowledge a critical factor for firms to obtain a competitive advantage in the international business arena. This especially applies to firms involved in ICJVs, which are defined as a business partnership in which at least one partner has its headquarters outside the joint venture's country of operation (Ozorhon et al., 2008). Participating in an ICJV is deemed to be a successful strategy for organisations in developed and developing countries to benefit from international market opportunities in the

globalised world (Ozorhon et al., 2008b, V.V. et al., Carrillo, 1996). Moreover, an ICJV is a mechanism for transferring knowledge between the partners and a way for local partners to improve their knowledge and skills (Mo et al., 2011; Hajidimitriou and Rotsios, 2009; Tsang, 1999). Knowledge is increasingly becoming a crucial strategic resource in the continued intensity of global competition. It is not only regarded as a key factor for the successful completion of a project but also as a critical asset for a firm to achieve a long-term competitive advantage (Piyanut et al., 2009). The success of an organisation in the current competitive commercial environment is significantly linked to its ability to effectively build, utilise and manage its capacity for knowledge to sustain its competitive position in a constantly changing business environment. Therefore, firms regard knowledge as their most valuable resource, and its transfer within and between them plays a significant role in their success. Hence, the extent to which ICJV companies benefit from their new international relationships greatly depends on their ability to transfer knowledge (Hajidimitriou and Rotsios, 2009).

As demonstrated above, the efficient transfer of knowledge is an extremely important factor for an organisation to achieve a competitive advantage due to the rapid changes in the current international commercial environment. KT, which refers to the transfer of expertise between global firms, plays a critical role in their long-term existence, as well as being recognised as one of the key factors of success in implementing any kind of project. KT is strategically important for construction firms for several reasons, which include the provision of social capital in construction management and the creation of new knowledge. Its ability to transform a firm into a learning organisation, transfer technology and build communities of practice has also led to KT being recognised as one way to significantly improve construction project management.

It is difficult to capture the concept of the KT process from the literature because there is no clear distinction between the transfer of existing knowledge and the creation of new knowledge (Wende, 2009). Nevertheless, it is clear from a review of inter-partnership learning that academic scholars have been attracted to study cross-national alliances in recent years and have identified various issues in relation to the KT process, the first of which concerns the knowledge acquisition process; in other words, how knowledge is acquired or transferred across partner firms and what factors facilitate or inhibit this process. The second issue is the type of knowledge being transferred (Evangelista, 2007). Knowledge flows and KT both 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 some examples of activities (knowledge flow between actors), controls or constraints (i.e., performance and success factors, knowledge facilitators and key enabling and inhibiting factors) and mechanisms for transferring knowledge. It is vital for organisations to develop new knowledge and skills as they become involved in international projects, and their presence has increased in the international business field. Lech (2011) defines KT as 'a process of the exchange of tacit and explicit knowledge between

two actors', and Goh (2002) posits that the basic process underlying KT is another important factor to consider. Prior researchers have suggested three sets of factors that are likely to influence KT: the source and the recipient, the type of knowledge and the knowledge transfer process by which the transfer takes place (Goh, 2002; Evangelista, 2007). The key concepts in the area of KT, which contributed to the development of the conceptual framework in this study, are examined in the next subsection. They include the knowledge flow between actors (i.e., the source, recipient and type of knowledge) and the key factors that influence the process of KT mechanisms).

The exchange of knowledge between the source and the recipient enables organisations that wish to increase their international business activities to develop new knowledge and skills that are deemed to be necessary for international projects. Nonaka and Takeuchi's (1995) *SECI Model* includes four distinctive mechanisms that contribute to the efficient creation and transfer of knowledge by successful companies. This spiral of knowledge represents tacit and explicit knowledge and emphasises the importance of the interaction of different actors. The model not only defines the creation of knowledge but also the process of transferring it.

The flow and transfer of knowledge are both important to firms for several strategic reasons. Knowledge flows along a channel between a source and a target and the process of acquiring and transferring it involves two key players, namely, the knowledge holder and knowledge receiver (Hau and Evangelista, 2007). The distance of the knowledge flow also affects the method chosen for the KT. Dobrai et al. (2012) claim that the pattern of interaction between local and foreign companies can be different, such as foreign to foreign (F-F), foreign to local (F-L) and local to local (L-L). Knowledge flows and the transfer of knowledge involve the transmission of expertise that is relevant globally, and this is of strategic importance to organisations for several reasons. The conceptual framework in this section includes several sample activities (knowledge flow between actors), controls or constraints (i.e., success factors, knowledge facilitators and key factors) and various mechanisms used to transfer knowledge. The first key factor that affects the KT process in this conceptual framework is *Actors*.

Therefore, the effectiveness of the learning of local members in an ICJV not only depends on their intention and ability to learn but also the source of the knowledge, because 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 fill the gaps in the knowledge between the source and the recipient. This research is focused on exploring the theory that underpins the transfer of knowledge in ICJV projects in Thailand. Since its aim is to explore the process of transferring knowledge in these projects so that local members can have a better understanding of it, the study will include some examples of the flow of knowledge from foreign to local (F-L) actors in selected projects. Moreover, Goh (2002) and Evangelista (2007) posit that the

type of knowledge is another important factor to consider when studying the basic process of KT.

Knowledge Transfer Processes

Organisational knowledge is a critical component for firms to secure a competitive advantage in the current rapidly changing commercial environment. An ICJV is defined as a joint venture in which the headquarters of at least one partner is located outside the joint venture's country of operation (Ozorhon et al., 2008a; Ozorhon et al., 2008b). The establishment of an ICJV between organisations located in developed and developing countries is considered an extremely successful strategy for them to benefit from international market opportunities in this globalised world (Carrillo, 1996; Ozorhon et al., 2008b). Moreover, an ICJV can be a mechanism for the transfer of knowledge between the partners and a way to improve the knowledge and skills of local partners (Mo et al., 2011, Hajidimitriou and Rotsios, 2009; Hajidimitriou, 2012; Tsang, 1999; Tsang, 2010). As competition in business continues to intensify across the globe, knowledge has increasingly become a crucial strategic resource and is regarded as a key factor in the successful completion of projects as well as a critical asset for organisations to acquire and sustain a competitive advantage (Piyanut et al., 2009). The success of a firm in building its capacity in today's competitive business environment is strongly related to its ability to utilise knowledge. Many organisations have been able to sustain their primary position in a fiercely competitive business arena by effectively managing their capacity for knowledge. Knowledge is deemed to be the most valuable resource by firms, and its transfer within and between them is a key factor in their success. Whether ICJV companies benefit from their new international relationship greatly depends on their ability to transfer knowledge (Hajidimitriou and Rotsios, 2009).

Based on the earlier literature review, construction firms are faced with enormous challenges due to constant international competitiveness caused by globalisation. If they can learn and understand the process of transferring knowledge, especially in ICJV projects, it will enable them to develop and improve their knowledge and capacity to be internationally competitive. Therefore, given the particular significance of understanding how new knowledge in an ICJV project can be transferred and adopted between foreign and local partners, this study attempts to fill this knowledge gap by designing a practical framework to explore SNA and KT processes in selected ICJV projects. Some important gaps in the literature were identified from the extensive review of relevant research on ICJV projects and KT processes.

The first gap in the literature concerns the absence of the factors that there is a lack of research offering analysis of the key enabling and inhibiting factors that influence the KT 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 of

Intra-knowledge (within an organisation) transfer. Furthermore, there are relatively few studies based on the impact of cultural differences on KT (van Wijk et al., 2008). According to Easterby-Smith et al. (2008), this may be 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, no study has examined all these factors simultaneously in the context of inter-organisational KT. Therefore, the current understanding of what contributes to KT processes and the success of ICJV projects remains limited.

Secondly, an extensive review of the literature indicates that, although several previous researchers have examined KT 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 KT 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 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 projects, there is limited research conducted in 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.

METHODOLOGY

This research was based on a case study design. In order to fulfil the research aim and objectives, the data for this study were collected from an ICJV project. This ICJV project has an excellent performance record in infrastructure construction projects in Thailand and has joint venture agreements in Thailand with foreign companies from France. The data for this ICJV project were collected from a sample of managerial and professional staff in Bangkok, Thailand. This ICJV project was undertaken by a French firm (F) and a local company (L) with an equity share of 35% and 65%, 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, to complement the foreign partner's lack of local knowledge, and to share each other's expertise. Local

Company (L) is one of the largest firms in Thailand, with major activities ranging 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.

Questionnaire surveys were used to collect 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, concepts, areas, and so on. Moreover, the participants were asked to nominate other potential respondents from their SNs based on snowball sampling to identify other key participants with a specific range of skills and attributes that have been determined as being critical for the transfer of knowledge. 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. Furthermore, the interviewees were required to have experience in 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. The criteria of experts to be interviewed included 1) profile (certificates and qualifications), 2) position, 3) past experience, 4) experience of ICJV projects and 5) experience and role in the knowledge domain that 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 KT in the ICJV project to be evaluated.

A total of 19 questionnaire surveys were undertaken with selected team members from a local and a foreign company. It was mostly collected in an office on the construction site. UCINET 6.0, SNA package (Borgatti, Everett and Freeman, 2002) was used to analyse the collected data. NetDraw was used to visualise the sociogram (Borgatti, 2002). This study yielded context-specific findings on the impact of three SNA metrics (i.e., density, centrality and clique) on KT practices.

SOCIAL NETWORK ANALYSIS

The survey results indicated that all the participants (100.00%) were male. The managerial and professional staff came from two different countries. Furthermore, 5.26% of them were French and 94.74% were Thai. 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 respondents in this ICJV project were aged between 26 and 30 years.

This network consisted of 71 nodes, comprised of 19 research respondents and 52 other project participants who were named by them. The network boundary was defined as all the participants from the

organisation chart of this project; as a result, there were 19 participants in this case study. The collaboration networks, network structure and the strength of the ties between nodes developed by the collected ICJV project and the expertise of different stakeholders in various positions in the collaborative network is shown Figure 1. 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. Observations reveal that the stronger the tie, the more often they exchange knowledge.

In these collaborative networks, it is shown 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 2, there was a good connection between foreign and local actors, supervisor (L-Sup02), senior engineer (L-SEng01), project engineer (L-PEng02) and 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.

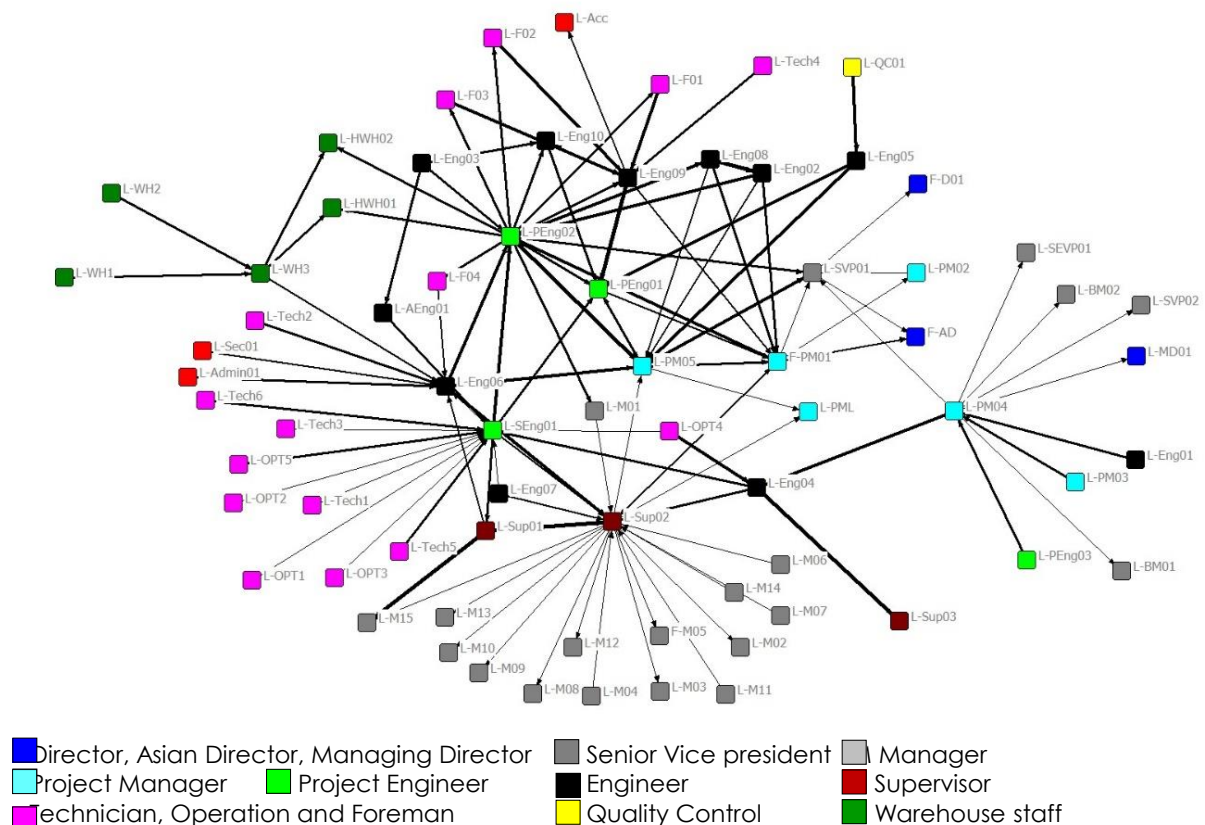


Figure 1. Sociogram showing network density according to SNA restricted to a position.

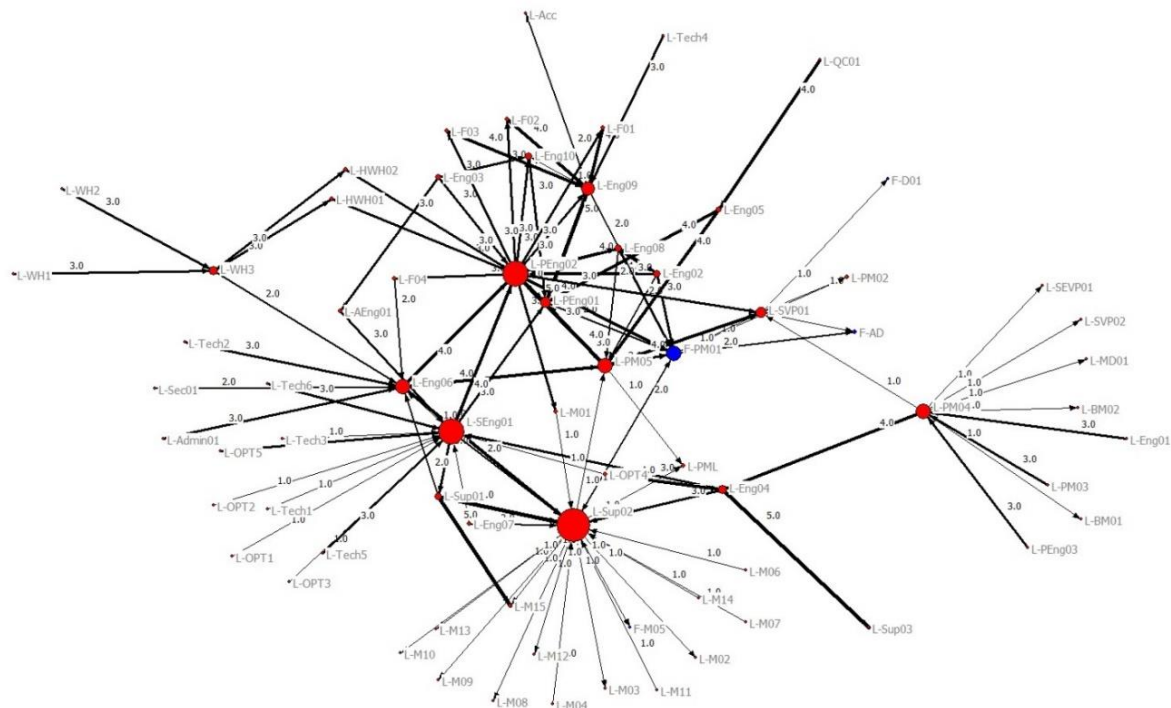


Figure 2. Sociogram showing network density.

The collaborative network shown in Figures 2 indicates that most of the local staff 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 staff and the foreign manager (F-PM01) in terms of the KT processes in this project. Furthermore, the collaborative network in Figures 2 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 who obtained knowledge and experience on how to manage 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 that the 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 as local partner. L-

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 1, in which the average degree of centrality is illustrated. The in-degree and out-degree values of this case study are shown in Table 1.

Table 1. Degree of Centrality

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 age, 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 1 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 who was a foreign partner were involved in receiving and disseminating knowledge in the project. Based on the demographic characteristics and the centrality measures in Table 1, it could be argued that being a knowledge broker was not associated with a hierarchical position, years of experience or age.

Table 2. Betweenness Centrality Measures

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

Table 2 indicates that L-PEng02 (project engineer) had the highest betweenness centrality score, as indicated in Table 2, followed by L-Sup02 (supervisor). This shows that L-PEng02 was regarded as the main gatekeeper in this network. Similarly, L-PEng02 also had high in-degree and out-degree centrality values. Therefore, it may be said that L-PEng02 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 operation disruption. The most likely explanation for this result is that L-PEng02 played a broker role in this network since many nodes needed L-PEng02 to reach other nodes by an efficient path. L-PEng02 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 could effectively discriminate between nodes and potentially correlate well with other nodes.

According to the data in Table 3, this network contained 24 clusters, each of which consisted of three or more members. Moreover, cliques 5, 8, 9, 13, 19, 21 and 24 contained a mixture of local and foreign members.

Table 3. Cluster Analysis

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.

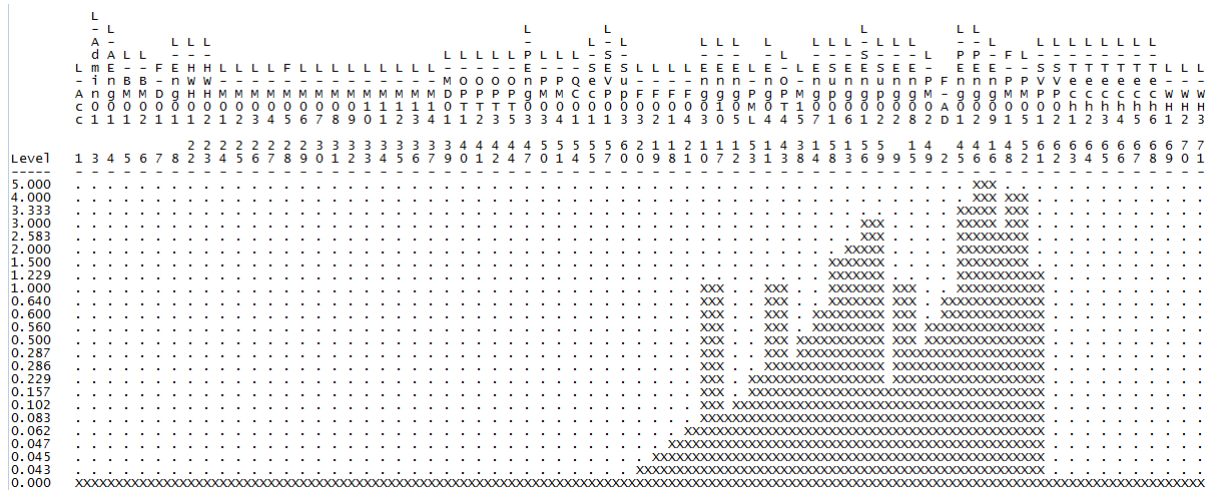


Figure 4. Hierarchical Clustering of Overlap Matrix.

As can be seen from Figure 4, L-Eng02 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 3 that L-PEng02 and L-Eng09 were in five different cliques together (cliques 12, 13, 14, 15 and 16), indicating that these actors were important within the group and possibly held leadership roles in this ICJV project. Moreover, it is indicated in Table 3 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 knowledge gaps between 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 (the 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 (the 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 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 at least once a week because he trusted 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.

As argued in the previous section, L-Sup02 (supervisor) was perceived as 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.

Table 4. SNA between key actors

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

Furthermore for 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 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. The findings showed that most of the key actors in this ICJV project preferred to use face-to-face communication, mentoring and coaching, group meetings or team meetings, project history or case writing, brainstorming, socialising out-of-hours (lunch or coffee breaks), regular meetings and continuous meetings, on-the-job training, memoranda and letters, minutes of meetings, team collaboration tools, knowledge databases, mentoring and coaching and 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-PEng02, the project engineer 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. Ninety percent 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 project management was the most important knowledge flow, followed by procurement system subcontracting arrangements and management or corporate commitment and the ability to assess technologies in building and components. These findings indicate that there was a lack of exchanging knowledge and experience of economic, marketing and financial expertise in this ICJV project. Moreover, only some key actors asked for advice and shared their knowledge of technological expertise, quality assurance and control expertise, safety expertise, construction resources and 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 six 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.

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

DISCUSSION AND CONCLUSION

The data gathered in a case study related to experience revealed that ICJV staff sought to achieve KT throughout the course of the ICJV. However, it was challenging, and its success depended on multiple knowledge characteristics, methods and mechanisms, as well as the type of knowledge. In this ICJV project, 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. As a result, the key actors in this case study were the project manager and supervisor. It seems clear that the KT processes had taken place between the project managers (from both local and foreign partners) and supervisors. According to the aim of this study, the interviewees were asked to define the processes of transferring knowledge in this ICJV project between local and foreign partners. In terms of the knowledge source and reasons to exchange knowledge, the vast majority of the key knowledge actors in this ICJV project indicated that ‘boss’ and ‘work colleagues’ were more frequently considered to be a source of knowledge in this ICJV project. 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), Pícha et al (2017) and Mba and Agumba (2018), 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. This result is supported by Hajidimitriou and Rotsios (2009), Al-Salti (2011), Khamaksorn, Kurul and Tah (2016) and Saifi, Dillon and McQueen (2016), 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 in this ICJV project also provided the reasons for exchanging their knowledge and experience with alliance members to facilitate learning. Specifically, the participants from this ICJV project argued that ‘their knowledge and experience’ were 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 an important reason for learning.

In terms of expatriate experts, the survey results and SNA showed that the key actor in this case study was the supervisor. This result is contrary to the finding of 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. However, this result is supported by Park (2011), who demonstrated that supervisors or 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 project manager in ICJV project.

Having achieved the 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 KT 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 KT 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 this ICJV project noted that they had used four types of mechanisms to transfer knowledge between them, especially 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 or minutes of meetings, regular or 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 or companies, visiting a foreign company and visiting plants or manufacturers were never used in this ICJV project, neither were ICT collaboration tools (e.g., expert systems, decision support systems, COPs, etc.).

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. The understanding of what contributes to the success of KT processes and the success of ICJV projects is still limited due to the lack of a holistic and thorough examination in prior studies.

The sample in this study was restricted to one ICJV project. 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.

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