KNOWLEDGE TRANSFER OF JOINT VENTURE CONTRACTORS IN FOREIGN FUNDED WATER SECTOR CONSTRUCTION PROJECTS

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DECLARATION

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ABSTRACT

The economy of a country highly depends on its investments in the construction industry. The construction industry has been widely described as a very competitive industry (Shen and Cheung 2017). In this context capacity development of the local contractors is utmost important for long term sustainability.

In Sri Lanka, the involvement of foreign contractors to undertake large scale construction projects has increased recently. One of the major benefits offered by the involvement of foreign contractors in construction projects is the "Knowledge Transfer" (Bandara 2014). The most favourable collaboration type between local and foreign contractors in terms of knowledge transfer is Joint Venture (JV). However, the effectiveness of the knowledge transfer under JV is moderately discussed in past studies. Hence it is important to undertake a comprehensive study to analyse in Sri Lankan construction industry.

The main objectives of this research are (i) to identify the global knowledge transferring and critical knowledge areas which contribute to the knowledge transfer under ICJVs in water sector projects, (ii) to analyse the degree of knowledge and to determine the knowledge gaps between the local and foreign contractors in water sector projects, (iii) to analyse success and failures of knowledge transfer under past ICJVs and (iv) to recommend best practices to remedy the knowledge gaps through enforcing/enhancing the existing ICJV mechanism. The scope of the study is limited to water sector construction projects only.

The research is based on literature review and data collected through Unstructured/Structured interviews and questionnaire survey among the professionals. The data were analysed qualitatively and quantitatively. The main findings of the study are, local contractors lacked in all the considered Project Management and Contract Management knowledge areas compared to the foreign contractors and knowledge transfer in past ICJV water projects was very low. Amend the existing JV mechanism, introduction of contractual provisions in the contract documents, introduction of Government policies and effective involvement of donor funding agencies are within the recommendations for the knowledge transfer process to be successful.

Key Words: Knowledge, Knowledge Transfer, Joint Venture (JV), International Construction Joint Venture (ICJV), Projects, Water Sector, Construction Industry, Contractors

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ABBREVIATIONS

ADB – Asian Development Bank

BOQ – Bills of Quantities

CIDA – Construction Industry Development Authority

D&B – Design and Build

DRC – Department of Registrar of Companies

ENAA – Engineering Advancement Association of Japan

FDI – Foreign Direct Investment

FIDIC – Fédération Internationale Des Ingénieurs – Conseils

HR – Human Resources

HRM – Human Resource Management

ICJV – International Construction Joint Venture

ICTAD – Institute of Construction Training and Development

IJV – International Joint Venture

JV – Joint Venture

KT – Knowledge Transfer

MNC – Multi-National Companies

PM – Project Manager

R&D – Research and Development

RII – Relative Important Index

SA – Strategic Alliances

SCA – Sub Contract Agreement

TT – Technology Transfer

UK – United Kingdom

CHAPTER 01: INTRODUCTION

1.1 Background

In Sri Lanka, there were several infrastructure development projects initiated particularly right after the TSUNAMI and after the end of three decades war in 2009. There has been a steady inflow of multilateral funding from World Bank, Asian Development Bank, JICA etc. mainly for water supply, sewerage, irrigation and highway projects. Subsequently, the number of foreign-funded projects coming up for Joint Ventures (JVs) or Sub Contract Agreements (SCAs) generally increase with the flow of foreign funds and resources for projects (Ganesan and Kelsey 2006). Several foreign contractors as well as local contractors have involved in the fore-mentioned reconstruction and development projects in Sri Lanka. At present, the situation has been further accelerated as the government places great emphasis on larger construction projects under the direct involvement of foreign funds. The government has planned many construction-related projects for coming up years, although certain contracts may be awarded to foreign contractors, substantial part of the work would be transferred to local contractors (Bandara 2014).

In many of the above infrastructure projects, involvement of foreign contractors was predominant. Drewer (1980) noted that countries require to have exposure in wide range of construction projects in their early stages of the development, in which some of their domestic firms lack the capacity and expertise to undertake. Because the country was lacked with required resources to undertake large scale development projects, the industry had to rely on foreign construction firms and their resources. Involvement of foreign construction firms in the Sri Lankan construction industry has a history of few decades (Bandara 2014). The Mahaweli development project is one of the largest construction projects constructed with the involvement of foreign construction firms. Thereafter Southern Expressway project, Hambantota international airport project, Colombo – Katunayake Expressway, Upper Kotmale Hydro-Power Plant projects were constructed with the engagement of foreign firms. Furthermore, there are several ongoing projects such as Uma Oya project, Port City Development project, Kandy – Colombo Expressway project that can be identified as major construction projects, in which foreign contractors have expected to play the leading role over the local counterpart. The situation is similar for the water sector construction projects as well,

where several foreign contractors were offered to undertake the leading national water projects such as Greater Colombo Water and Wastewater Management Improvement Investment Project, Dry Zone Urban Water and Sanitation Project, Jaffna-Kilinochchi Water Supply Project etc.

Recently, collaboration between the construction firms has become an eminent feature in the Sri Lankan construction industry. The most popular type of collaboration is the Joint Venture (hereafter called JV). In the construction industry, joint ventures (JVs) have become one of the major organizational forms utilized in large-scale projects and are considered one of the major entry modes to international markets (Ho et al. 2009). The foreign contractors and local contractors seek the opportunity to participate in international construction projects, in order to expand their businesses over the world and to get the competitive advantage of the market. An international joint venture (IJV) is a subset of JV where the partners or parents are from two different countries or more. The international construction JV (ICJV) is an IJV alliance applied in the construction field (Zhang et al. 2014). ICJVs can be formed in many ways, such as combination of two or more foreign partners themselves or combination of foreign partners with local partners.

In Sri Lanka, many local contractors tend to form joint ventures with foreign contractors to become partners in projects. The construction industry has been widely described as a very competitive industry (Shen and Cheung 2017). Hence the competition and complexities introduced by the construction industry persuade local contractors to form the fore mentioned ICJVs in Sri Lanka. The local contractors create joint ventures to develop themselves by learning from foreign construction firms (Bandara 2014). ICJVs generally offer number of benefits, but at the same time it may become very difficult to manage, as a result of many complexities introduced by the association of two or more companies from different backgrounds (Political, Legal and Cultural etc.). The importance of having joint ventures for developing the local construction industry should be investigated to study the current situation of joint ventures (Bandara 2014). Therefore, it is evident that the effectiveness of collaboration between local and foreign construction firms has not been evaluated in the past, specially the formation of International Construction Joint Ventures with the objective of knowledge transfer.
The construction industry has been identified as a knowledge and technology intensive industry. Thus, the involvement of foreign contractors in major construction projects is

a greater opportunity for local contractors to bridge their gaps in knowledge and technology. One of the major benefits offered by the involvement of foreign contractors in construction projects is the "Knowledge Transfer" (Bandara 2014). This transference will not only increase the capacities of local contractors but also their competitive advantage over the construction industry. In the reviewed literature, authors have extensively discussed the technology transfer in construction projects, but fewer findings related to the areas of knowledge and knowledge transfer. This indicates that the importance of knowledge has not been highlighted in the past research, particularly in the construction industry. It has been identified that without knowledge transfer, technology transfer does not take place as knowledge is the key to control technology as a whole (Li-Hua 2003). Hence knowledge transfer is most important in the process of technology transfer. Moreover, the authors have discussed about the Tacit and Explicit knowledge transfer, but few findings related to the Knowledge transfer (Technology – Knowledge) as a whole. Hence it is viable to conduct a comprehensive study to find out the knowledge and knowledge transfer to local contractors from foreign contractors in local construction projects.

It is widely accepted that local construction companies possess narrow opportunities to gain knowledge and technology with respect to the dynamic construction industry. Therefore, ICJV projects are believed to be strong vehicles to gain the required knowledge and technology to the local construction industry. This transference will ultimately lead to the capacity building of local construction firms and them to compete in the global construction market. Emerging economies seek to develop their local proficiencies by absorbing new knowledge and technology (Ponomariov and Toivanen 2014). The construction industry is one of the key contributors to the national economy. Thus, the government is continuously introducing new policies in light of developing the local construction industry. Recently there was such proposal introduced by the government as a budgetary proposal, which would promote the knowledge and technology transfer by formation of ICJVs. Foreign contractors involve modern knowledge and technology in major construction projects, but the transference is intermediate (Purangedara 2017). Hence it is noteworthy to investigate the effectiveness of knowledge transfer from the foreign contractor to the local contractor in the form of ICJV.

1.2 Research Problem

In Sri Lankan construction industry, recently there is a tendency to form ICJVs between the local and foreign contractors due to number of benefits offered. In local contractors point of view, one of the major benefits offered by the creation of ICJV is knowledge transfer. However, the effectiveness of knowledge transfer from the Joint Venture (from the foreign partner to the local partner) is still questionable. In the past, there were not much of extensive studies carried out to evaluate the individual knowledge capacities of the local and foreign firms, knowledge gap between the local and foreign firms and effectiveness of knowledge transfer from the foreign partner to the local partner in the ICJV. Eventually, there is a question arises, whether the formation of ICJV is effective in terms of knowledge transfer. Hence in this study, considerable effort has been taken to evaluate the degree of individual knowledge and knowledge gap in between foreign and local contractors and whether the formation of ICJV is effective in terms of knowledge transfer.

1.3 Research Objectives

The main objectives of the research are the following,

1. To Identify the global knowledge transferring and critical knowledge areas which contribute to the knowledge transfer under ICJVs in water sector construction projects.
2. To Analyse the degree of knowledge and to determine knowledge gaps between the local and foreign contractors in water sector construction projects.
3. To Analyse success and failures of knowledge transfer under ICJVs in water sector construction projects.
4. To Recommend best practices to remedy the knowledge gaps through enforcing/enhancing the existing ICJV mechanism.

1.4 Significance of the Study

The future society will be called “knowledge” society. The knowledge will act as the key resource to control major industries in the world, particularly the construction industry. According to previous studies, the topics of technology transfer, knowledge transfer, and knowledge-technology transfer in international construction projects and its effectiveness in joint ventures have given considerable interest to many researchers

around the world. However, the applicability of these areas to the Sri Lankan construction industry has been moderately discussed by very few researchers.

Further, according to 2019 budget proposals the government has introduced a regulation that foreign contractors should form Joint Ventures with local contractors when bidding for local contracts. The main objective of this approach is to improve the process of knowledge and technology transfer in the local construction industry. There is considerable interest in the government and other institutions to develop the capacity of local construction industry by gaining knowledge and technology from other countries. The main objective of this approach is to make local construction industry a knowledge-intensive without relying on other countries. Ultimately this will lead local contractors to compete in the global market. Therefore, it is high time to conduct comprehensive research to evaluate knowledge gaps in the local construction industry, and whether these gaps could overcome through the formation of Joint Ventures with foreign construction firms.

1.5 Methodology

In order to achieve the above objectives, the following methodology was carried out.

1. A comprehensive literature review was carried out to study the global knowledge transferring under ICJV projects.
2. Initially, the following preliminary methods were used to identify the construction industry knowledge transferring under ICJV projects.
    a. Studying the contract documents (FIDIC, ICTAD…etc) to identify the relevant conditions stipulated in the documents applicable to the knowledge transfer under ICJV projects.
    b. Interviewing of water sector construction experts (unstructured and structured interviews) to identify the key knowledge areas which contribute to the knowledge transferring under ICJV projects in water sector.
3. From the above preliminary study, key knowledge areas were selected for further study.
4. Questionnaire survey to validate the above identified knowledge areas and find out success/failures of knowledge transfer in terms of ICJV in water sector construction projects.

5. Analysis of data to determine the knowledge gaps between the local and foreign contractors in water sector construction projects.
6. Identify the shortcomings and recommend the best practices to remedy.
7. Present the research findings to the Government and donor funding agencies.

1.6 Limitation of the Research

This research is conducted only by selecting the water sector construction projects and related ICJVs. Hence the experience of key personals in water sector construction projects is taken into consideration for research evaluations.

1.7 Main Findings

The study has revealed that in current water sector construction industry local contractors are lack of project management and contract management knowledge. Further, it has been identified that the knowledge transference in past ICJV projects is very low and foreign contractors' involvement for knowledge transfer is very minimum. Hence the ICJVs formed in water sector construction projects are not effective with the objective of knowledge transfer.

1.8 Structure of the report

The dissertation is organized in five (05) chapters and the content of each chapter is described below.

Chapter 01: Discusses the introduction of the report, highlighting the background and reasons led me to conduct a research on Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Projects. The significance of the research, Objectives, methodology and limitations are also explained in this chapter.

Chapter 02: Describes the latest literature findings related to the topic Knowledge transfer, technology transfer in the construction industry, types of knowledge factors lacking in the local construction industry, types of collaboration facilitates the knowledge transfer, factors affecting the knowledge and technology transfer and history of knowledge and technology transfer in Sri Lanka.

Chapter 03: Comprised of the research methodology in detail and the mechanism of the data collection is discussed. Method of data analysis also discussed in this chapter.

Chapter 04: Discusses the data analysed from the interviews and questionnaire and the results obtained from the process. Results are discussed in detail and presented in graphical form as well.

Chapter 05: Provides the conclusion and discussion of the research study. Limitations and recommendations on the knowledge and knowledge transference under ICJV projects in water sector. Finally, the directions for further research areas are also presented.

CHAPTER 02: LITERATURE REVIEW

2.1 General

An extensive literature review was carried out with the main objective of identifying the key knowledge deficiencies of the local contractors in the local construction industries in Sri Lanka and other developing countries. As the first step, the history and background of the research area have been scrutinized referring to various publications. Specially covering the areas of need for knowledge improvement of local contractors and how ICJVs would facilitate the knowledge transfer. The various past researches related to knowledge and technology transfer were studied to identify the research gap. Further, the key knowledge deficiencies of local construction industries were identified referring to various publications. The types of collaborations that facilitates the knowledge transfer was discussed in detail. Finally, the key factors affecting the process of knowledge and technology transfer were explored. Overall following key areas have been scrutinized in the literature review of this research.

- History and Background
- Definition of Knowledge and its dimensions
- Knowledge and Technology Transfer
- Knowledge and Technology deficiencies in Developing Countries
- Types of Collaboration facilitates the Knowledge and Technology Transfer
- Factors affecting/influencing Knowledge and Technology Transfer
- History of Knowledge/Technology transfer of the Construction industry in Sri Lanka

2.2 History and Background

As the world progresses towards globalization, more countries have commenced participating in the competition of the global construction market. Globalization in construction provides opportunities for underdeveloped construction industries and over time could increase the competitiveness in terms of project performance and delivery (cost, time and quality etc.) (Raftery et al. 1998). Hence it is vital for the local construction industry to improve their knowledge and skills to meet the competition of the global construction market. To compete, firms need to upgrade capabilities and resources, improve efficiency, enhance the quality of work, and improve the ability to secure low cost capital resources. (Raftery et al. 1998). As identified by many of the

previously conducted researches, the country economy largely affects the growth of the construction industry in developing countries. Which tends to have a fewer number of high-end contractors along with the large resource capability to undertake large construction projects. The majority of construction firms in developing countries are small to medium scale companies with lower resource base (Osabutey et al. 2013). This indicates the fact that the capacity of local construction firms should be improved in order to meet the market requirements. Apart from that, in the last few decades many foreign contractors have approached the construction industry of the Asian developing countries, solely because of technological and managerial knowledge constraints demanded in the industry and to obtain the anticipated financial advantage.

The Construction industry is believed to be rich in knowledge and technology which need to be transferred and absorbed by construction firms in order to gain the competitive advantage over the period. Construction projects can be used for Technology & Knowledge transfer and capacity building of the local contractors in developing countries (Osabutey et al. 2013). In terms of knowledge & Technology transfer, collaboration with overseas construction firms has become an eminent feature in developing countries. The international construction joint ventures (ICJVs) formed between foreign and local contractors are the most favourable type of collaboration in terms of knowledge transference. ICJVs can be used as a vehicle to transfer knowledge between partners and means of improving the knowledge of the local partners (Khamaksorn et al. 2016). Hence the formation of ICJVs and the knowledge transfer in major construction projects have a direct impact on the capacity building of local construction firms. Eventually, this leads to the development of the local construction industry in developing counties and to compete in the international construction market. Hence many researchers have been stimulated to conduct academic research in the particular subject area.

Several previous research studies have been conducted in the area of global technology transfer, but an intermediate effort has been put into the investigation of the knowledge transfer as a whole. It has been identified the fact that without knowledge transfer, technology transfer does not take place as knowledge is the key to control technology as a whole. (Li-Hua 2003).

In Sri Lanka, there were not many previous research studies carried out to investigate the knowledge and different aspects of knowledge transference related to the local construction industry. Limited experimental studies exist on knowledge management and its various dimensions such as knowledge transfer concerning the developing countries and specifically, for Sri Lanka (Senaratne and Priyadarshi 2015). Thus, it is important to study the knowledge capacities of contractors and the potential knowledge transfer, which will contribute to the development of local construction firms in Sri Lanka through the formation of effective ICJVs.

2.3 Definition of Knowledge and its Dimensions

The word "Knowledge" has been given many definitions by various authors in the reviewed literature. These definitions vary in a wider range from the simplest form to more complex elaborations. It is important to identify different extents of the definitions of knowledge to have a comprehensive understanding of the subject area.

According to DeTienne and Jensen (2001), Knowledge has been described as information which has been used and integrated with a person's knowledge-based experience and behavioural patterns. Davenport and Prusak (1998) has provided more comprehensive definition to knowledge as, Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.

The literature findings describe that knowledge can be divided into following two primary categories,

1. Tacit Knowledge
2. Explicit Knowledge

Tacit knowledge is personal knowledge about a specific context. Such knowledge is hard to formulate, record or express clearly since it is stored in human brains. (Tiwana 2000). Kanapeckiene et al. (2010) defines that the Tacit knowledge may be identified through competence, individual experience, Historical Memory, Tolerance, Process Changes, Problems Related to, Problem Solutions, Expert Tips, Innovations, and Know-how. Tacit knowledge can be further separated into two types; the first is cognitive knowledge which includes mental beliefs, intuition and hunches, the second type is technical knowledge, the know-how and skills (D'Eredita and Barreto 2006).

On the other hand, explicit knowledge is learned and acquired indirectly. The knowledge must be decoded into the individual mental models of each person. This knowledge can be found in organisational documents, including reports, articles, agreements, manuals, patents, drawings, video and audio materials, software etc. (Kanapeckiene et al. 2010).

The construction industry explicit knowledge is mostly transferred from one project to another in the form of documents such as lesson learnt documents, templates etc., but the tacit knowledge transfer is really challenging as most projects are one-off and due to high staff turnover organization faces difficulty in retaining the tacit knowledge. The determining factor of the organizations' competitive advantage over the industry is the ability to convert tacit knowledge into explicit knowledge through the organization learning (Maitland 1999).

Knowledge has directly linked with the countries economic development as a result of the globalization. Globalization has assisted the countries to move towards the knowledge-based economic development, which provides sustainable solutions in the long run. In this sustainable economic development knowledge and technology accumulation, transfer, application and diffusion are the key contributing factors (Sung and Gibson 2005). Hence in future “Knowledge” is the most valuable resource that would control the economic development as a whole.

Knowledge is considered as the most valuable resource available for an organization and its transfer within and in between the organizations is important for development. Compared to the traditional resources (labour, land and capital etc.) which are likely to depreciate with use and over time, Knowledge is presented as an intangible resource which will continue to get appreciated over the time (Davenport and Prusak 1998). Thus, it is utmost important for organizations to explore methods to acquire, develop and retain knowledge for the continuous development of the organization in a sustainable way.

The construction organizations engage in international construction projects, which are unique, temporary in nature and associated with different types of resources in each and every project. Among other industries, the construction industry is considered as a knowledge-based industry and the knowledge is vital for organisations and their project teams to implement and deliver the projects successfully (Senaratne and Priyadarshi

2015). Moving from one project to another, knowledge is the most valuable resource transfers over, all the other available physical resources such as human, material and equipment, which will be depreciated over time. As organizations increase and expand their international business activities, they must acquire and develop new knowledge and skills involved in international projects (Khamaksorn et al. 2016). Hence construction organizations invest their time and money on acquisition, management and development of the knowledge, for capacity development and to obtain the competitive advantage over the industry. There are many resources available for organizations to compete in the market. Among them, a key resource to gain the competitive advantage is knowledge (Grant 1996). Knowledge is critically being distinguished as a vital organizational resource that provides market leverage and competitive advantage (Leonard-Barton 1995). Hence knowledge is the most valuable resource that should be captured by the local construction firms to upgrade themselves and to obtain the competitive advantage in the industry.

2.4 Knowledge and Technology Transfer

There is a considerable amount of literature findings related to the topic of technology transfer, but limited studies were done on the topic of knowledge transfer. After scrutinizing the available literature, it has been observed the literature describes technology transfer, knowledge transfer and knowledge and technology transfer together in different papers. But limited studies available to describe the differences between each topic. This is consistent with the findings of Purangedara (2017) mentioned, it reveals that little effort has been taken to explain the difference between the knowledge and technology transfer in the past research as per the reviewed literature.

Therefore, it is important to have a clear and distinct understanding of each individual topic mentioned above. Many of the studies do not draw a distinct line between knowledge and technology transfer, because most of the studies have often applied the term interchangeably in both technology transfer and knowledge transfer literature. Most of the previous studies have considered knowledge transfer and technology transfer has a similar meaning (Purangedara 2017). This has made certain doubts in the readers' mind to gain a clear understanding of the two subject areas.

As there is a certain doubt existing in the differentiation of two subject areas, various authors have studied different dimensions of the technology and knowledge transfer. Many researchers have attempted to explain the connection between technology and knowledge transfer and some tried to describe the difference between two concepts (Purangedara 2017).

Some authors have explained that technology and knowledge are integrated subject areas and cannot describe independently. The technology transfer and knowledge transfer can't be considered as separate subject areas because when a technological product is transferred, the relevant knowledge of its creation is also transferred (Bozeman 2000). This finding has further confirmed by Purangedara (2017) mentioning that, according to the findings of previous studies technology and knowledge are inseparable. A similar conclusion has been given by Dunning (1994) as past studies have explained that technology is directly linked with the knowledge and Sinani and Meyer (2004) identified no difference between technology transfer and knowledge transfer in the technology transfer from FDIs in Estonia.

Another important study was done by Sung and Gibson (2000) identified, Technology transfer and knowledge transfer cannot have the same meanings considering the key aspects in two different concepts. The main argument here is, the knowledge and technology can be transferred from a person or an organization via different forms of channels. Purangedara (2017) also made a similar argument that, although Technology transfer and knowledge transfer are highly interactive, they serve for different objectives.

The Gopalakrishnan and Santoro (2004) have done their research based on the purpose served by technology and knowledge transfer and distinguish technology transfer and knowledge transfer in terms of their purposes, knowledge transfer focuses on a broader and have more inclusive construct which is directed more towards the "why" for change, whereas technology transfer focuses on a narrow and more targeted construct that usually embodies certain tools for changing the environment.

The importance of the knowledge and its transfer over the technology has discussed by researchers in their findings. Most of them have commented, knowledge is the key resource over the technology. Hence, its effectiveness should be further investigated. This was highlighted by Li-Hua (2003), without knowledge transfer, technology

transfer does not take place as knowledge is the key to control technology as a whole. This is consistent with the findings of Purangedara (2017), even though there are differences between their purposes, majority of researchers agree that knowledge is the critical element that underlies technology transfer.

2.4.1 Knowledge Transfer

The study of literature presents several definitions related to the topic of knowledge transfer. Thus, it implies the significance of the study. Dougherty (1999) describes Knowledge transfer is about connection not collection, and that connection ultimately depends on the choice made by individuals. According to Easterby – Smith et al. (2008), it is the process where one organization learns from the experience of the other. This is an important definition that, process of knowledge transfer is not only the explicit knowledge transfer but also learning from the previous experience which exists the knowledge as tacit form. These findings are evidenced by Lech (2011), as the knowledge transfer is the process of exchanging tacit and explicit knowledge between two different partners. Another definition describes this as a process where one firm is affected by the experience of another (Argote and Ingram 2000). The firm who is affected due to the experience of other, receives the knowledge in "Tacit" form. This would ultimately lead to capacity building of the organization who receives the experience.

According to the PMI's Pulse of the Profession (2015), Knowledge transfer is the methodical replication of the expertise, wisdom, insight and tacit knowledge of key professionals into the heads and hands of their co-workers. Additionally, same journal explains the knowledge transfer as a sustainable process where the transferred knowledge would be available for future use. Knowledge transfer leads to organise, create, capture, or distribute the "know-how" and ensure its sustainability. Hence the knowledge transfer can be identified as a well-defined process, where organizations should adhere to receive successful outcomes. The knowledge transfer consists of a life cycle that includes a five steps process namely identifying, capturing, sharing, applying and assessing. Organizations receive improved results in terms of performance matrices of cost, time etc. when essential knowledge is captured and shared (PMI's Pulse of the Profession 2015). Hence the organizations that are effective in transferring knowledge, eventually get successful outcomes and results in upgrading themselves to obtain competitive advantage. Knowledge Transfer (KT) plays a critical role in the long term

existence of the organisations. Effective knowledge transfer leads to successful outcomes and performance improvement of the firms (Kanapeckiene et al. 2010).

The literature review provides a wide and extensive understanding of international technology transfer. However, according to the past research little has been done in the research area of knowledge transfer (Li Hua 2003). This indicates that still there is a considerable literature gap exists in the area of international knowledge transfer. Some of the literature findings studied the combination of knowledge and technology transfers, this is because technology and knowledge are two interrelated topics and should be discussed together. It has been identified that without knowledge transfer, technology transfer does not take place as knowledge is the key to control technology as a whole, hence knowledge transfer is critical in the process of technology transfer (Li Hua 2003). Therefore, authors have emphasized that future research need to be undertaken to investigate the subject of international knowledge transfer.

Knowledge is exchanged between or among individuals, teams, groups, or organizations (Duan 2010). All these knowledge exchanges are necessary for an organization to become a knowledge-intensive organization. From the above-mentioned types, inter-organization knowledge transference is the most favourable form of knowledge acquisition for local construction firms. In the long run individual, team, peer and group knowledge transfer is required for a company to retain the absorbed knowledge for continuous development.

2.4.2 Technology Transfer

As mentioned above, the literature provides a broader study with reference to the subject of technology transfer. There are several definitions given by different authors in the reviewed literature. This shows the interest of worldwide researchers towards the particular subject area. According to Dunning (1993), Technology transfer involves the transfer of physical assets, knowledge, and human capabilities to enhance the efficiency of an organization to undertake construction projects. Abbot (1985) defined technology transfer as the movement of science from one group to another. Further, the study of Senaratne and Priyadarshi (2015) identified, Technology transfer is the process that knowledge in some form is transferred from a person or organisation who possess it, to another person or organisation who arranges to receive it. This study reveals that the technology transfer only transfers some form of knowledge out of the available entire

knowledge which can be transferred, hence technology acts as a part of the whole knowledge. This transference can occur in between one sector/firm to another domestically, or between one country to another across the national boundaries. which is called as international technology transfer (Purangedara 2017).

Osabutey et al. (2013), added to the above definitions as, technology transfer cannot only concentrate on the product, because the product needs to be transferred with the embedded knowledge relevant for its use and applications. Hence this evidenced that, knowledge is the key resource that should be transferred in the process of successful technology transfer.

As highlighted by many authors in the reviewed literature, Technology Transfer plays a major role in the economic development in developing countries. Many authors have linked the development of the construction industry in developing countries to technology transfer (Fox 2003, Ofori 1994a, 1994b, 2000, Ofori and Chan 2001, Raftery et al. 1998). Scaringella and Burtschell (2015) have demonstrated that, technology transfer between developed and developing countries has not only drawn the attention of researchers but also policymakers, financial institutions and other relevant organizations etc.

The construction industry has been identified as the principal contributor of the economic development in developing countries, Ofori (1994) also observes that technology transfer plays a significant role in technology development in the construction industry and requires country-specific policies and approaches for continuous planning and monitoring. Hence the developing countries need to have relevant government policies to get the required technology transfer to the construction industry for economic development. These findings have been substantiated by Van Egmond (2012) as technological development in the developing countries are assisted by the technology transfer.

It has identified by Ling (2005, 2009), local firms can learn new construction technologies from foreign firms. Due to the high-end technology application by foreign firms in the major international construction projects, local firms are urged to collaborate with foreign firms to learn and apply these technologies. Chatterji (1990) believes that Developing countries should implement policies that promote technology transfer between foreign and local firms, to strengthen the capabilities of the local firms

and to reduce their dependence on foreign firms. Hence this collaboration eventually leads to capacity building of the local construction industry. This was also highlighted by the same author mentioned earlier that technology transfer should target for capacity building of the local firms and this will cause the reduction of reliance on foreign firms and thereby the imported resources from them (Chatterji 1990). Therefore, in the journey of developing countries to reach the level of developed countries, technology transfer reduces the gap of major differences in technological capabilities in between different countries (developed and developing) (Ganesan and Kelsey 2006)

Foreign and local joint ventures (JVs) and SCAs are found to be the preferred methods of collaboration that favour the technology transfer process. This statement has been validated by several literature surveys. Among the availability of various methods, Joint Ventures (JVs) and Subcontract Agreements (SCAs) are serious vehicles of Technology Transfer and this has made an impact on upgrading the construction inputs significantly in the construction industry (Ganesan and Kelsey 2006). It is argued by some researchers that, when the firms establish a JV, technology transfer is the key objective that should be considered, and the JV success will be measured by assessing whether the parent firm learns from its partner about the technology and management know-how (Kogut 1988). But observing the past and present JVs formed in the construction sector the adherence to this key objective is questionable. Harrigan (1985) has also validated that the JV can be regarded as successful if it improves the competitive position of the parent firms in the industry compared to the past. Similar to the statement given above, the formation of JVs with the key objective of technology transfer and improving the competitive position of local firms should be further investigated with the present industry situation.

Foreign firms generally enter into Joint Ventures with local firms for different purposes. Gale and Luo (2004) identified that Joint venture project-based companies enter the market for foreign investment and technology transfer. Further to the above, some authors have witnessed the benefits received by local firms with the formation of joint ventures as product lives are shorter, cost advantages, and number of local firms that operated in the domestic market started to dominate in the global market and become global competitors (Purangedara 2017).

The construction industry technology transfer could be evaluated through the parameters, as proposed by some authors. Upgrading construction outputs in terms of time, cost, quality or some combination of all three can act as a means of technology diffusion (Ganesan and Kelsey 2006). Hence the improvement of the outputs in terms of triple constraints is an indicator of the successful technology transfer. However, some papers argued that without the will power and incentives, technology transfer will not be promoted among contractors. Carrillo (1994) has highlighted this, for technology transfer to happen effectively there should be willpower and commitment from the parties involved to it (Both Transferrer and Receiver). According to the same author who has carried out interviews with UK contractors identified that, despite the willingness, the foreign contractors don't receive any incentive for the technology to be transferred to the local contractors in the developing countries.

There are several methods proposed by authors to get the expected technology transfer. Carrillo (1994) has emphasized Technology transfer is a process that involves much more than just telling others what to do. Many ways of minimizing difficulties and improving technology transfer were proposed. These can be grouped into four main categories as Training, Time, Finance, and Commitment (Carrillo (1994)). Similarly, Senaratne and Priyadarshi (2015) has presented that when transferring and making that technology of real value to the receiving organisation, the transfer of specific skills and embedded knowledge and on-the-job training is required. Hence both technology and knowledge transfer should go hand in hand and both processes are important for overall improvement of the organizations.

According to the research paper of Li Hua (2003), World Bank has a policy in principle that client organisations should not award contracts without forming meaningful and effective partnerships with local firms and committing technology transfer. This indicates the importance and weightage placed on the technology transfer by foreign-funded agencies.

2.5 Knowledge/Technology Deficiencies in Developing Countries

In this research one of the major objectives is to investigate the critical knowledge areas, which will contribute to the knowledge transferring process in ICJV projects. Thus, the relevant knowledge areas highlighted in the reviewed literature have been taken into account for further study. Ganesan and Kelsey (2006) in their study identified that the

primary areas accommodating the knowledge transfer in construction are: design knowledge and skills; embodied technologies; construction techniques and equipment; and organisation know-how and management systems.

It is important to identify the knowledge deficiencies in the local construction industry in order to study, analyse and recommend best practices to overcome the said deficiencies through formation of ICJVs with the potential foreign construction firms. Several past researchers have identified the knowledge deficiencies in local construction industries around the world. Knowledge deficiencies in local industries in project management could be bridged through collaboration with foreign firms and the government needs to have policies to encourage such collaboration (Osabutey et al. 2013). In addition to that Kale et al. (2014), identified knowledge areas that will be facilitated through the formation of ICJVs as local contractors receive benefits from the joint venture and share the risks associated with the projects with more experienced partners. Further contractors receive access to better technology, quality and safety standards and get to know about modern site management. Some authors recommended that better Human Resource Management (HRM)/Development practices will facilitate the process of technology and knowledge transfer. HRM practices which emphasize employee's ability and motivation can also contribute to the process of Technology and Knowledge transfer (Minbaeva et al. 2003).

Majority of researchers believe that technical knowledge can be more easily documented and transferred than the management knowledge and skills (Carrillo 1994). This is mainly because technical knowledge can be easily transferred from the explicit form to the tacit form, while management knowledge is difficult to transfer as it exists mostly in the tacit form.

The research carried out by Osabutey et al. (2013), specially targeting the construction industry in Ghana, observed that the local construction industry is lack of required knowledge to carry out the local projects efficiently, these can be divided into managerial functions, skills and competencies needed to effective and efficient use of resources etc.

The same researchers have identified that Ghanaian construction firms generally lacked the expertise in project management and contract administration, which negatively affected their efficiency and profitability. They have highlighted that, foreign firms have

specialists in contracts administration who explore shortcomings in the contracts to earn more profits, according to the interviews carried out most interviewees said that project management expertise was lacking among local construction firms in Ghana (Osabutey et al. 2013).

Further, they have identified that local construction firms lack financial management knowledge, which greatly affected their performance. The poor financial management practices resulted in financial difficulties within the local construction firms and limited the access for financing for projects. This has restricted the adoption of new Technology and Knowledge in construction projects (Osabutey et al. 2013).

Table 2
Expertise lacking in most local firms in Ghana.

Contracts administration • Design development • Costing • Tendering process • Dispute resolution	**Project management** • Control systems–time, costs, quality, variation, etc. • ICT hardware & software knowledge and usage	**Human resource management** • Human resource planning • Training & development • Performance appraisal • Health and safety
Financial management • Financial control & budgeting • Arranging financing • Investment appraisal • Cash flow and profitability	**Quality & environmental control management** • Quality systems & standards • Environmental control systems & standards	**Procurement and plant & equipment management** • Bills of quantities • Planning & negotiations • Supply chain management • Appropriate choice & management of fleet (hire or purchase) • Preventative maintenance
Business development • Developing new business opportunities, customer care marketing, growth, etc.	**Strategic management** • Situation analysis, strategy formulation, implementation and evaluation, etc.	

Source: Constructed from the researchers' field notes.

Table 2-1: Lack of Expertise in most local firms in Ghana

According to the study carried out by Carrillo (1994), identified that most developing countries (North Africa, Sub-Saharan Africa, Asia, South East Asia and Caribbean) lacked management skills/management expertise, the technical expertise required for specialized areas, financial management, contract management, expertise in project management.

Reference to Sri Lankan construction industry, Silva et al. (2005) identified some knowledge deficiencies, which controlled the development of local construction firms. These can be categorized into Management and co-ordination of projects, Cost planning, documentation management, time management, communication, progress monitoring, administrative issues.

Further, as highlighted by the same authors proper time management and effective progress monitoring strategies, Lack of labour, equipment, knowledge and integration

are also identified as knowledge and technology deficiencies in the local construction industry (Silva et al. 2005).

2.6 Types of Collaboration facilitate the Knowledge and Technology Transfer

Around the world, many firms collaborate with other firms with the intent of upgrading themselves to obtain the competitive advantage over the industry. In the past, there were many collaborative approaches engaged by local construction firms, which indirectly upgraded knowledge and technological capacity. Because local construction firms are inadequately resourced to undertake the construction projects, collaborative opportunities could increase their resource base which would ultimately lead to Technology and Knowledge transfer and capacity building (Osabutey et al. 2013). It is a well-understood fact that the primary objective of collaboration is not gaining the Knowledge and Technology transfer, but many researchers argued that "collaboration" assisted firms to upgrade their Knowledge and Technology capacities. This has highlighted by Raftery et al. (1998), in many cases access to labour and material could be found domestically, but other important components of technology, management and finance are available globally, and collaboration with foreign firms provides the access to these.

There can be many collaboration types favour the process of knowledge transfer. The studies of Ganesan and Kelsey (2006), Ofori (1991, 1994a), World Bank (1986), demonstrated the types of collaborations that could facilitate knowledge transfer include JVs, subcontracting arrangements (SCAs), strategic alliances (SAs) or consortia. In this research, the objective is to investigate the effectiveness of the knowledge transfer through collaboration technique of "Joint Venture". Hence it is important to investigate the related literature of joint venture, as the next subsection describes.

2.6.1 Joint Ventures

Many authors have given a wide range of definitions for the term joint venture. Hence it is important to understand the difference between each definition, before moving to in-depth study. Kale et al. (2014) defined, joint venture (JV) as; An enterprise, co-operation or partnership, formed by two or more companies, individuals, or organizations, at least one of whom is an operating entity that wishes to broaden its activities to conduct a new, profit motivated business of permanent duration. Hence the Joint Venture can be formed with either two or more parties with different objectives.

A joint venture is defined as an arrangement where there is a commitment, for more than a short duration, of funds, facilities and services by two or more legally separated interests, to an enterprise for their mutual benefit (Tomlinson 1970). This definition has been further elaborated by Scaringella and Burtschell (2015), Joint Venture is a very specific type of strategic alliance, and it is a co-enterprise created by joining two or more companies owning variable shares. A similar definition to the above findings has been given by Khamaksorn et al. (2016), it is a special type of strategic alliance which offers a unique opportunity to combine the distinctive competencies and the complementary resource of participating firms and Miller (1993), identified, a joint venture is a combination of two or more persons to perform a single business enterprise or a series of business enterprises for profit, to achieve this cause parties share items such as money, property, knowledge and skills etc during the period.

There can be several types of Joint Ventures (JVs) formed. Such as Foreign-Foreign JV, Local – Local JV and Foreign – Local JV. International Construction Joint Venture (ICJV) is the most effective type of JVs in terms of knowledge transfer as described in various research papers. As Zhang et al. (2010) defined, an international joint venture (IJV) is a subset of JV where the partners, or parents, are from two or more countries. The international construction Joint Venture (ICJV) is an IJV specifically formed in the construction field. Further Ozorhon et al. (2008) identified an International Joint Ventures (IJVs) is a Joint Venture at least one partner of the JV is headquartered outside the joint ventures country of operation. A similar definition established by Geringer and Hebert (1989) in their study, Joint Venture may be defined as “International”, if at least one of the parties (or parents) of the JV is based outside the country where the venture is in operation. The objective of this research is to investigate the effectiveness of JV formed between foreign and local construction firms in Sri Lanka. The foreign – local JV carries an extensive interest among various scholars around the world, particularly because it has a direct impact on the development of local construction industry and economic growth of the country, due to potential technology and knowledge transfer.

The relation between the knowledge and technology transfer and the JV formation in developing countries have been broadly discussed in the past literature. This is discussed in the below sections. Raftery et al. (1998), identified that the construction industries of the developing countries need to develop and upgrade in technology, finance and management know-how. A possible approach is through forming joint

ventures with foreign construction companies. The transfer of technology and management know-how can be achieved better through this arrangement. The advantages and opportunities received by local construction firms have been highlighted in some research papers as, the foreign-local joint ventures provide good opportunities for technology transfer in the construction industry (Ofori 1994), The importance of learning within organizations has long been recognized, as learning effectiveness in ICJVs would assist partners to achieve core technological advantage and to enhance their overall competitiveness (Zhang et al. 2010). Yoshino and Rangan (1995), substantiated the above findings as Joint Ventures have emerged as a famous strategy and it creates a favorable environment to access to latest technologies and market penetration.

Some authors have argued that, the reason to form Joint Venture is directly linked to the expected Knowledge and Technology transfer through it. Some of the reasons to form Joint Ventures are Knowledge and Technology Transfer, Sharing and spreading of risks (Commercial, Political etc.), Competition strategy, Tax implications (Kale et al. 2014). While some authors have debated in their findings that, the knowledge and technology transfer under JVs, highly depends on the skill level of the developing country. The World Bank (1986) also distinguishes that JVs are only effective if the developing country has a certain level of managerial skill. Khamaksorn et al. (2016), presented a similar argument the determining factor whether the IJV is benefited from the JV highly depends on the JV partners' ability to transfer knowledge.

There is considerable debate in the literature, among several collaboration methods whether Subcontracting or the Joint Venture plays the most critical role in terms of knowledge transference. Bakuli (1994), in his study has given a more clear answer to that question, It is not sufficient for local contractors to operate only as subcontractors in the projects. This is mainly due to two reasons, first, it may not be economically feasible to subcontract certain projects and second as a subcontractor interaction with the main contractor is limited i.e.; maybe just for few site meetings, hence they may not learn from the main contractor as anticipated. This statement has been validated by Ganesan and Kelsey (2006), In a JV local partner receives higher status and plays a more active role in terms of project planning and management compared to Sub Contractor. Hence it can be concluded that Subcontracting has no strong obligations/relationship with the foreign partner and has a little level of control over the

projects. Unlike in JV, SCA has not given the opportunity to take management decisions for the partners. To get the management skills transferred to the domestic contractors, they need to be in the management boards of JVs with the MNCs (Bakuli 1994).

The foreign firms seek opportunities to enter into the markets of developing countries due to various benefits offered to them. IJVs have become a key entry mode for many foreign firms, particularly firms looking for an entry into Asian market (Lin and Germain 1999). The easiest way to enter into the construction market in developing countries is, forming the joint ventures. The number of international construction joint ventures coming up is growing worldwide at an increasing pace, particularly in developing countries (Lim and Liu 2001).

To promote the JV formation and to obtain the expected Knowledge and Technology transfer, governments of developing countries have to have certain policies. Osabutey et al. (2013) has validated this, a government and industry policy are required to develop the local firms by collaborating with the foreign firms in the form of JVs. Because the construction market is one of the leaders for the development and economic growth of countries. Developing countries perceive ICJVs as one of the best options available for meeting the interests of economic development (Sornarajah 1992).

Furthermore, the government can establish rules and regulations to persuade foreign contractors to form joint ventures when they enter local construction projects. MNCs should encourage to create Join Ventures with local contractors when awarding the contracts (Bakuli 1994). And, to provide some incentives for foreign contractors to form JVs and transfer intended knowledge and technology. Various measures have been adopted by the governments in the region. These include offering preferential interest rates for joint ventures (Raftery et al. 1998). Otherwise, foreign contractors may not have the will and the motivation to do so. This has been identified by Carrillo (1994) in his study as, contractors have no desire to transfer their expertise (knowledge) and there is little or no incentive to do so. Foreign contractors consider international projects as a way of earning more profits not for providing knowledge and technology, knowledge and technology transfer may lose their position and competitive advantage in the industry.

Figure 2-2 highlights the perceived advantages and disadvantages of joint ventures as stated by the eight UK contractors interviewed (Carrillo 1994)

Table 1 Joint venture advantages and disadvantages

	Advantages	Disadvantages
Partner from developed country	Spreading of risks Sharing of fixed costs Pooling of knowledge and resources Reduces cultural problems As a front Political influence Local purchasing muscle	Ability to reduce potential competition Unstable agreements for a limited period Reduces competitive advantage Local partner may continually want more Additional risk Loss of control Diluted earnings Possible conflict
Partner from developing country	Balance sheet substance Improved track record Sharing of risks Opportunity to work on large projects Staff acquires know-how Improved purchasing muscle	May be considered as necessity only Loss of control Work goes to overseas company Possible dilution of 'single point of responsibility' principle

Table 2-2: Joint Venture Advantages and Disadvantages

2.7 Factors affecting/influencing Knowledge and Technology Transfer

Many factors affect the knowledge and technology transfer as analysed by past researchers. According to Senaratne and Priyadarshi (2015), Organisational characteristics, leadership style, problem seeking/ solving behaviour, presence of support structures, absorptive and retentive capacity and types of knowledge are identified as key influencing factors in the process of knowledge transfer. Adding to the above elements Bellinia et al. (2016) have identified some partnering success factors, collaboration, mutual trust, and open communication are directly related to effective knowledge transfer. Further argued by Senaratne and Priyadarshi (2015) that, the culture of the organisation is a critical factor in determining the success or failure of knowledge transfer. The below figure shows the influencing factors identified by Senaratne and Priyadarshi (2015),

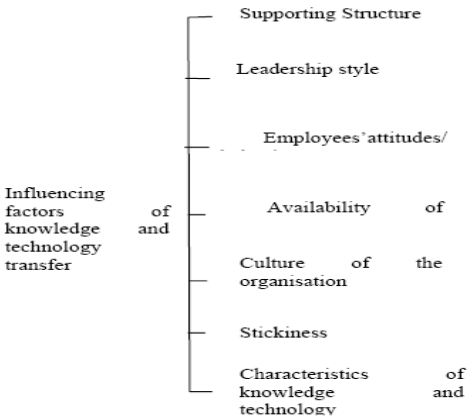

Figure 2: Influencing factors of knowledge and technology transfer

Figure 2-1: Influencing factors of Knowledge and Technology Transfer

Some authors have identified enablers and barriers for knowledge and technology transfer in their studies. Shrestha and Kumaraswami (2000), identified technology transfer barriers such as, (i) Organizational culture, (ii) Lack of time, (iii) Capacities of individuals (iv) Attitudes of individuals, (v) Lack of clear policy, (vi) National /ethnic culture differences, (vii) Lack of clear agreements (viii) Lack of clear procedures, (ix) Lack of funding provisions, and (x) Language, Steward and Waroonkun (2007) developed a conceptual framework which included four technology transfer enablers namely, transfer environment, learning environment, transferor (foreigner) and transferee (host) characteristics.

Some other influential factors are also highlighted in the reviewed literature. According to Osabutey and Jin (2016), factors that could influence Technology and Knowledge transfer are less congestion of firms (foreign and local), government policy incentives, effective intermediate industry institutions and educational effectiveness. Quality of Technology & Knowledge transfer and management largely depend on the availability of quality foreign and local firms.

Government policies and intervention are critical factors that influence the process of knowledge transfer. This phrase has been validated by Purangedara (2017) as lack of government support may cause the failure of technology transfer and/or create barriers to further development of Technology Transfer. This is consistent with the findings of Osabutey et al. (2013), related to the research carried out in Ghanaian construction industry, Technology & Knowledge deficiencies presented can be recognized as an absence of comprehensive government policy for the construction industry in Ghana and as well as more government involvement is needed. Moreover, Caves (1996) that referred to the quality of infrastructure and institutions, emphasizing that, in developing countries, effective industry and professional bodies could influence the transfer process.

Among the above mentioned factors, absorption capacity can be identified as one key factor to be considered for further study.

2.7.1 Absorption Capacity

When transferring the knowledge and technology, absorption capacity of the local partner greatly affects the effective transferal process. In case of effective knowledge transfer, it requires not only transmission but also absorption and use (Senaratne and

Priyadarshi 2015). This has been argued in several past research papers. Cohen and Levinthal (1990) defined absorptive capacity as the "ability to recognize the value of new external information, assimilate it, and apply it to commercial ends". A similar but simpler definition given by Todorova and Durisin (2007) Firm-level absorptive capacity, represented by capacity/capability to utilize acquired knowledge. Highlighting the relation of absorption and Joint Ventures, Kandemir and Hult (2004) argued that a joint venture is a specific type of strategic alliance that facilitates the efficient absorption of technology, specially the areas of tacit knowledge and know-how. Further, Zahra and George (2002) identified that absorptive capacity has four dimensions – acquisition, assimilation, transformation and exploitation.

The interrelation between absorption capacity and knowledge transfer has been discussed by many authors in their findings. The absorptive capacities of local firms are important factors of Technology and Knowledge transfer (Blalock and Simon 2009, Eapen 2012, Spencer 2008). This indicates that the level of absorption capacity of the local firm is the decisive factor in receiving Technology & Knowledge. Some researchers have argued that most of the research on Technology & Knowledge transfer have focused mainly on the absorptive capacity of local firms, paying relatively little attention to transfers between the firms (foreign and local) (Sanna-Randaccio and Veugelers 2007). This highlights the importance of conducting research in order to study the knowledge transfer in the past construction projects.

Having discussed the importance of absorption capacity of the local firm, certain constraints can be identified which negatively affect the growth of absorption capacity. This has been identified by Tabassi and Abu Bakar (2009) there are different barriers exist to increase the individuals' absorptive capacities, such as the associated costs, required time for training, Employees' low basic education, employee turnover, and lack of motivation. Further to that Schilling (2002) argued that firms' lack of investment in learning leads to entries for new technologies (because of their low absorptive capacity). Hence Eapen (2012) suggested, local firms need to overcome existing barriers to improve their absorptive capacity.

Moreover, the importance of firms to invest in Research and Development (R&D), highlighted by Nekoei et al. (2007) as the absorptive capacity is path-dependent and encourages firms to continuously invest in Research and Development (R&D) and to

reinforce their absorptive capacity in the search of future developments. Therefore, local construction firms should improve their absorption capacities by investing more on learning, training and R&D in order to become a successful competitor in the construction industry.

2.8 History of Knowledge/Technology transfer of the Construction industry in Sri Lanka

Sri Lanka's 20 million population currently subsist on a per capita annual income of about US$1,000. The construction as a share of GDP is LKR 1,040,891 Mn, with the growth rate of 11.4% (Economics and Social Statistics, Central bank, 2018). The construction industry is one of the fastest-growing industries in Sri Lanka and places a vital role in economical and physical development in the country. However, in recent years, there has been a slowdown in construction activities due to government regulations and policies. According to the Central Bank sources, construction is the fourth highest sector contributing to Sri Lankan economy after services, agriculture, manufacturing and mining.

Sri Lanka has a tremendous history in the development of infrastructure of the country during the eras of ancient kings (Purangedara 2017). According to historical evidence, Sri Lanka had incredible knowledge and technology in the construction of irrigation systems, Buddhist Stupas…etc., where they have used unique knowledge and technology that cannot be seen in other countries. This evidences that Sri Lanka had a knowledge-intensive and technological advanced society in ancient times.

After European countries conquered Sri Lanka, global knowledge and technology started to flow into the country. This was the very first time where Sri Lanka had experienced the transfer of knowledge and technology from foreign countries. The European knowledge and technology mainly concerned about the development of infrastructure facilities in Sri Lanka. After English invaded the country, they were interested in developing the road and rail network, irrigation schemes and other infrastructure purely with the intension of increasing the production capacities. The technological era began from the 19th century with British colonization (Purangedara 2017).

Thereafter at the post-independence period some studies have highlighted some positive government initiatives like establishing Ceylon Institute of Science and Industrial and

Research (CISIR). Until 1970 intermediate level of knowledge and technology has been transferred from foreign countries to the local construction industry. From 1970 to 1977, the economic environment was shaped up by socialist influence. This approach caused a restriction in the private-sector participation of countries economic development. This made a negative impact on the flow of foreign investments to the country (Weddikkara and Devapriya 2019). Owing to these government regulations, foreign involvement for the construction industry development was drastically reduced in this period. However, the local industry had demonstrated independent capability in many construction sectors prior to 1978, Before opening up the country's economy to global market in the year 1978, Sri Lanka received significant assistance for the development of rural and urban infrastructure, which created several opportunities to create JVs and SCAs (Ganesan and Kelsey 2006). Therefore, this highlights that knowledge and technology transfer favourable environment existed in the country even prior to opening up the economy to global in 1978.

During the time period of 1978-1981, the construction industry growth rate was high, but construction industry development did not happen after 1983, due to the growing matter of ethnic problem in the country (Purangedara 2017). Hence in this time period the knowledge and technology transfer was happened at a very low level. In 1986 the establishment of Institute of Construction Training and Development (ICTAD) was a great initiative taken by the government, in turn some knowledge and technology transferred to the local construction industry through training, seminars and, R&D.

In Sri Lanka during the period of 1985-2000, SCAs formed in the construction industry contributed to upgrade the national technological capacity in the country (Ganesan and Kelsey 2006). There had been a number of SCAs created in the local construction industry, which brought some knowledge and technological advancement to the country. However local contractors were not given many opportunities to work as JVs in foreign-funded projects, in which the knowledge and technology transfer was restricted.

After end of the three-decade war in the year 2009, construction industry started to grow faster than ever before. After the post-war, reconstruction and rehabilitation efforts and the general economic condition were intended to cause boom in construction industry

(Purangedara 2017). The below figure shows the growth rate of construction industry in the post-war period.

Central Bank Sources

Figure 2-2: Construction Industry Growth (2002-2012)

It was observed that several infrastructure development projects were initiated in the country including the sectors of Highways, Railways, High-rise Buildings, Water Supply and Irrigation. In line with this, the flow of multilateral funds from banks and foreign direct investments (FDIs) has also been increased. There has been a steady inflow of multilateral funding from the World Bank, Asian Development Bank, JICA etc. for water supply, sewerage, irrigation, energy, health and highway projects. The number of foreign-funded projects coming up generally increases with the flow of foreign resources for projects, subsequently, the formation of JVs and SCAs increase in the projects (Ganesan and Kelsey 2006). Thus, in the post-war period, formation of JV s also increased mainly due to the involvement of foreign funds, engagement of foreign contractors, the magnitude of projects and knowledge and technological complexities. This environment favoured the transfer of knowledge and technology to the local construction industry.

This had been continued until the year 2015, and suddenly, the change of government and policies caused the reduction of infrastructure development. The certain policy decisions are taken by a government subjected to rapid changes due to the political instability, specially this happens during a political transformation in a country (Silva

et al. 2005). In par foreign involvement in construction projects has been lowered due to the halt of construction projects initiated by the previous government. The political changes and government policies, rules and regulations are critical factors in planning and implementing the knowledge and technology transfer. The development of construction industry in Sri Lanka which occurred during the last three decades has closely connected with the political changes that took place in the country (Weddikkara and Devapriya (2019)). The construction industry growth rate from the year 2015 to the year 2017 presents in below figure.

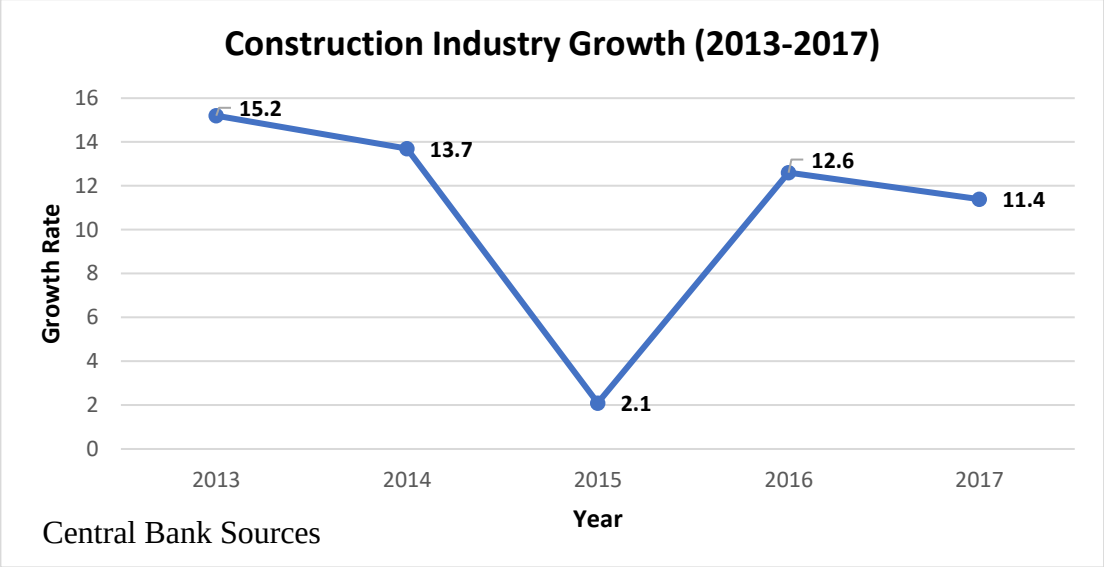

Figure 2-3: Construction Industry Growth (2013-2017)

However, with time the new government has started mega construction projects such as Port City Development Project, Kandy – Colombo Expressway, Railway system – especially LRT system introduced by the ministry of Mega Police. In these projects, the foreign contractors' involvement expected to be immense. This is mainly due to the knowledge and technology advancements will be demanded in the projects. Thus, it can be expected that foreign contractors will be increasingly involved in delivering the major projects in Sri Lanka's construction industry for the coming up years (Weddikkara and Devapriya 2019). The local contractors have to play a major role in forming JVs with these foreign firms to gain the knowledge and technology to the local construction industry. However, local contractors' lower financial capacity and non-availability of previous similar experience in the projects will be constraints to the formation of joint ventures with their foreign partners (Weddikkara and Devapriya 2019). In addition to this Silva et al. (2005), emphasized that the local construction

industry was not fully armed to meet the entirety of this increased knowledge and technology demand, thus; some of the large scale construction projects were undertaken by foreign contractors were lack of technological development and knowledge capacities.

In this respect, the government should be engaged in encouraging local contractors to form joint ventures with foreign contractors. Most researchers have highlighted the importance of having a government policy to develop the local construction industry in terms of knowledge and technology. Additionally, it is an evident fact that work opportunities for local contractors in foreign-funded projects have been limited in Sri Lanka. Most of the construction industry-related issues continued with the absence of concerted government policy on domestic contractor development (Ganesan and Kelsey 2006). Nevertheless, with the efforts of different government and other institutes, considerable development has occurred in the local construction industry. This has been validated by Silva et al. (2005) in their findings, during the last decade, it can be identified that a fair degree of technology transfer was attained with a well-equipped technology and management base. But still, there is a lot more to be improved.

The government as well as the private sector contribution to the Research and Development (R&D) is very little. Lack of initiatives, availability of funds, opportunities and attitudes of the industry personals were identified as major issues for inculcating R&D culture in the construction industry. (Silva et al. 2005). One common feature that can be seen in the developed countries like Japan, Singapore, China etc. is that they invest more and have strong policies on R&D sectors.

There have been very few literature findings related to the construction industry knowledge transference in Sri Lanka with respect to the ICJVs, however quite a few literatures available in the area of technology transfer.

2.9 Chapter Summary

This Chapter discusses the topics of knowledge and knowledge transfer of joint venture contractors in the construction industries in Sri Lanka and other developing countries. Mainly the key knowledge deficiencies of local contractors were identified related to the construction industries. Further types of collaborations facilitate and factors affecting the knowledge transfer was discussed in detail. The following major findings can be summarized based on the literature findings

As the world progresses towards globalization, more countries have commenced to participate in the competition of global construction market. Therefore, local construction industries in developing countries also try to enhance their capacities in terms of technological and managerial, to meet the competition over the globe.

There is a growing trend in the construction industries of developing countries where local contractors tend to form joint ventures with foreign contractors in order to become partners in projects. One of the main objectives behind this approach is to absorb knowledge and technology, so as to obtain competitive advantage over the industry.

As previous studies revealed, out of all the available resources knowledge is the key resource that needs to be absorbed by local construction firms to build their capacities. There were many previous research undertaken to study the technology transfer in the JV construction projects, but little effort has put to identify the knowledge transfer to the local construction industry. Hence the importance of carrying out a comprehensive study to evaluate knowledge transfer in past Joint Ventures in construction projects was identified.

It is important to evaluate and identify the existing knowledge deficiencies in local construction industries, in order to bridge the knowledge gap through the formation of effective joint ventures with foreign firms. Referring to various previous researches undertaken, there have been many knowledge deficiencies identified in the construction industries of developing countries such as Project Management (Time Management, Financial Management, Human Resource Management, Risk Management, Quality Management, Procurement, Plant and Equipment Management, Resource Management and Communication Management), Contract Management/Contract Administration, Business Development, Strategic Management etc. This is one of the major findings of the literature review, which will be considered for further evaluations.

In Sri Lanka, the government has started many large scale construction projects under the direct involvement of funds from foreign-funded agencies. Along with these initiatives, foreign contractor's involvement also increased over the last few decades. This has urged local contractors to form joint ventures with foreign firms to absorb necessary knowledge and technology. As identified from previous literature, the main knowledge deficiencies in Sri Lankan construction industry can be identified as Project

Management and Contract Management. The major limiting factor to acquire the required knowledge through ICJV is identified as the lower absorptive capacity of the local construction firms.

The government has to play a critical role in the process of forming Joint Ventures and to get the expected knowledge transfer from foreign firms. In this respect, the government have to bring certain policies related to the construction industry, specially targeting joint ventures and knowledge and technology transfer. Furthermore, the government should encourage/enforce foreign firms to transfer their knowledge and technology to local firms, by providing some incentives, performance-based payments etc.

CHAPTER 03: METHODOLOGY

3.1 General

This chapter discusses the basic framework to conduct the research course. This includes background of the study, preparation of sample, population of sample, method of data collection and data collection process, questionnaire design and data analysis.

3.2 Background of the Study

The main research objective is to determine whether the key knowledge deficiencies in the local construction industry could overcome through formation of Joint Ventures with foreign construction firms. Hence the research methodology was designed to accomplish these objectives. It was sequenced in such a way that, this logical approach will ultimately lead to a successful outcome.

As per the objectives first and foremost, it is required to identify the knowledge deficiencies of the local contractors in the water sector construction industry. This was done in the following three methods.

1. Through the literature survey, it was identified the key knowledge areas which lacked in the construction industries in other developing countries.
2. The identified knowledge areas were validated by conducting unstructured interviews with experts in the water sector industry, from this process knowledge areas were filtered specifically to the water sector industry i.e. new areas were identified and some omitted.
3. Contractual documents were studied to identify the stipulations related to knowledge areas and knowledge transfer under ICJV projects in the water sector.

The above identified knowledge areas were further analysed through structured interviews for detailed validation. The personal judgement also was taken into account. Following the above processes, key knowledge deficiencies of local contractors in the water sector construction industry were identified.

Finally, a detailed questionnaire survey was done to analyse the degree of knowledge of local and foreign contractors and the knowledge gap between them for the selected knowledge areas. Further, the knowledge transference in past ICJV projects and potentiality to fill the knowledge gap through formation of ICJVs were analysed.

The following figure shows the graphical representation of the research methodology

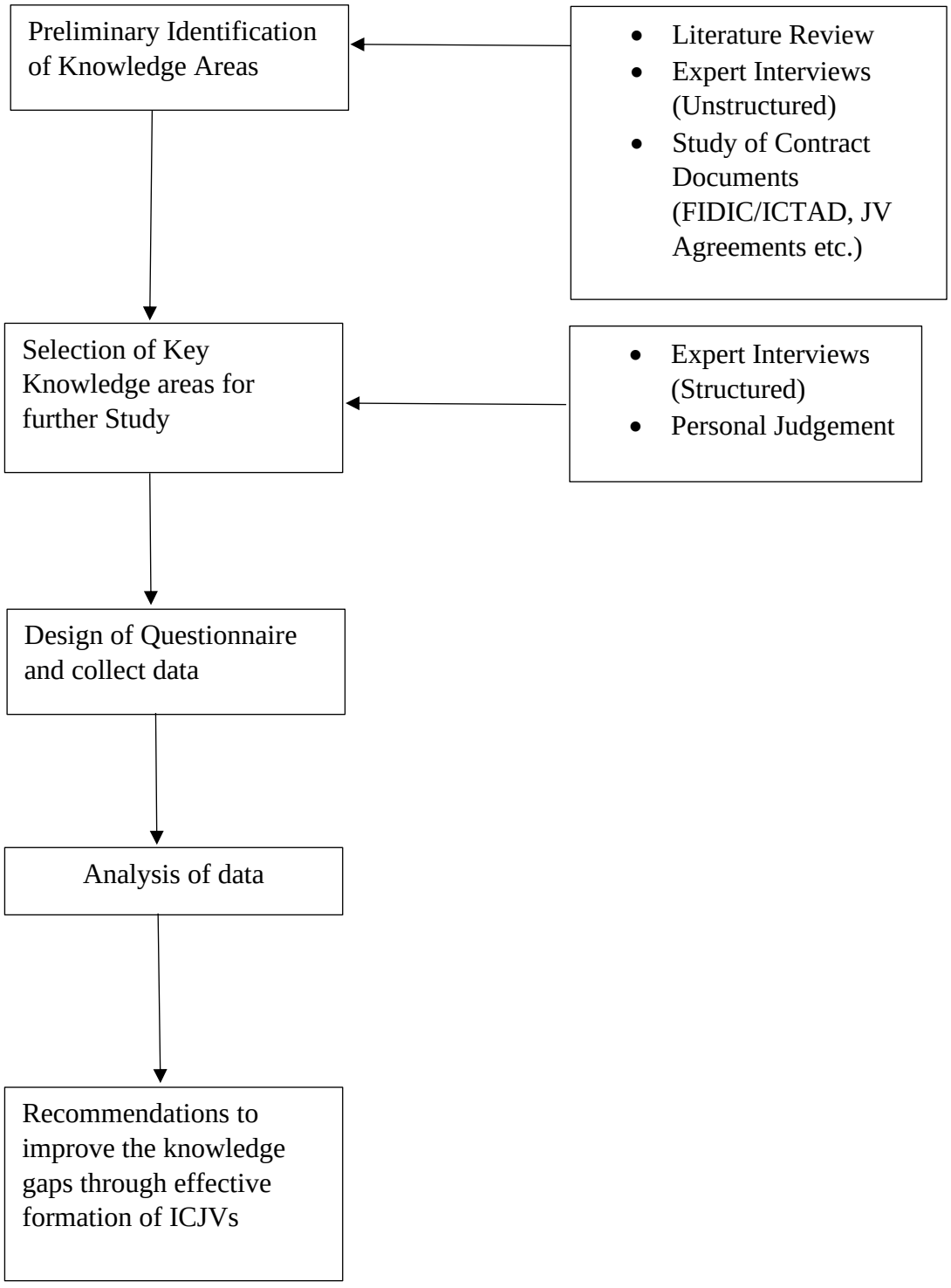

Figure 3-1: Research Methodology

3.3 Preparation of Sample

This research is both qualitative and quantitative study based on the results of the unstructured/structured interviews and structured questionnaire survey respectively.

3.4 Population of Sample

The population of this study represents the project management professionals in the water sector construction industry including Project Directors, Project Managers, Project officers, Team Leaders, Deputy Team Leaders, Chief Engineers, Engineers in funding agency, client, consultant and contractor organizations. The following sample population was selected for different studies.

- Unstructured Interviews – Ten (10) number of water sector professionals
- Structured Interviews – Twenty (20) number of water sector professionals
- Questionnaire Survey – Sixty (60) number of water sector professionals

3.5 Method of Data Collection; Reasons for selection of the Methodology

As the literature presented, this research topic has not been discussed widely in worldwide and locally, but researchers have made several recommendations highlighting the importance of researching the subject. Since this research area is fairly new to the Sri Lankan construction industry, it is vital to conduct a preliminary investigation to study the research area and justify the applicability to the local construction environment.

In the beginning, some secondary data sources were studied to identify the availability of reliable data sources related to this research. There are many types of secondary data available for a study. Such as documentary data, survey-based data and those compiled from multiple sources. Concerning this particular study, documentary secondary data was used as a method for data collection as it can provide the existing data related to the contractual provisions in the documents for the subject area. The “Documentary Secondary Data” is often used in research projects also use primary data collection methods (Research methods for business students, Saunders et al.). Since this study is related to the construction industry, exploring the available contract documents is vital to assess the contractual extents of the research area. Therefore, available secondary data in the Conditions of Contract documents (FIDIC, ICTAD) were studied to identify the contractual provisions under knowledge and knowledge transfer in the ICJV

projects. In addition to that existing Joint Venture (JV) agreements of the on-going ICJV water projects were studied to identify the existing arrangement of formation and implementation of JV with local and foreign contractors. This study is much important to find out the existing issues in the formation and implementation of JVs and make future recommendations for knowledge transfer process to be effective and successful.

The use of interviews can help you to gather valid and reliable data that are relevant to your research question(s) and research objectives (Research methods for business students, Saunders et al.). As a preliminary investigation, two interview sessions, namely unstructured and semi-structured interviews were conducted. These are generally called "non-directive" and "directive" interviews, respectively. The unstructured interviews were conducted to evaluate the applicability and compatibility of the research topic to the water sector construction industry and to achieve the research objectives.

Accordingly, at first a series of unstructured interviews were performed with the participation of water sector construction professionals. These experts are well qualified in the field of Civil Engineering, with lots of hands on experience in water sector projects. All the experts interviewed were above the level of Engineer category and their job relevancy to the research area was considered. In unstructured type of interview, the interviewee is allowed to talk freely about events, behaviour and beliefs in relation to the topic area (Research methods for business students, Saunders et al.). These interviews are unbiased and interviewer plays a facilitator role to guide the interview where necessary. Thus, the interviewees were given the freedom to freely talk about the subject area and their experience related to the same. Since there are no predetermined questions designed for the unstructured type of interviews, respondents were given the opportunity to provide detailed explanations and justifications about the statements. As per the literature review, it was observed that in past very few research studies carried out for this particular research area in the worldwide and locally. Hence these type of interviews can be used to justify the selection of the topic and the research area. In addition to that, the knowledge deficiencies identified in the literature were presented to professionals for the validation. The information gathered is basically from their past experiences in the water sector construction projects.

Interviewing has been identified as one of the most result oriented method of collecting data concerning someone's knowledge, past experiences, attitudes etc. (Purangedara 2017). Subsequently, another series of semi-structured interviews were conducted with construction experts in the water sector. In semi-structured interviews, the researchers will have a list of themes and questions to be covered (Research methods for business students, Saunders et al.). Hence questions were designed in a systematic way to achieve the objectives of the research. These experts with broad experience are well competent in handling water sector construction projects.

The questionnaire prepared for the semi-structured interview was arranged in such a way, to analyse and justify the selection of final set of knowledge areas for further study. The questions were asked to identify the knowledge deficiencies of local contractors in water sector construction industry compared to the foreign contractors. The questionnaire consists of two parts as described below (Refer Appendix 01)

- Part 01 of the questionnaire – Background information of the professional (such as Organization, Designation, Education Background and Working experience) requested in this section.
- Part 02 of the questionnaire – Part 02 of the questionnaire has provided the questions related to the knowledge areas identified in the literature and confirmed through unstructured interview process. The questions were categorized into two major groups as Project Management (Schedule Management, Financial Management, Resource Management, Risk Management and Communication Management) and Contract Management (Conditions of Contract, Claims and Variations and Dispute Resolution). These are presented below. Respondents were requested to answer the "open-ended" questions with respect to their similar experience in water sector construction projects. The respondents were questioned about the topics of practices of advanced tools and techniques, knowledge deficiencies of local contractors, knowledge transfer in past ICJV projects, enablers/barriers of the research area. Further any comments and suggestions were encouraged to get other concerns of the respondents.

An open question is designed to encourage the interviewee to provide and developmental answer (Grummitt 1980). Thus, the selected knowledge areas have been further validated through this semi-structured questionnaire.

All the knowledge areas that were selected from the literature review and validated from unstructured interviews, were further analysed by designing a questionnaire survey to evaluate the degree of individual knowledge, knowledge gap of local and foreign contractors and effectiveness of knowledge transfer in past ICJV projects. This is presented in the below section.

3.6 Questionnaire Survey

Based on the literature survey and series of structured and unstructured interviews, key knowledge areas were identified for development of the questionnaire. Several discussions were held with the research supervisor and revisions were made to meet the research objectives and be user friendly.

The questionnaire consists of two parts (Refer Appendix 02). First requests the background information of the respondent. In this section, respondent's information such as type of employment, designation and working experience was requested. However, it was refrained from asking personal information such as name, address etc. to keep confidentiality.

Part two is divided into three sections namely below,

- Part A – Questionnaire related to Project Management, this section covers five key Project Management knowledge areas identified in the literature and unstructured and structured interviews process. These are listed below.
    - Schedule Management
    - Finance Management
    - Resource Management
    - Risk Management
    - Communication Management
- Part B – Questionnaire related to Contract Management/Contract Administration. This section covers three key Contract Management areas identified in the literature and unstructured and structured interviews process. These are listed below.

- Conditions of Contract
- Claims and Variations
- Dispute Resolution

In part A and part B, the respondents were asked to rate the questions by indicating the extent to which "Agree", on a scale of 1 to 5.

- Part C – Questionnaire to rank the overall knowledge of foreign and local contractors. In this section, the respondents were asked to rank the knowledge level of different contractors to the extent on a scale of 1 to 3.

3.7 Method of Data Analysis

The data were analysed in both qualitative and quantitative methods to confirm that research objectives are reached at the end. Data analysis is the process of reducing and summarizing large amounts of data into sensible and readable format (Purangedara 2007).

3.7.1 Qualitative Analysis of Data

Interpretation and analysis of data to ascertained using structured interviews is the first step in obtaining a qualitative measure of knowledge and knowledge gap between the local and foreign contractors in the areas of Project Management and Contract Management. The data analysed to determine the knowledge deficiencies of local contractors in the current water sector construction projects compared to the foreign contractors and arrived at conclusions for each selected knowledge area. Further, the knowledge transfer in past ICJV projects was questioned and analysed to identify its effectiveness.

3.7.2 Quantitative Analysis of Data

The quantitative data was analysed based on the Relative Important Index (RII) method for the responses received in the questionnaire. Each knowledge area was ranked for both local and foreign contractors based on their knowledge level as per the responses.

RII was calculated from the below given equation;

$$\text{Relative Important Index (RII)} = \frac{\sum \mu}{A \; x \; N}$$

Where;

“μ” is the constant expressing weight given to each response, (ranging from 1 to 3)

“A” is the highest weight

“N” is the total number of respondents

RII has a range from 0 to 1. Highest Value gives the highest significance of the case

3.8 Chapter Summary

This chapter presented the methodology used to carry out the research. The basic framework of the research course, background of the study, sample characteristics, method of data collection, questionnaire design have been discussed. Two different data collection processes have been considered for the research study namely qualitative and quantitative data collection. Under the qualitative data collection process, two interview sessions (unstructured and structured) were undertaken. From this, the key knowledge deficiencies presented in the local water sector industry were identified. The relevant information, past data and knowledge areas that are required to be considered were identified through literature review and interviews. As the next step, a questionnaire survey was undertaken to evaluate the knowledge gap between the local and foreign contractors in the water construction industry. The questionnaire format has been designed considering the chapters of Background information, Questionirre related to Project Management, Questionirre related to Contract Management, Overall knowledge of foreign and local contractors. Furthermore, it has discussed the methods of data analysis under the qualitative and quantitative data analysis process.

CHAPTER 04: ANALYSIS OF DATA AND DISCUSSION OF RESULTS

4.1 General

This chapter is focused on thorough analysis of responses received from the respondents in both qualitative and quantitative data collection processes.

4.2 Analysis of Qualitative Data

4.2.1 Secondary Data

As discussed in Chapter 03, first the secondary data sources such as FIDIC, ICTAD contract documents were studied to identify the contractual implications with reference to the knowledge transfer in construction projects. No reference could be found in any of these secondary data sources relevant to the subject area of knowledge transfer. Further JV agreements in the present ICJV contracts were studied to identify the current arrangement of JV formation and its application. The findings can be summarised as below.

- There is no standard format followed as the JV agreement under existing ICJV projects. The contractors use different formats in different contracts as per the requirement.
- The contractors do not follow the roles and responsibilities as mentioned in the JV agreement. It has been noted that most of the management responsibilities are solely vested on the foreign partner. But in most contracts foreign partner is not engaged in the contract implementation.
- No terms and conditions/clauses related to knowledge and knowledge transfer through ICJV can be observed in the JV agreement.

Subsequently, series of unstructured and structured interviews have been conducted. Accordingly, analysis and discussions are presented in the following sections.

4.2.2 Unstructured Interviews

In unstructured interviews, the experts were given the opportunity to freely talk about their opinion and suggestions about the research area. During the unstructured interview process, ten (10) number of water sector construction experts have been selected and questioned regarding the applicability and compatibility of the research topic for the local construction industry and water sector projects. All the interviewees accepted the

importance of researching the selected topic, highlighting the recent upward trend in foreign contractor's involvement and construction sector boost in Sri Lanka. Following the series of interviews, experts' opinions can be summarized with below points.

- In water sector construction projects, ICJVs have formed only to gain the advantage in competitive bidding process by claiming the experience and qualification of the foreign partner. Hence in most projects, foreign partner is absent during contract implementation which negatively affects the project performance and knowledge transfer.
- The employers have not monitored the JV agreement, whether it follows responsibilities and relevant percentage of work share as agreed between the parties at the time of bidding, awarding and implementation of contracts.
- Most of the water projects, there is not much technology to receive from the foreign partner. The local contractors are equipped with the required technology to undertake the water sector construction projects.
- Project Management knowledge is the weakest area in local contractors compared to the foreign contractors and global construction industry.
- Referring to the Contract Management knowledge, the areas of Conditions of Contract, Claims and Variations and Dispute Resolution are weak in local contractors.
- Foreign – Local JVs are most suitable to have in Sri Lankan construction industry because performance is better than other forms of JVs.
- Joint ventures do not transfer the intended knowledge to the local partners, hence the government, donor agencies and other agencies should work towards the goal of achieving this.
- Foreign contractors mostly upgrade their knowledge and adopt newer technologies, while local contractors hesitate. Sri Lanka as a developing country cannot compete in the global market without upgrading knowledge and technology.
- The absorptive capacity of the local firm should be improved. Sometimes local contractors do not have enough financial capacity to support the knowledge transferring process.
- Local contractors do not have the will to improve to a greater extent, they generally employ conservative practices. Foreign contractors introduce some

advanced systems, but the locals tend to move with same old systems. Thus, the attitude should be improved.

- Language is a barrier for the knowledge transferring process in the local context. Because of communication/language barrier of the local people, the knowledge transfer becomes more difficult.

According to the detailed literature review carried out, several key knowledge deficiencies have been identified in the local construction industry of other developing countries. These knowledge deficiencies can be basically categorized into following major knowledge areas.

- Project Management
    - ✓ Human Resource Management
    - ✓ Time Management
    - ✓ Communication Management
    - ✓ Financial Management
    - ✓ Procurement and Plant & Equipment Management
    - ✓ Risk Management
    - ✓ Resource Management
- Contract Management/Administration
- Strategic Management
- Business Development
- Technology

The key knowledge areas identified in the literature have been presented and further validated through the fore-mentioned unstructured interviews. Considering the applicability to water sector construction projects, only the critical knowledge areas have been selected for further study with the consent and patronage of experts. Therefore, succeeding this filtration process, following key knowledge areas have been selected for further study.

- Project Management
    - ✓ Time Management
    - ✓ Financial Management
    - ✓ Risk Management
    - ✓ Resource Management

- ✓ Communication Management

- Contract Management/Administration
  - ✓ Conditions of Contract
  - ✓ Claims and Variations
  - ✓ Dispute Resolution

4.2.3 Structured Interviews

Semi-structured interviews have been conducted with the participation of Twenty (20) field experts and the responses were evaluated and analysed based on each knowledge area selected for the study. This is described in coming up sections.

4.2.3.1 Project Management

1. Schedule Management

Most of the interviewees have identified that foreign contractors possess advanced knowledge in the area of schedule management in comparison to the local contractors in water sector construction projects. Furthermore, they have highlighted that majority of the local contractors do not practise advanced tools and techniques for schedule management, hence most of the local water projects get delayed without any action being taken. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for schedule management. According to the responses given by the professionals, following knowledge deficiencies in the local contractors have been identified in comparison with the foreign contractors.

- It is observed that schedule management tools and techniques are practised at a low level in local water projects.
- Contractors do not either prepare or use the schedule management plan in the projects. It has been noted that critical path analysis is not followed. There is no integration of resources and financials in the schedule management plan.
- Schedule management tools are not used for high-level planning (Primavera, EZ-PERT etc.) by integrating the resources and cost/financials. At present, most contractors tend to use scheduling tools only to produce bar charts as per client's requirement.

- The schedule is neither monitored daily/weekly/monthly nor updated/revised/rescheduled according to the baselines.
- The local contractors do not have required IT knowledge to use high-end schedule management tools and techniques.
- The knowledge is not upgraded to comply with the international level schedule management practices.
- Project planning issues, cash flow problems and financial issues affect the overall schedule of the project. Hence, poor financial management knowledge has a direct impact to the schedule management.
- Skilful technical staff is not available and at the same time experienced local staff is not involved in the schedule management process.
- Devotion and dedication of local contractors towards proper schedule management is insufficient. Apart from that, their lack of awareness about the importance of effective schedule management plays a major role.
- Competency level of the Project Managers and rest of the other local construction experts is less. Additionally, the commanding power and demanding power should be improved as well.

Therefore, in keeping with the above responses, it has been clearly identified that there is a clear knowledge gap exists between the local contractors and foreign contractors in the knowledge area of schedule management. The degree of individual knowledge of each contractor and knowledge gap to be analysed in the quantitative data analysis process.

2. Financial Management

Most of the respondents emphasised the fact that foreign contractors have performed better in terms of managing finances in the water sector projects. In addition, most of the projects done by local contractors have been completed with over budget, whilst majority of projects with the engagement of foreign contractors have been completed on or under budget. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for financial management. The following financial management deficiencies were identified within local construction firms in water sector projects.

- There are no proper financial management practices within the local construction firms. When a project is awarded, contractors used to get the advance payment and invest that money on other projects. There are no dedicated finances (credit lines etc.) allocated for each project.
- When pricing the BOQ proper rate analysis is not undertaken and costing for safety and quality aspects is not offered. Owing to the competitive bidding process, contractors tend to put a lower profit margin in order to win the bid, but at the implementation contract amount is not adequate to complete the project successfully. In turn, this affects the overall project performance due to unavailability of funds.
- Mismanagement of cash flow, Poor financial planning and management, Bank Loans and Over Drafts (OD) to cover the financial deficit, Higher Overhead percentages, Eligible claims and variations are not submitted in a timely manner.
- Delay in subcontractor payment affects the performance of the project in general.
- Some fixed assets are mentioned only in the document, but those are not physically available.
- Lack of experienced and Knowledgeable financial management experts involved in the projects.
- There is no cost/financial management plan maintaining for projects. This ad-hoc approach to financial management greatly affects the progress of the project. No timely submission of the interim payments to the client (monthly basis).
- Financial forecasting is not done, no proper arrangement of finances, no adequate knowledge and experience to arrange the finances in a timely manner from suitable channels.
- Local companies follow very conservative practices compared to foreign construction firms and do not follow standard practices.

Taking into consideration the above-mentioned reasons, it is evidenced that there is a clear knowledge gap exists between the local contractors and foreign contractors in the area of financial management. Hence, further analysis to be carried out to evaluate the individual knowledge of each contractor and the extent of the knowledge gap.

3. Resource Management

Resource Management is an area where foreign contractors possess higher knowledge and experience comparing to the local contractors. This statement has been proved by the responses given by many respondents. This is mainly due to the vast exposure and experience gained by foreign contractors handling large-scale global projects. Most experts have stressed that foreign contractors have sound knowledge and practices in place for resource management. Foreign contractors use the resources in a proper way that, equipment's and materials will improve the quality of the output leading to greater performance and less maintenance. In comparison with that, local firms' knowledge and practices are at a moderate level and they need to upgrade their knowledge, best practices and systems. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for resource management. The following deficiencies have been identified in terms of resource management in the local firms of the water sector construction projects,

- There is no Resource management plan prepared beforehand and practised in the projects.
- Efficiency and attitudes are unsatisfactory towards the resource management, mismanagement of resources (material, equipment), equipment's are not operated at the optimum levels.
- Unlike in foreign firms, there is no separate equipment/material Manager with expertise knowledge assigned or separate equipment division in the organization to oversee the resource management aspect in projects.
- Local contractors do not practise the HR disciplines (recruitment, training and development, performance appraisal etc.), no proper records kept for material and equipment handling, wastages.
- No high-level planning is done for proper resource management. Also, material supply delays have been affected to the total project schedule, idling of equipment at sites and quality equipment are not available.
- Unlike in foreign firms, there is no buffer zone to handle materials for effective implementation of projects.
- Weak in Resource allocation for projects, Supply Chain Management is not done, the minimum working efficiency of equipment is not maintained and delays in material supplies.

- Poor planning of resources, requirements are not identified, negligence of resource management.
- No proper knowledge to get the maximum efficiency of resources
- Locals try to compromise the material quality and use low rated equipment, resulting in several contract implementations issues.
- Locals do not have the motivation for proper resource management, there is a Language barrier.

The above knowledge deficiencies of the local contractors indicate that there is a clear knowledge gap exists in comparison to the foreign contractors in the context of resource management. Hence further analysis to be taken to evaluate the individual knowledge level of the contractors and extent of the knowledge gap.

4. Risk Management

The interviewees were questioned on their experience with regard to the risk management in the water sector construction projects. All the respondents have stated that no practices can be experienced with respect to risk management by local contractors in local water projects. This is mainly due to the deficiency of knowledge in risk management in the local construction industry. Most of the local contractors do not pay attention to identify, analyse and control the risks in the project. In comparison, foreign contractors possess advanced knowledge and practices in risk management and respondents have emphasized it has given them many benefits in managing the projects. In addition, questions have been asked to evaluate the management of country-level risks, market-level risks and project-level risks in the water sector projects by both local and foreign contractors. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for risk management. The following knowledge deficiencies have been identified in local contractors comparing to foreign contractors.

- There is no proper knowledge and practices in local firms for risk management in the water sector projects.
- Lack of knowledgeable experts/Project Management experts in the local construction industry to handle risk management.

- Unlike in foreign firms, there are no dedicated experts assigned and at the same time responsibility has not been given to Project Manager to manage the risks in the projects.
- The risk management plan is not prepared and practised in the projects.
- Negligence and no proper knowledge and awareness of the importance of risk management.
- Risk assessment is not carried out before the commencement of any project.
- No opportunities for awareness and training in local construction environment for risk management.
- Local contractors are deficient in managing market level and project level risks.

Foreign experts have expressed that there are dedicated experts (Risk Engineer/Manager) assigned or the responsibility has been given to the existing project staff (i.e. Project Manager) to conduct the risk management aspects in the projects. Every month risks are analysed and mitigatory measures are taken to control the risks. Furthermore, experts have accepted that there are established management systems in place to manage the risks in foreign construction firms. Hence, considering the above weaknesses and knowledge deficiencies, the knowledge level of the local contractors can be categorized as low to medium. There is a considerable knowledge gap exists between local and foreign firms. This will be further evaluated to determine the extent of the knowledge gap between local and foreign firms.

5. Communication Management

The respondents were questioned about their experience related to communication management by local and foreign firms in water sector construction projects. Most of the experts have insisted that foreign firms concerned to use advance techniques in managing the communications in the projects while local firms move with the same old traditional systems. In the project management language, it is believed that 90% of the project activities rely on effective communication management. Hence effective plan, monitor and control communications are utmost important for project success. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for communication management. The following knowledge deficiencies were identified within the local firms with regard to the communication management.

- There is no communication management plan prepared and followed in the projects.
- In almost all the projects plan, manage and control communications is not done.
- Proper communications have not been done with effective participation and engagement of relevant stakeholders in the projects, whether their interests, requirements and perspectives are being satisfied.
- Advanced electronic tools and techniques such as Aconex, MS Sharepoint etc. platforms are not being used for efficient communications in the projects.
- Delays and gaps in communications affect the overall performance of the projects.
- Poor attitude in local firms and hesitate to use new systems for better performance.

Due to the above-mentioned reasons, it can be concluded that the local construction firms are lagged with knowledge and experience in managing the communications in the water sector projects. Further analysis to be done to quantify the individual knowledge and knowledge gap between the different contractors.

4.2.3.2 Contract Management/Contract Administration

1. Conditions of Contract

As per the experts, foreign contractors strictly monitor the contracts with reference to the conditions of contract (FIDIC, ENAA etc.) and they own advanced knowledge and experience in the subject area. Majority of experts have stressed that some experience received by local contractors as knowledge transfer in past ICJV water projects for reviewing and analysing conditions of contract. The following knowledge deficiencies have been experienced within local construction firms in water sector projects with respect to the foreign construction firms.

- Local contractors haven't got the knowledgeable and experienced staff within the firms to monitor the conditions of contract.
- Local contractors do not practice and monitor the contracts according to the conditions of contract. This results in management issues within the firm.
- Local contractors tend to hire foreign experts to handle the subject due to in-house knowledge deficiency, no dedicated local experts available or assigned.

- The importance of practising the conditions of contract has not been identified. Proactive planning is not done.
- No proper knowledge and practices to follow the international standards (FIDIC, ENAA etc.) in conditions of contract. Locals mostly know how to follow the ICTAD conditions.
- No proper knowledge and understanding about how to refer to the conditions of contract when contract management issue arises.
- Lack of training and development opportunities for contract management in the local construction environment.
- The site-level staff does not get the opportunity to learn and practice contract conditions, but they involve in the contract management activities, therefore they should learn and knowledge should be improved.
- No knowledge transfer to the people who work below the senior management categories.
- Attitudes of the local contractors (i.e.; the importance is not identified).
- Country/company culture also plays a key role. In Sri Lankan construction industry culture, no emphasis is given to practice international standard documents.

Due to the fore-mentioned reasons, it can be concluded that there is a considerable knowledge gap exists in the local construction firms compared to foreign construction firms. Further analysis to be done to evaluate the extent of the knowledge gap.

2. Claims and Variations

Most respondents have expressed that, there is not much knowledge gap exists in between the local and foreign contractors in handling claims and variations. But in that respect still, foreign firms are much knowledgeable in handling claims and variations. This is mainly due to their wider exposure in the construction industry and sound contract management practices experienced in different countries. Majority of experts have stressed that considerable experience received by local contractors as the knowledge transfer in past ICJV water projects for handling claims and variations. However, the following knowledge deficiencies of local contractors have been highlighted by some of the experts in water sector construction projects.

- Local contractors do not have widespread experience and knowledge of claim management.
- Knowledge deficiency in submitting legitimate claims timely to the client.
- No dedicated experts assigned to manage the claims (Claim Engineers/Managers).
- The site-level staff does not maintain proper records promptly. Records should be kept for each construction activity with all the required details. The variations and claims should be supported by these records at the time of claim preparation.
- No timely submission of notice to claim, variations and other contract management issues.

As mentioned by the experts during the interview sessions, foreign contractors tend to submit more variations and claims due to the contractual relationship maintained with the client. In comparison, local contractors usually try to maintain a good relationship with the client without submitting legitimate claims and variations. This intention has created a barrier to enhance knowledge and experience in the subject field. Due to the fore-mentioned reasons, the existing knowledge of local contractors can be categorized in the intermediate level. Further analysis to be carried out to determine the extent of the knowledge and knowledge gap.

3. Dispute Resolution

According to the experts, there has not been knowledge received by the local contractors in handling disputes with respect to the local water projects. Hence, there are fewer opportunities for local contractors to upgrade their knowledge and experience in the subject field. In contrast, foreign contractors possess much experience and knowledge in handling disputes in international level projects. Majority of experts have stressed that little or no experience received by local contractors for knowledge transfer in past ICJV water projects for dispute resolution. The following knowledge deficiencies have been highlighted by experts.

- Local contractors do not keep proper records for each construction activity. Early preparation for disputes and close monitoring of contracts have not been experienced.
- Scope of the contract is not clearly identified, As a result, more disputes arrive at the implementation stage.

- Local contractors do not anticipate the disputes, therefore proactive planning and actions have not been taken.
- There are no dedicated experts assigned to handle the disputes in the contracts.
- There is no dispute resolution mechanism followed in the projects.

As per the responses, it has been highlighted that local contractors have got intermediate knowledge in handling disputes. As per the wider exposure and experiences obtained in international level projects, foreign contractors are much knowledgeable in the subject field. Thus, there is a clear knowledge gap exists and further analysis to be done to evaluate the extent of the knowledge and knowledge gap.

4.3 Analysis of Quantitative Data

This section is focused on a thorough analysis and discussion of the responses received from the respondents for the questionnaire. The data analysis is carried out as presented in Chapter 03 and MS Excel used as calculation and analysis tool.

4.3.1 Sample and Demographic Characteristics of Respondents

The responses were received online and by hand. Seventy questionnaires were distributed among the experts in the water sector construction industry and Sixty were received back. The characteristics such as employment, speciality and years of experience are taken into consideration in this section.

4.3.2 Distribution of Sample

Figure 4-1 shows the distribution of sample based on the type of employment. The sample contains 13% representing funding agency, 17% representing consultant, 37% representing contractor and 33% representing the client. It is shown in figure 4-2.

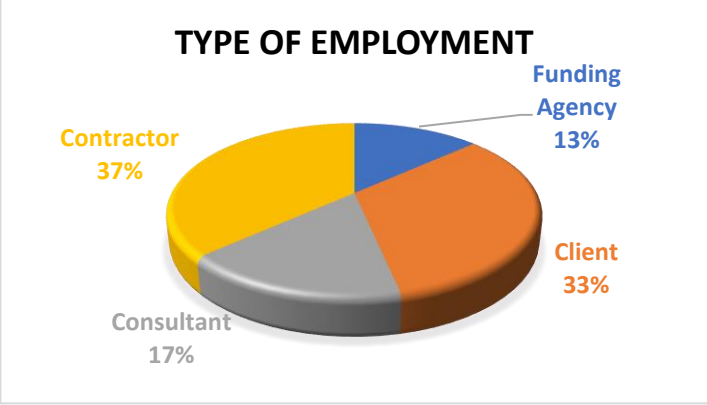

Figure 4-1: Sample Characteristics based on the type of employment

4.3.3 Demographic Characteristics of Respondents (Type of contractor)

Based on the type of contractor firm the sample was further characterized. It contains 55% of foreign contractor and 45% of local contractor individuals. It is shown in figure 4-2.

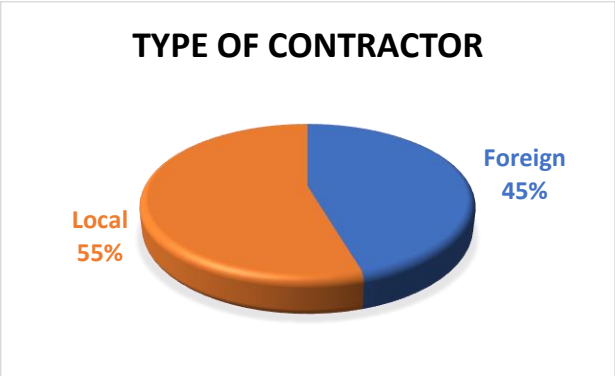

Figure 4-2: Sample Characteristics based on the type of contractor

4.3.4 Demographic Characteristics of Respondents (Speciality of the Expert)

Based on the speciality of the professional the sample was further characterized. It is shown in figure 4-3.

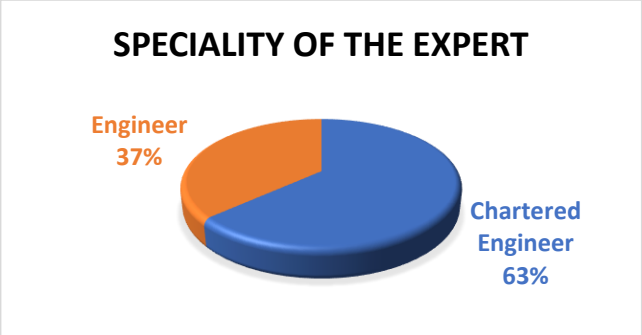

Figure 4-3: Sample Characteristics based on the speciality

4.3.5 Demographic Characteristics of Respondents (Years of Experience in water sector)

Based on the experience of the expert in the water sector sample was further characterized. It is shown in figure 4-4.

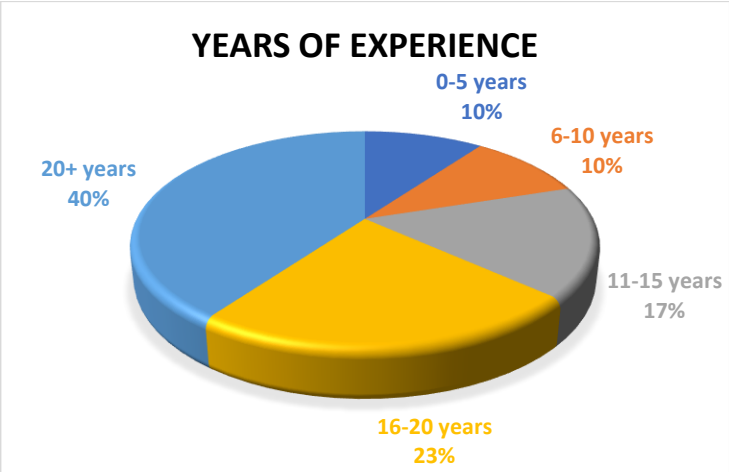

Figure 4-4: Sample Characteristics based on the experience

4.3.6 Project Management

4.3.6.1 Schedule Management

The questionnaire for schedule management was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses were given by the experts for each question were recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have used tools and techniques (such as Primavera, MS Project etc..) to plan, implement, monitor and control the schedule of projects

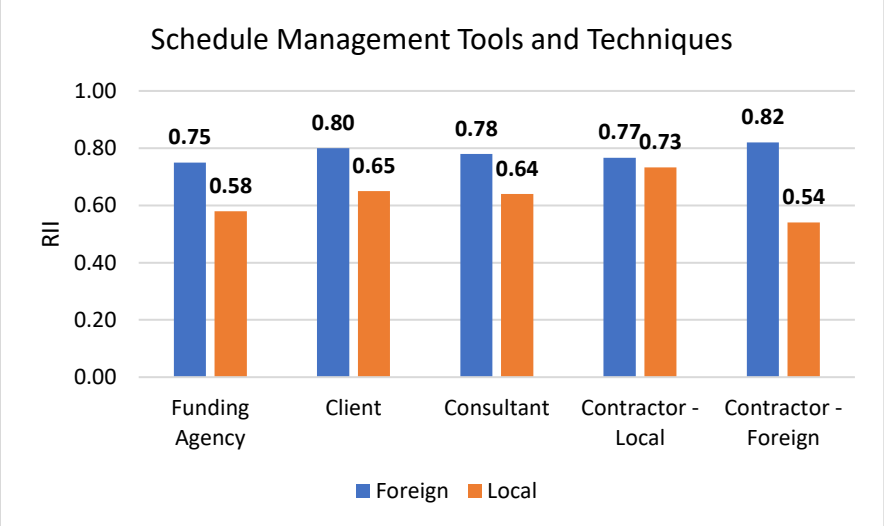

Figure 4-5: Use of Tools and Techniques by different Contractors

According to the above figure 4-5, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This clearly indicates the knowledge gap of the local water sector industry in the context of schedule management. This is further supported with the statements made by experts in the structured interviews mentioning that, "many of the local contractors don't use advanced tools and techniques to plan, monitor and control the schedule of the projects". The gap is narrow as per the responses given by the local contractors, this is mainly due to their misperception that they perform equally or better than the foreign contractors. This was also observed as per the statements made by local contractors in the structured interview process. Hence as the majority of parties responded there is a clear knowledge gap between foreign and local for schedule management.

B. Local Contractors need to improve their knowledge and practices for schedule management in projects

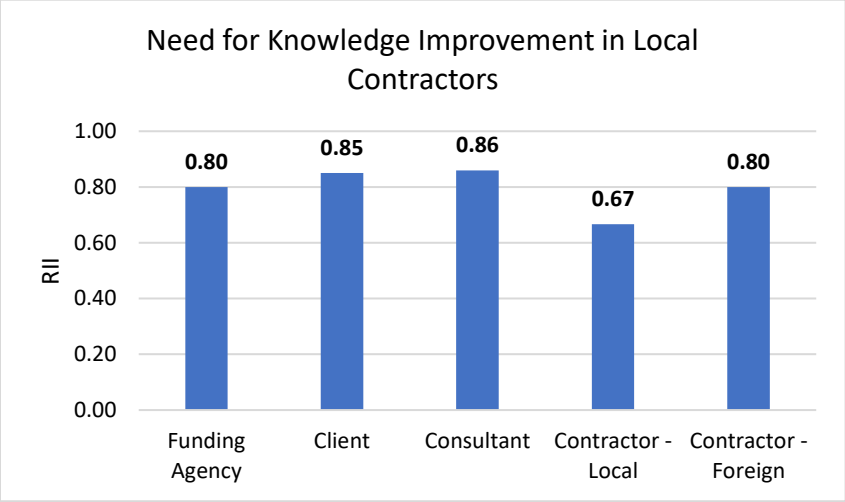

Figure 4-6: Need for knowledge improvement in local contractors

According to the above figure: 4-6, RII value for the given statement is more than 0.8 as responded by Funding Agency, Client, Consultant and Contractor – Foreign. For Local Contractors, the RII value is 0.67, which they accepted the need for knowledge improvement. This indicates that local contractors need to improve their knowledge and practices on behalf of proper schedule management in the projects. This further validates the findings in the above section A and the qualitative data analysis section for knowledge deficiency in the local water sector industry. Hence considerable

knowledge should be transferred to the local water sector industry in order to build the capacity of the local contractors to manage the schedule in the projects.

C. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of schedule management

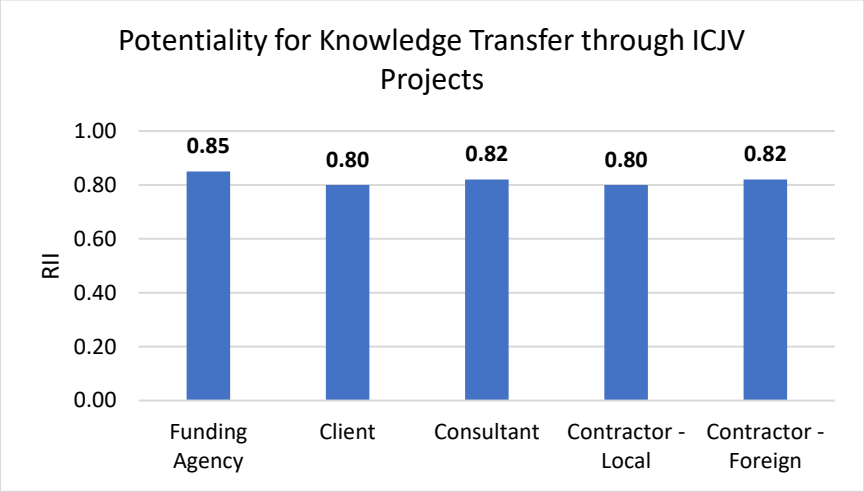

Figure 4-7: Potentiality for knowledge transfer through an ICJV

According to the above figure: 4-6, RII value for the given statement is more than 0.8 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV inbetween foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When forming an ICJV, the foreign experts who are mostly responsible for planning, executing, monitoring and controlling the schedule of the contract should work together with the local experts in a collaborative manner. Foreign firms use advance tools and techniques to manage the schedule of the contract in a comprehensive way, such as analyzing the schedule by allocating the resources of the project etc. Hence, this advance knowledge can be transferred to the local firms, if they work together in a JV effectively.

D. In past Foreign – Local Joint Venture (JV) construction projects, there was a considerable knowledge transfer to the local firm in terms of schedule management.

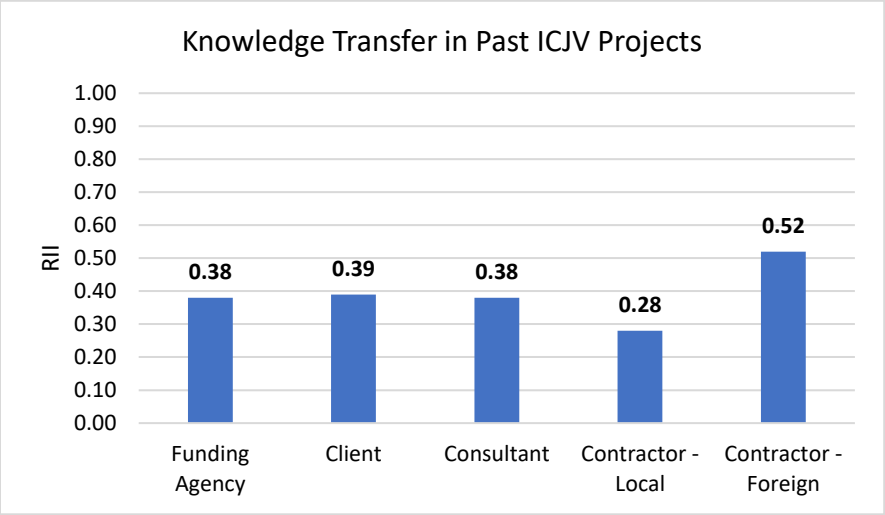

Figure 4-8: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-8, RII value for the given statement is less than 0.4 as responded by Funding Agency, Client and Consultant. The RII value for Contractor – Local of 0.28 indicates that local firms have highly disagreed with the statement. The RII value of 0.52 for Contractor – Foreign, indicates that they have agreed with the statement to a certain extent compared to other parties. Overall, this indicates that in past ICJV projects in the water sector, the knowledge transferring process in schedule management has happened at a very low level. This finding can be validated with the responses given by experts at the stages of unstructured and structured interviews. Most of the experts have expressed that in past ICJV water projects knowledge transfer in terms of schedule management has not been happened effectively due to various reasons. This will be discussed in the final part of the report as most of the causes are similar for the other knowledge areas as well.

4.3.6.2 Financial Management

The questionnaire for financial management was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have effectively managed the finances (cash flow, profitability, arranging finances etc.) of the projects

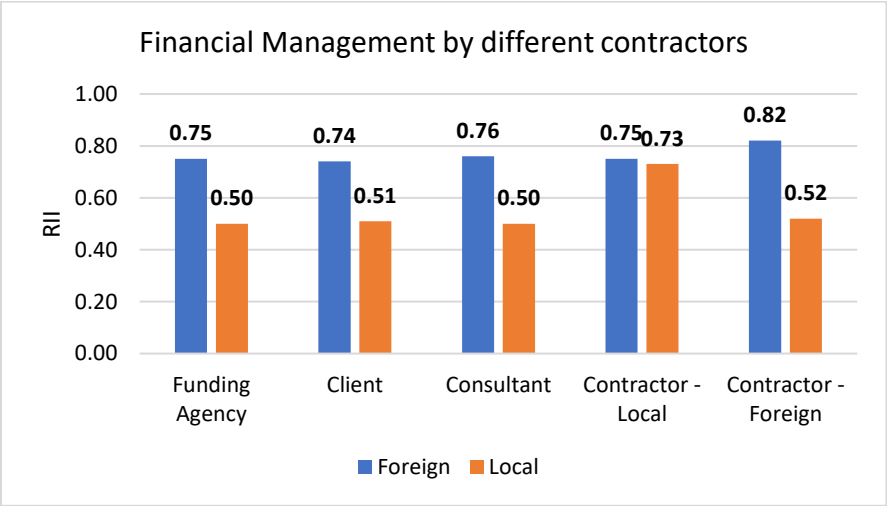

Figure 4-9: Financial Management by different Contractors

According to the above figure 4-9, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This clearly indicates the knowledge gap of the local water sector industry in the context of financial management. This is further supported by the statements made by experts during the structured interviews. The gap is narrow as per the responses given by the local contractors, this is mainly due to their misperception, that they perform equally or better than the foreign contractors. This was also observed as per the statements made by local contractors in the structured interview process. Hence, according to the responses of majority there is a clear knowledge gap between foreign and local regarding effective management of the cash flow, profitability and arrangement of finances etc. for the projects.

B. The local contractors need to improve their knowledge and practices for the proper financial management of projects

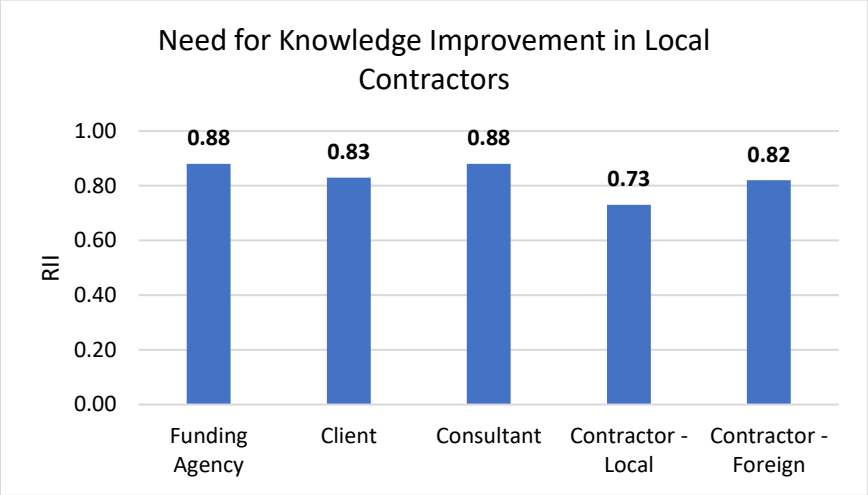

Figure 4-10: Need for knowledge improvement in local contractors

According to the above figure: 4-10, RII value for the given statement is more than 0.8 as responded by Funding Agency, Client, Consultant and Contractor – Foreign. For Local Contractors, the RII value is 0.73, in which they have accepted the need of knowledge improvement to manage the finances. This indicates that local contractors need to improve their knowledge and practices on behalf of proper financial management in the projects. This further validates the statements made by respondents at unstructured and structured interview stages. Hence considerable knowledge should be transferred to the local contractors to build the capacity of financial management in the local water sector construction industry.

C. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of financial management

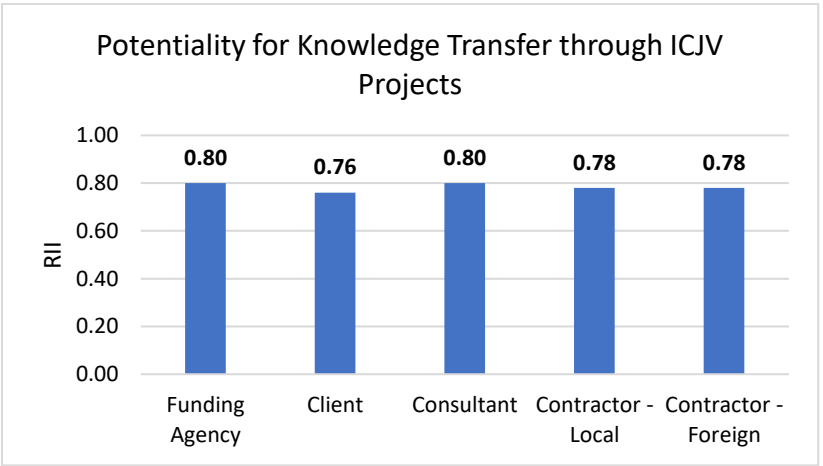

Figure 4-11: Potentiality for knowledge transfer through an ICJV

According to the above figure: 4-11, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When local and foreign JV is formed effectively and the responsibility of financial management is shared between both partners that will lead to definite knowledge transfer to the local partner.

D. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of financial management to the local firm

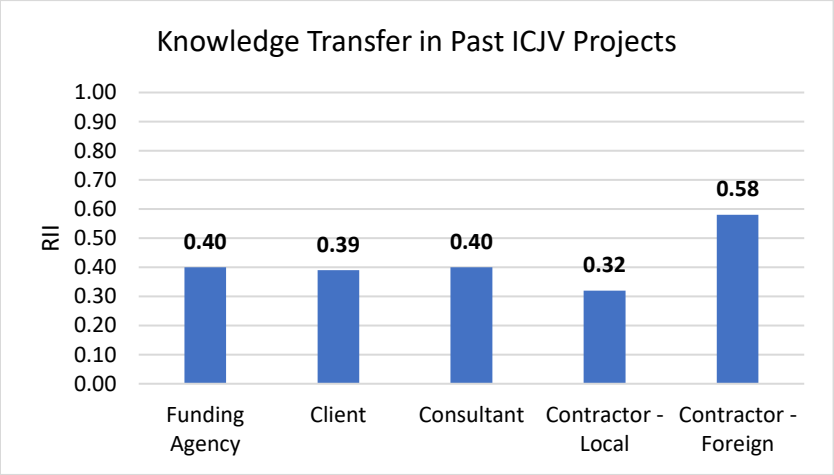

Figure 4-12: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-12, RII value for the given statement is less than 0.4 as responded by Funding Agency, Client and Consultant. The RII value for Contractor – Local is 0.32 indicates that local firms highly disagreed with the statement. The RII value of 0.58 for Contractor – Foreign, indicates that they have agreed with the statement to a certain extent compared to other parties. Overall this indicates that in past ICJV projects in the water sector, the knowledge transferring process in financial management has happened at a very low level. In most of the JV construction water projects, responsibility and authority of financial management have been vested on the foreign partner of the JV and hence local partner was not involved in the process. Most of the management functions have been carried out by foreign partner and, local partner was engaged only for construction supervision activities. This has been highlighted by

experts at the unstructured and structured interviews. Most of the experts have expressed that in past ICJV water projects knowledge transfer in terms of financial management has not been happened effectively due to various reasons. This will be discussed in the final part of the report as most of the causes are similar for the other knowledge areas as well.

4.3.6.3 Resource Management

The questionnaire for resource management was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have effectively managed the Resources (Equipment, Material and HR) in the construction projects

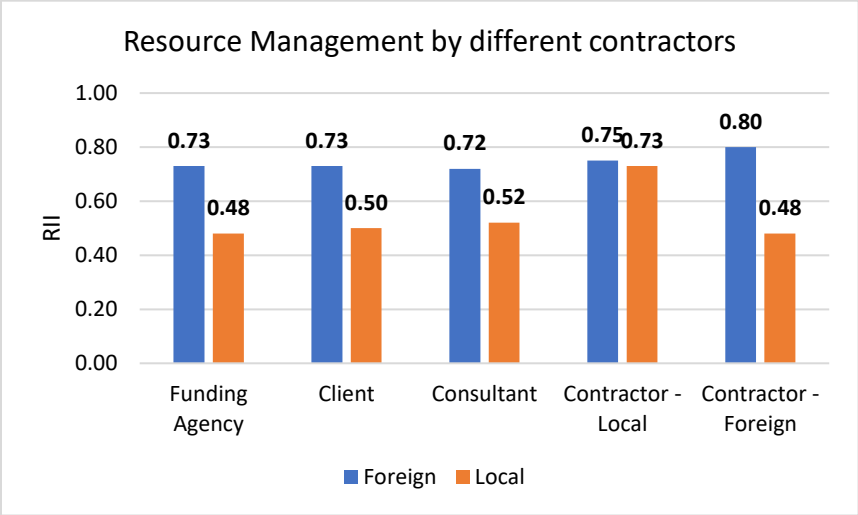

Figure 4-13: Resource Management by different Contractors

According to the above figure 4-13, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This clearly indicates the knowledge gap of the local water sector industry in the context of resource management. The RII values are almost equal as per the responses given by the local contractors. This is due to the misperception of local contractors that they perform equally or above the capacity of foreign contractors. But as the majority of parties

responded there is a clear knowledge gap between local and foreign contractors on resource management.

B. Resource Management in Construction Projects (Equipment, Material and HR)

a. Use best practices for equipment management to receive high efficiency

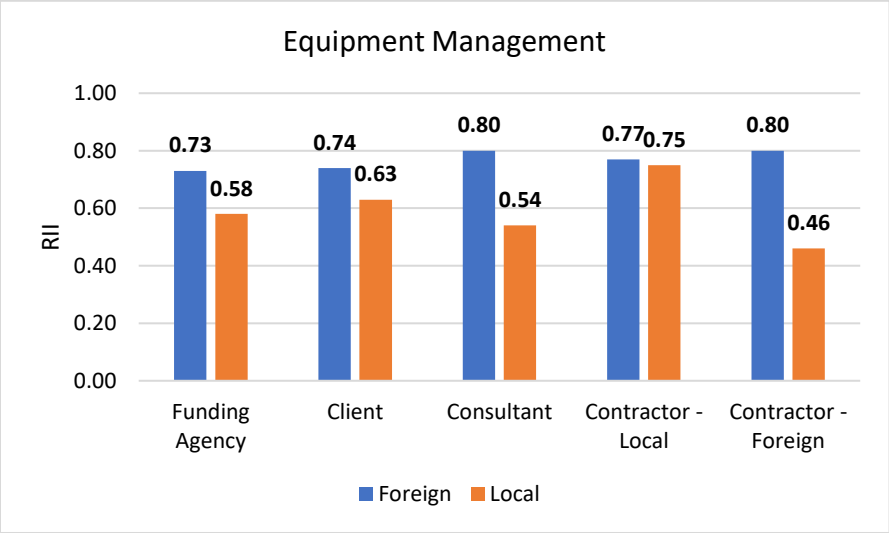

Figure 4-14: Equipment Management by different Contractors

According to the above figure 4-14, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Thus, there is a clear knowledge gap between the local and foreign contractors for equipment management in the water projects. This is further proved by the findings of unstructured interviews, where experts have stated that a lot of equipment idles and no equipment management and monitoring have been done. Hence the efficiency and performance of the equipment degrade with the time. There is no approach for monitoring and evaluation of equipment by the local contractors.

b. Use best practices for material management to receive high efficiency

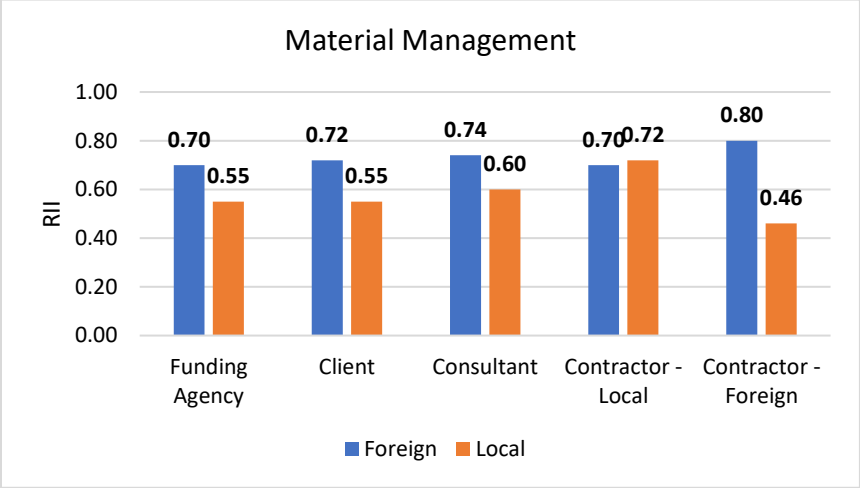

Figure 4-15: Material Management by different Contractors

According to the above figure 4-15, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant and Contractor – Foreign. Hence it can be concluded that there is a clear knowledge gap between the local and foreign contractors with regard to material management in water projects. As highlighted by the experts in the unstructured and structured interview processes, this is mainly due to the advanced tools and techniques for material management used by foreign contractors with efficient supply chains. As responded by Contractor – Local, the RII value for local contractors is above that of the foreign contractors. This is due to the misperception of local contractors that they perform equally or above the capacity of foreign contractors.

c. Practice well-defined HR principles (Recruitment, Training and Development, Performance Appraisals etc.)

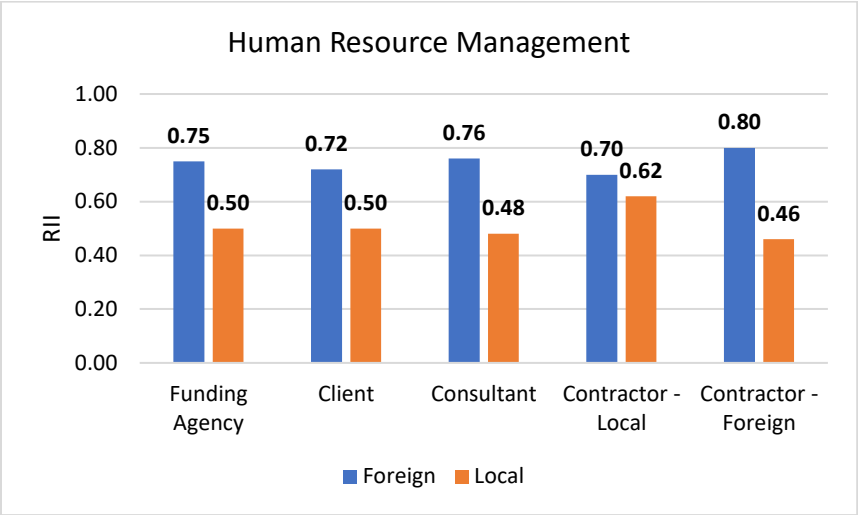

Figure 4-16: Human Resource Management by different Contractors

According to the above figure 4-16, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Thus, it can be clearly identified that in water sector projects HRM practices have not been properly followed by the local contractors. This was also stressed by the experts in the unstructured interviews mentioning that they could not observe any standard HR practices followed by local contractors in the water projects. Specially training and development, Performance appraisal have not been done by the local contractors. Therefore, the continued professional development of the industry professionals does not take place. Furthermore, the construction professionals leave their jobs due to no motivation and encouragement received.

C. The local contractors need to improve their knowledge and practices for proper resource management in the projects

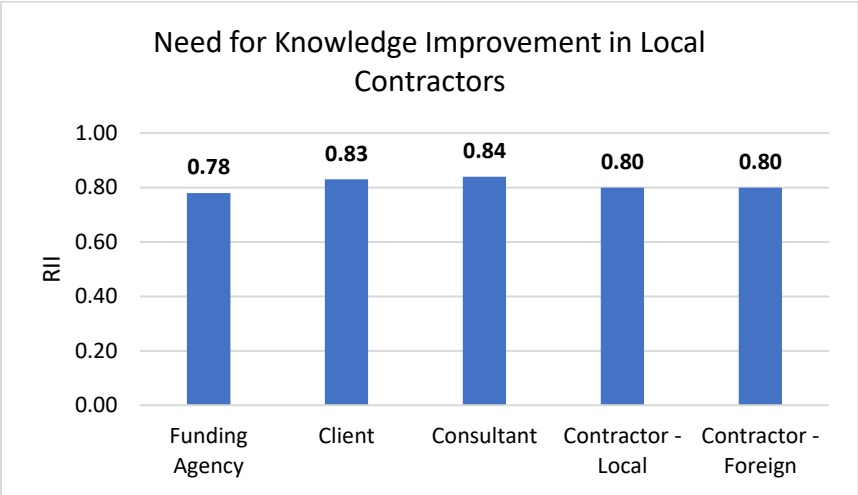

Figure 4-17: Need for knowledge improvement in local contractors

According to the above figure: 4-17, RII value for the given statement is more than 0.8 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates that local contractors need to improve their knowledge and practices on behalf of proper resource management in the projects. In water sector projects local contractors do not possess the required knowledge and practices to manage the project resources effectively. Therefore, the productivity and efficiency of the equipment lowered due to this reason, material supplies have not been handled effectively. Thus, this has affected the performance (Time, Cost and Quality) of construction. Apart from that poor HR practices have led to increased employee turnover and lowered efficiency.

D. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of resource management

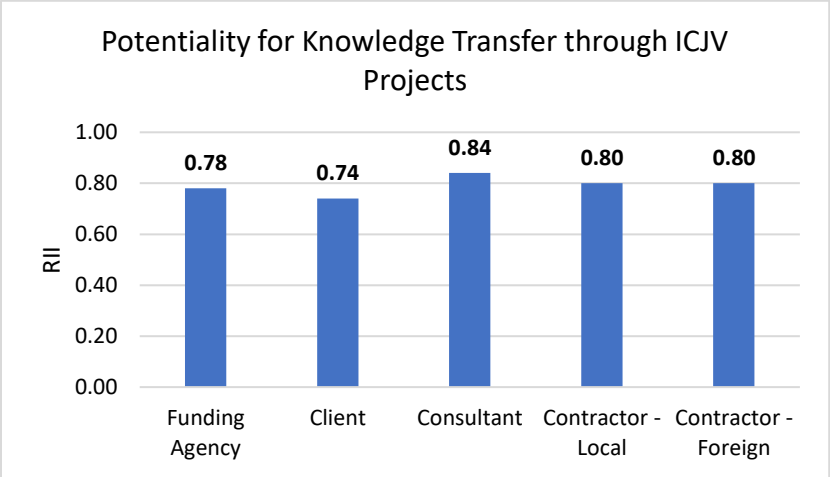

Figure 4-18: Potentiality for knowledge transfer through an ICJV

According to the above figure: 4-18, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". Due to the vast experience and exposure possessed in the international construction industry, foreign contractors have gained knowledge and technology regarding resource management which can be transferred through an effective formation and implementation of ICJV. Many foreign firms handle the equipments and materials with the latest technology. Apart from that HR management has been given the highest priority in order to build the capacities of the existing employees. Ultimately, this will facilitate local contractors to upgrade themselves on behalf of efficient project management in water sector projects.

E. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of resource management to the local firm

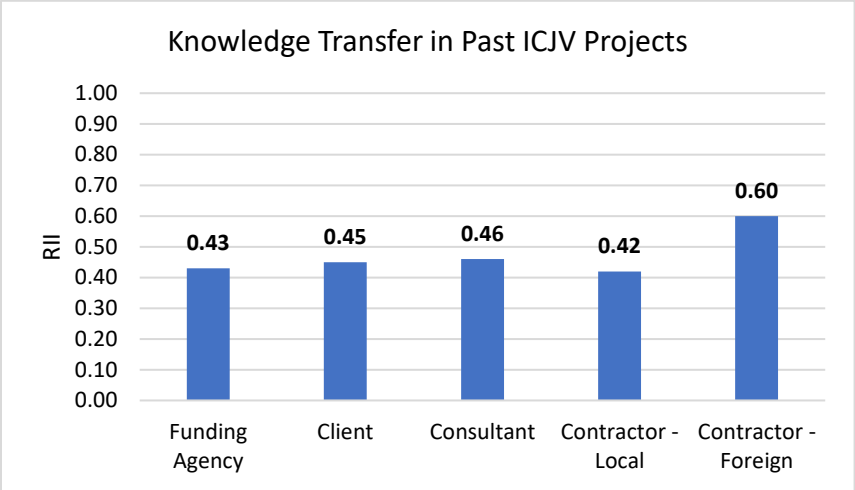

Figure 4-19: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-19, RII value for the given statement is less than 0.5 as responded by Funding Agency, Client, Consultant and Contractor - Local. The RII value of 0.60 for Contractor – Foreign, indicates that they have agreed with the statement to a certain extent compared to other parties. Overall this indicates that in past ICJV projects in the water sector, the knowledge transferring process in resource management has happened at a very low level. This has also been highlighted by the experts during the unstructured and structured interviews. The foreign construction management experts have not been much involved in the activities of transferring knowledge to the local construction staff. Most of the management decisions were taken by foreign experts and the involvement of local experts was very low. Hence both local and foreign staffs have not carried out the projects in a collaborative manner. The responsibilities were not shared equally between both parties by the JV agreement. There are similar reasons in all the other knowledge areas in which knowledge transfer has not happened or partially happened. These facts will be further discussed in the latter part of the report.

4.3.6.4 Risk Management

The questionnaire for risk management was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have used risk management practices (Identify, Analyse and Mitigate risks) in the construction projects

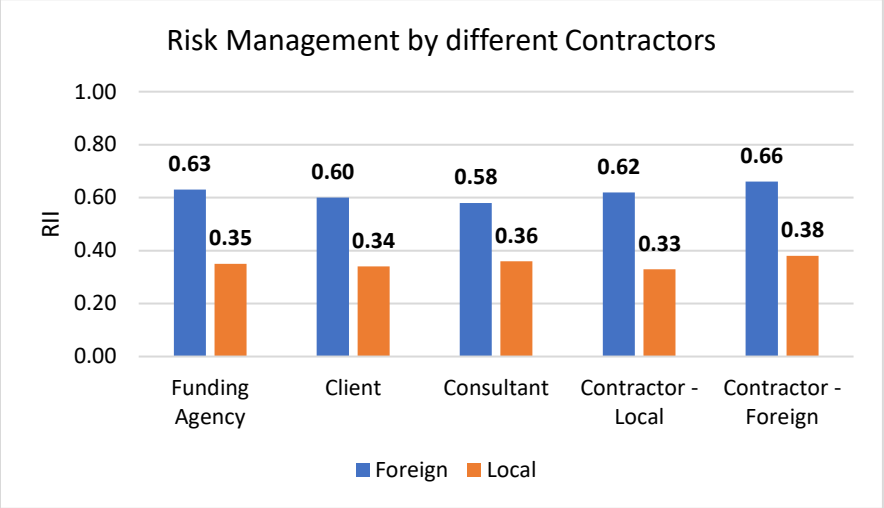

Figure 4-20: Risk Management by different Contractors

According to the above figure 4-20, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. Compared to other knowledge areas, knowledge gap is larger for risk management. It has been noted during the interviewing process, local contractors themselves have accepted that they do not have proper risk management practices in place. And also this was highlighted by the experts in the interviewing stage that none of them had sound experience with local contractors in practising risk management. In comparison, they have expressed that some foreign contractors have systems and practices in place for risk management in water sector projects.

B. Local contractors need to improve their existing knowledge and practices for proper risk management in construction projects

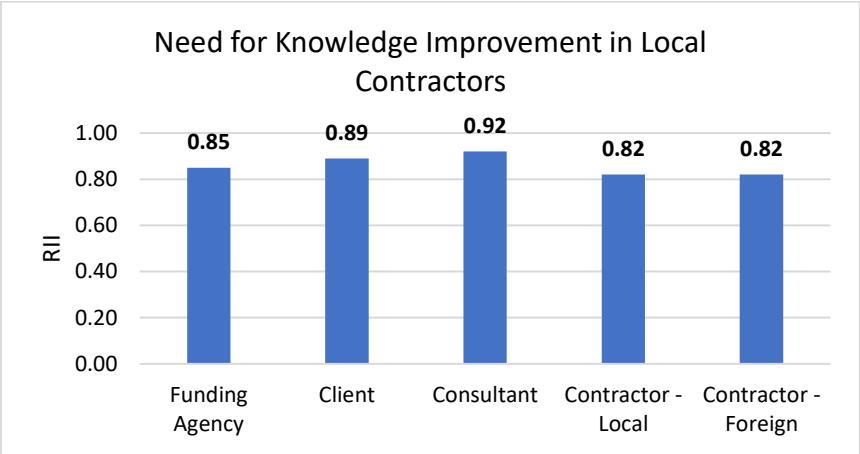

Figure 4-21: Need for knowledge improvement in local contractors

According to the above figure: 4-21, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates that local contractors desperately need to improve their knowledge and practices on behalf of proper risk management in the projects. This has been emphasised by almost all the experts at the interviewing stages, none of them have had experience with the local contractors in managing the risks. On the other hand, they have had experience with foreign contractors in managing the risks.

C. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and practices to local contractors in terms of risk management

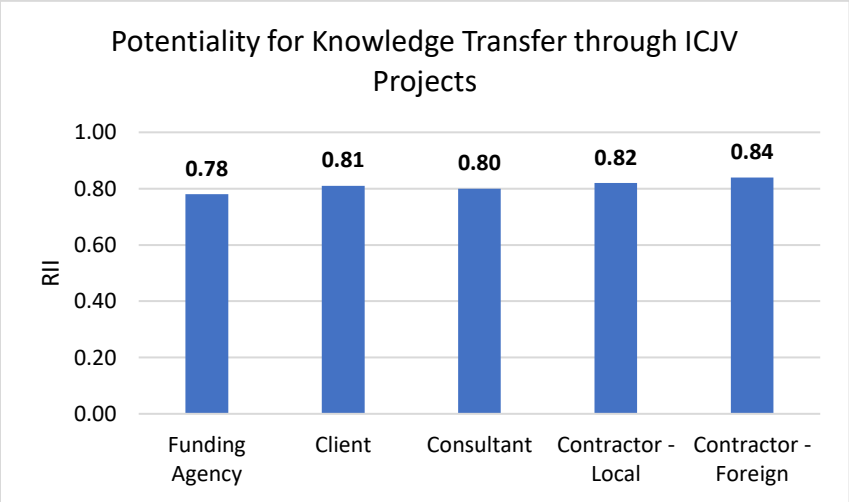

Figure 4-22: Potentiality for knowledge transfer through an ICJV

According to the above figure: 4-22, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". With the assistance of wider experience and exposure in international countries, foreign contractors have gained the knowledge and technology on risk management which can be transferred through an effective formation and implementation of ICJV. It has been revealed in structured and unstructured interviews that foreign contractors do have processes and practices for risk management.

D. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of risk management to the local firm

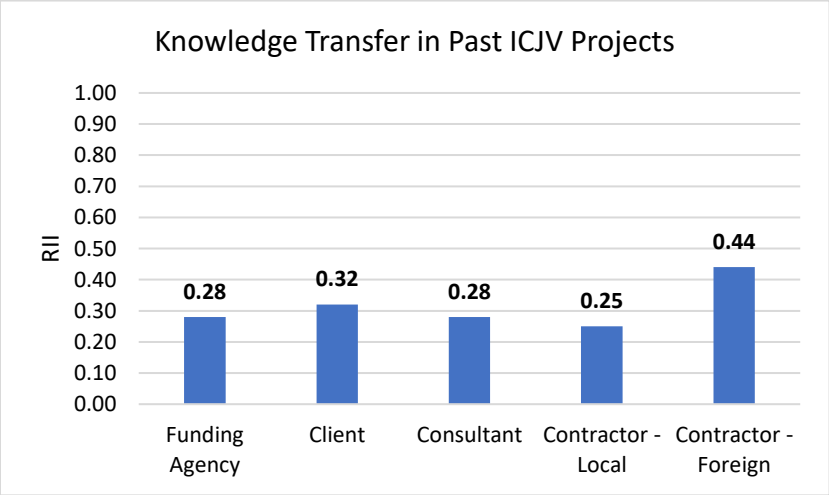

Figure 4-23: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-23, RII value for the given statement is less than 0.3 as responded by Funding Agency, Client, Consultant, Contractor – Local. The RII value for Contractor – Foreign is 0.44 indicates some knowledge transfer has happened. But the majority of parties responded against it. This indicates that in past ICJV water projects the knowledge transfer of risk management has not happened or very low. This has also been highlighted by the experts at the unstructured and structured interviews. The foreign construction management experts have not been involved in the activities of transferring the knowledge to the local construction staff. Most of the management decisions have been taken at higher levels. There are similar reasons for all the other

knowledge areas in which knowledge transfer has not happened or partially happened. These facts will be discussed in the latter part of the report.

4.3.6.5 Communication Management

The questionnaire for communication management was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have effectively and efficiently managed the communication of the construction projects (Plan, Manage and Control)

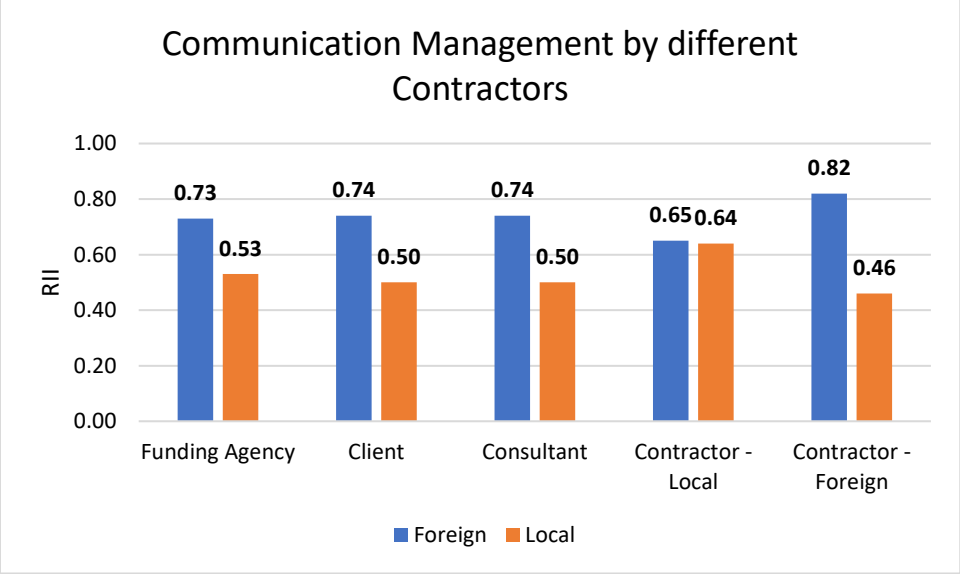

Figure 4-24: Communication Management by different Contractors

According to the above figure 4-24, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. Compared to other knowledge areas except risk management, knowledge gap is relatively higher for communication management. Hence it can be identified that there is a considerable knowledge gap between the foreign and local contractors with respect to communication management.

B. Contractors have used advanced tools and techniques (Such as Aconex, SAP, MS Sharepoint, Asana etc) for communication management in the construction projects

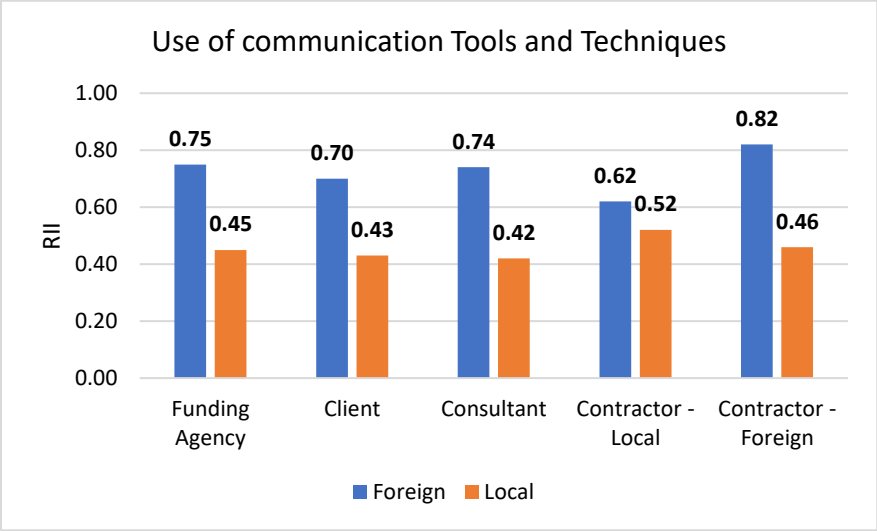

Figure 4-25: Use of Communication Tools and Techniques

As denoted in the above figure 4-25, RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This signifies there is a clear knowledge gap of using advanced tools and techniques in water sector projects. This has been expressed by the experts at the interview stages mentioning that very few local firms practised tools and techniques for effective communication management in the projects.

C. The local contractors need to improve their knowledge and practices for proper communication in the construction projects

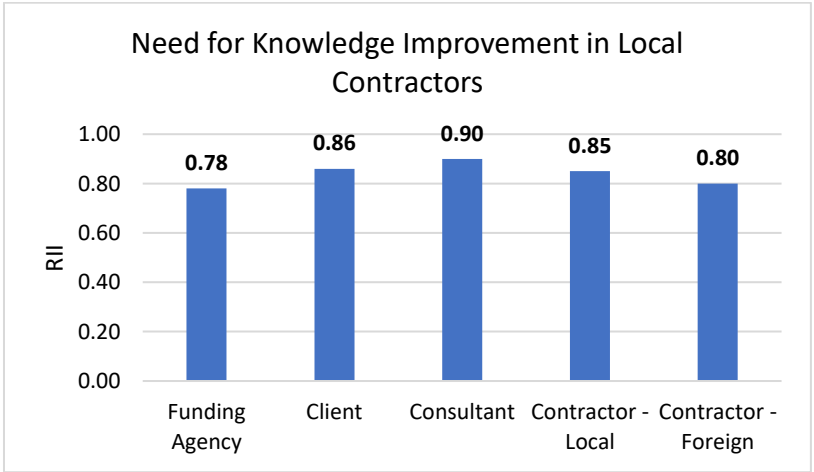

Figure 4-26: Need for knowledge improvement in local contractors

According to the above figure: 4-26, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. In water sector industry communication management is one of the weakest areas, which ultimately affects the overall performance of the project. There are many delays and loopholes in managing communications in the local water projects. This has been highlighted by the experts in the interview stages. Hence knowledge improvement is needed to upgrade the performance in the projects.

D. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of communication management

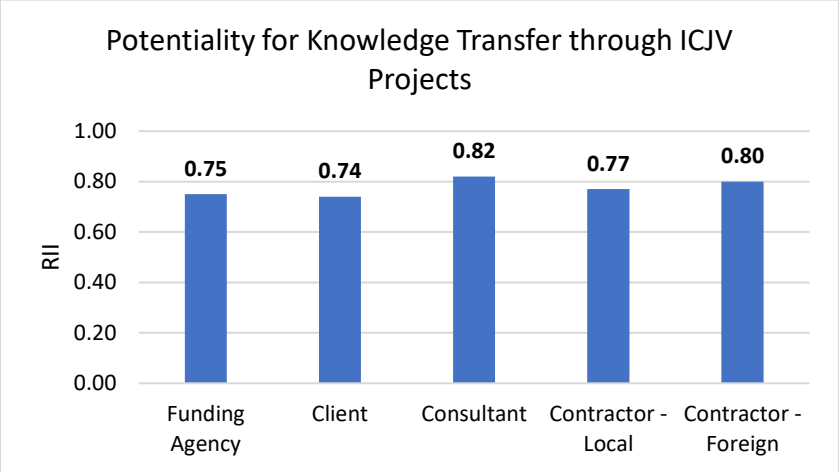

Figure 4-27: Potentiality for knowledge transfer through an ICJV

As denoted by above figure: 4-27, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When both foreign and local contractors work together in ICJV, local contractors tend to use the communication methods and practices followed by the foreign contractors and this will cause them to upgrade the knowledge of local contractors. Many foreign contractors follow the advanced tools and techniques for communication in the projects and this has increased the efficiency and performance of the projects.

E. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of communication management to the local firm

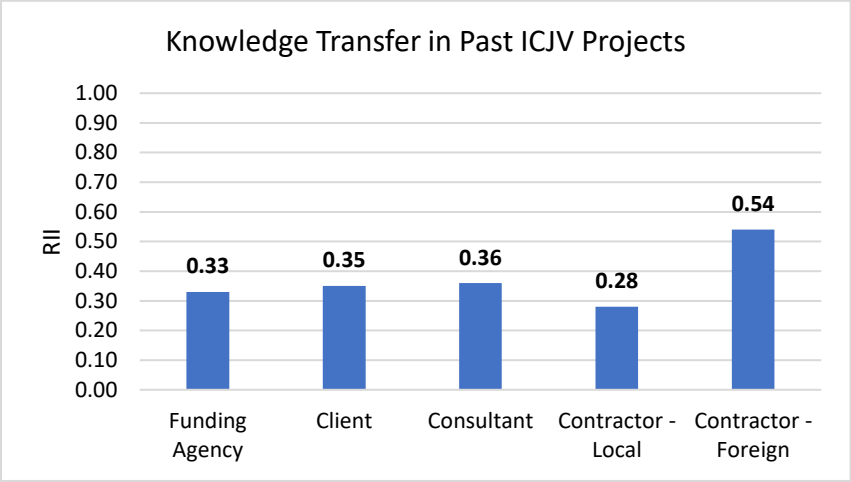

Figure 4-28: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-28, RII value for the given statement is less than 0.3 as responded by Funding Agency, Client, Consultant, Contractor – Local. The RII value for Contractor – Foreign is 0.54 indicates some knowledge transfer has happened. But the majority of parties has responded against it**.** This indicates that in past ICJV water projects the knowledge transfer of risk management has not happened or very low. This has also been highlighted by the experts at the unstructured and structured interviews. Mainly there was no collaborative approach in carrying out the construction projects. There are similar reasons for all the other knowledge areas in which knowledge transfer has not happened or partially happened. These facts will be discussed in the latter part of the report.

4.3.7 Contract Management/Contract Administration

4.3.7.1 Conditions of Contract

The questionnaire for Conditions of Contract was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have effectively monitored the contracts with reference to the Conditions of Contract (FIDIC, ENAA etc.)

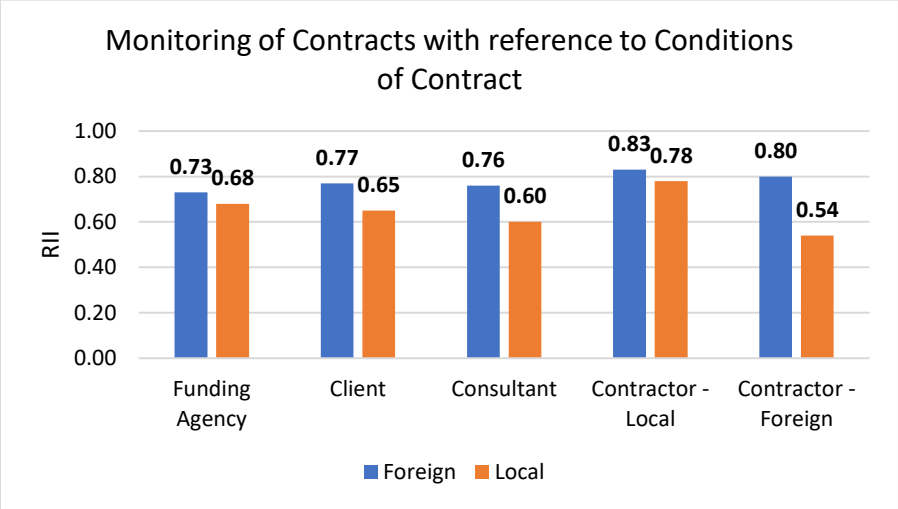

Figure 4-29: Monitoring of Contracts with reference to Conditions of Contract

According to the above figure 4-29, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. But compared to other knowledge areas the knowledge gap is less. This indicates that there is an improvement of knowledge with regard to the conditions of contract in local contractors.

B. Contractors have got experts within the organizations to handle conditions of contract (FIDIC, ENAA etc.)

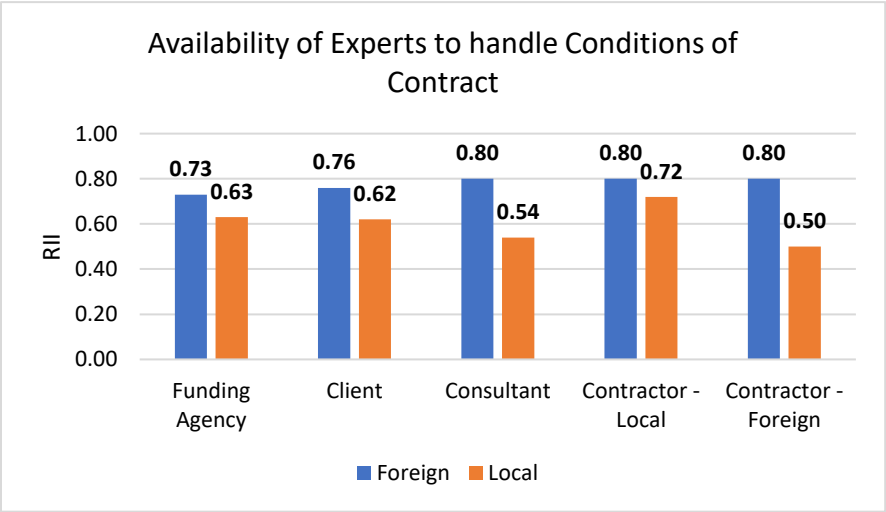

Figure 4-30: Availability of Experts

According to the above figure 4-30, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This indicates that the local water sector industry is lack of experts in handling the conditions of contract. As stated by the experts in interviews, experts in handling the contractual matters following the conditions of contract lack in the local water projects.

C. Local contractors need to improve their existing knowledge and practices to effectively monitor contracts with reference to conditions of contract

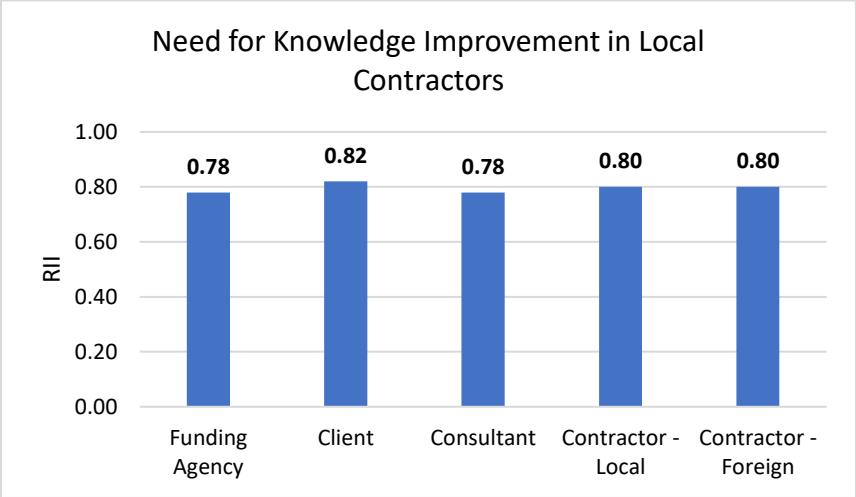

Figure 4-31: Need for knowledge improvement in local contractors

As denoted in the above figure: 4-31, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates that local contractors need to improve their knowledge and practices regarding conditions of contract in the water sector projects. It can be recognised that recently many contractors tend to upgrade their knowledge and practices for monitoring the contract conditions. Therefore compared to other knowledge areas, the knowledge gap between the local and foreign contractors is less subject to conditions of contract.

D. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in practising conditions of contract

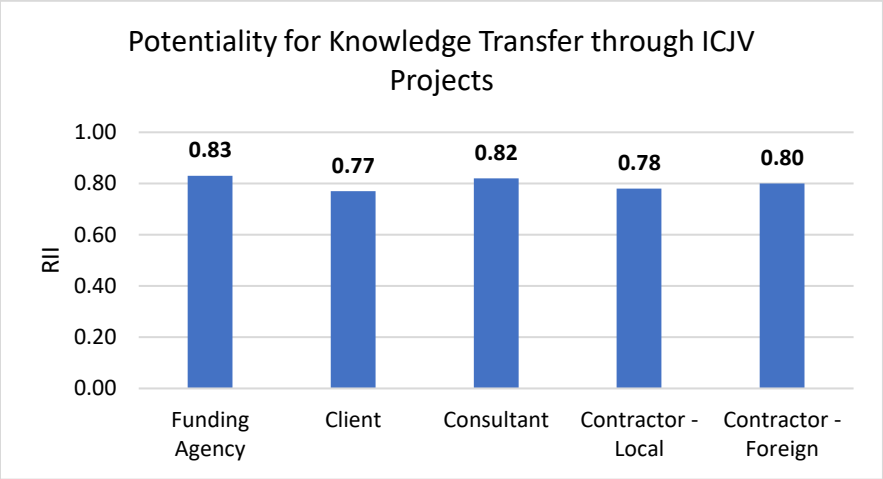

Figure 4-32: Potentiality for knowledge transfer through an ICJV

As denoted by above figure: 4-32, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer on conditions of contract could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When both foreign and local contractors work together in ICJV, locals can learn from the foreign and enhance their knowledge and skills to build the capacity in order to compete in the industry. Specially foreign contractors are experienced in handling contractual matters with reference to international standards and conditions (FIDIC, ENAA etc.), hence this knowledge can be transferred to local contractors through the effective formation of an ICJV.

E. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of conditions of contract to the local firm

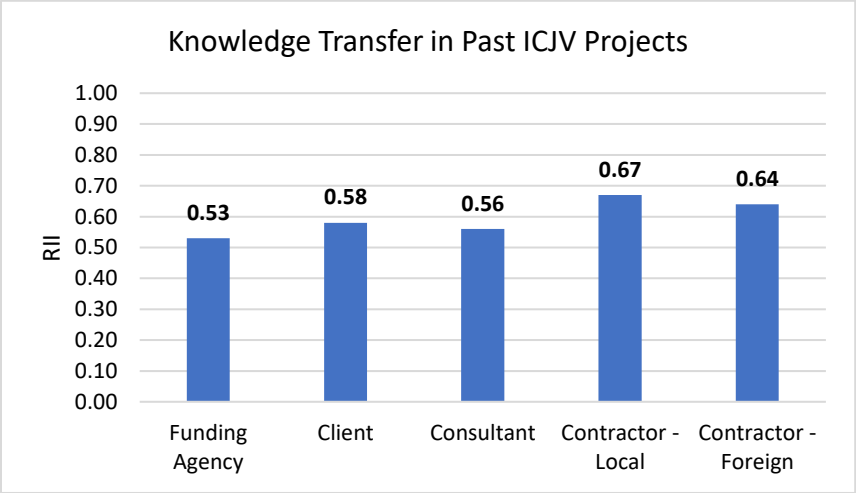

Figure 4-33: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-33, RII value for the given statement is less than 0.6 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor - Foreign. This indicates a moderate level of knowledge transfer has happened in the past ICJV water projects for the subject area of conditions of contract. This has also been highlighted by the experts at the unstructured and structured interviews. Nevertheless, considerable knowledge should be transferred to the local water sector construction industry. There are similar reasons for all the other knowledge areas, in which knowledge transfer has not happened or partially happened. These facts will be further discussed in the latter part of the report.

4.3.7.2 Claims and Variations

The questionnaire for Claims and Variations was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have got knowledge and experience to handle legitimate claims and variations in the contract

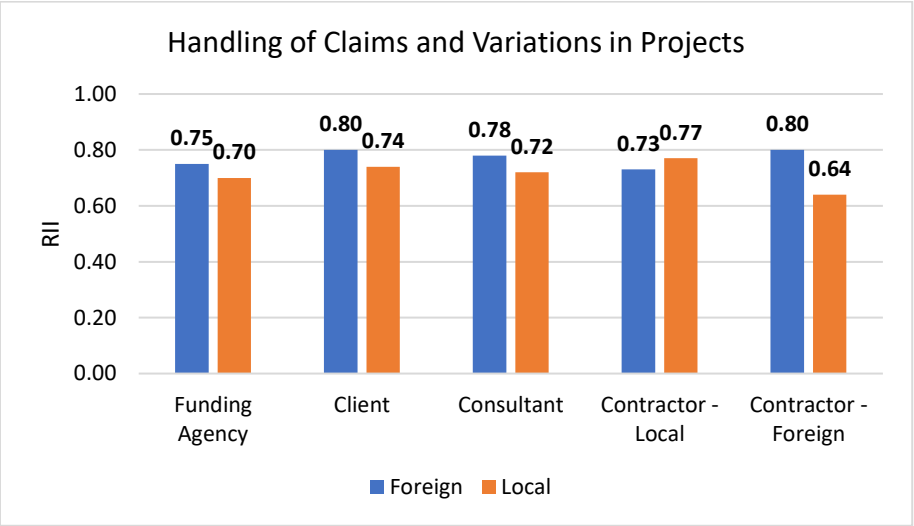

Figure 4-34: Handling Claims and Variations

According to the above figure 4-34, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant and Contractor – Foreign. But the knowledge gap is narrow compared to the other knowledge areas. Thus, it can be identified that both local and foreign contractors are nearly at an equal level of knowledge in handling claims and variations in local water projects. This has also been highlighted by the experts at the structured and unstructured interviews.

B. Contractors have got experts within the organizations to handle claims and variations in the contract

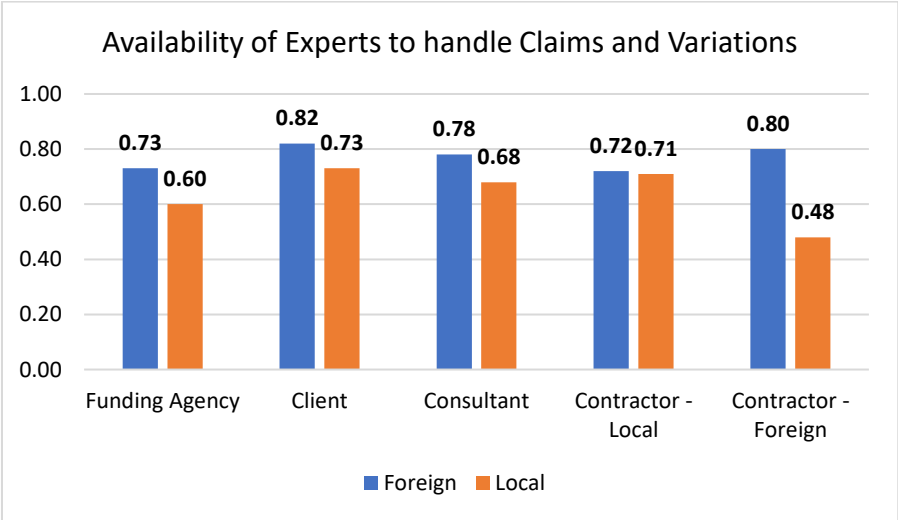

Figure 4-35: Availability of Experts

According to the above figure 4-35, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This indicates that the local water sector industry is lack of experts in handling the claims and variations. But compared to other knowledge areas the gap is less.

C. Local contractors need to improve their existing knowledge and practices in handling claims and variations

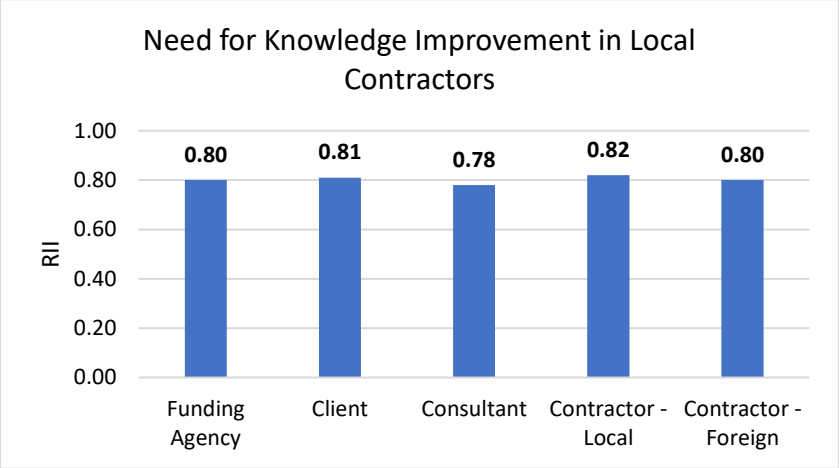

Figure 4-36: Need for knowledge improvement in local contractors

As denoted in the above figure: 4-36, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates that local contractors still need to improve their knowledge and practices for handling claims and variation in the water sector projects. It can be identified that compared to the other knowledge areas knowledge gap between the local and foreign contractors is less for the claims and variations.

D. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in handling claims and variations

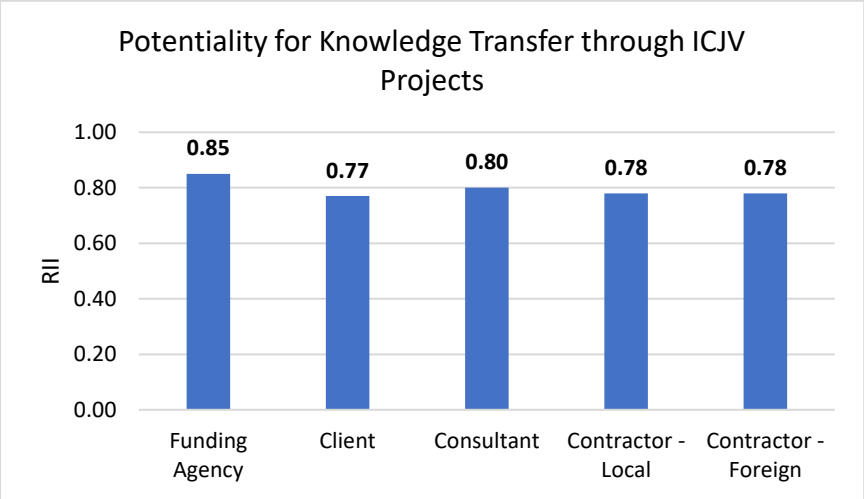

Figure 4-37: Potentiality for knowledge transfer through an ICJV

As denoted by above figure: 4-37, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer could be facilitated by the formation of ICJV between foreign and local contractors. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When both foreign and local contractors work together in ICJV, locals get the opportunity to learn from the foreign, resulting in the enhancement of their knowledge and skills.

E. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of handling claims and variations to the local firm

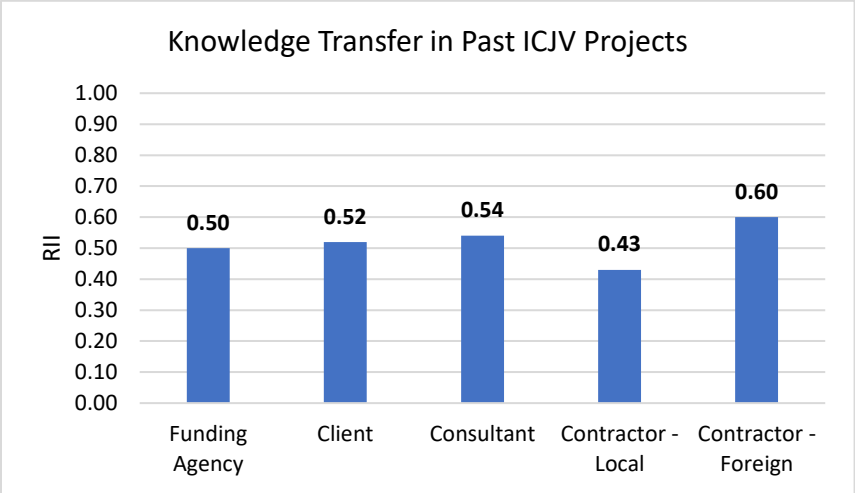

Figure 4-38: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-38, RII value for the given statement is less than 0.6 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor - Foreign. This indicates a moderate level of knowledge transfer has happened in the past ICJV water projects regarding the conditions of contract. Since there is no larger knowledge gap between the local and foreign contractors, the need for knowledge transfer is less. This has also been highlighted by the experts at the unstructured and structured interviews.

4.3.7.3 Dispute Resolution

The questionnaire for Dispute Resolution was designed and analysed in such a way to evaluate the knowledge gap between foreign and local contractors and the knowledge deficiencies in water sector construction projects. The responses given by the experts for each question have been recorded and analysed according to the Relative Important Index (RII) derived as discussed in Chapter 03.

A. Contractors have got knowledge and experience to handle disputes in the contract

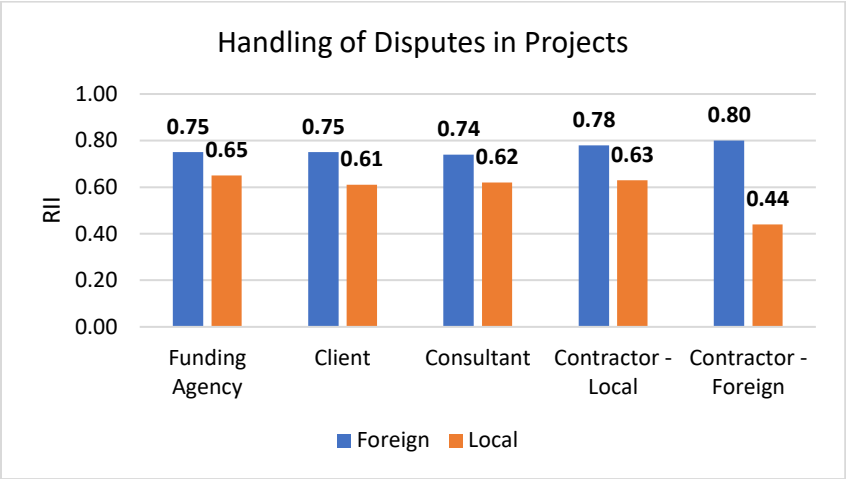

Figure 4-39: Handling of Disputes

According to the above figure 4-39, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Therefore, it is evident that a considerable knowledge gap exists between local and foreign contractors with respect to handling of disputes in water projects. This has also been highlighted by the experts at the structured and unstructured interviews.

B. Contractors have got experts within the organizations to handle disputes in the contract

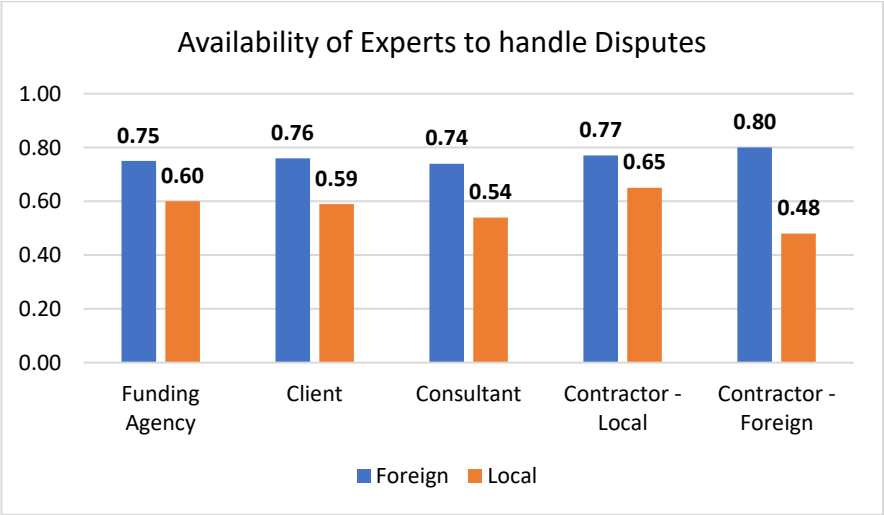

Figure 4-40: Avialability of Experts

According to the above figure 4-40, it can be observed that RII value for Foreign Contractors is above the Local Contractors as responded by Funding Agency, Client Consultant, Contractor – Local and Contractor – Foreign. Hence for all the cases, Foreign Contractors ranked 1st relative to the Local Contractors. This indicates that local water sector industry is lack of experts in handling the disputes in the contract.

C. Local contractors need to improve their existing knowledge and practices on handling disputes

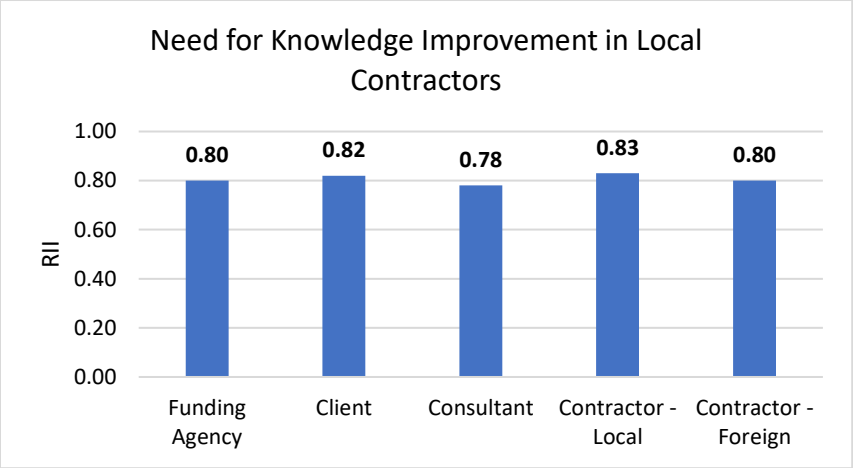

Figure 4-41: Need for knowledge improvement in local contractors

As denoted in the above figure: 4-41, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates that local contractors need to improve their knowledge and practices of handling disputes in the water sector projects. It has been expressed by the experts at the interviews that exposure of the local contractors in handling disputes is low compared to the foreign contractors. Hence, practical experience in following dispute resolution mechanisms lacks in the local contractors.

D. International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in handling disputes

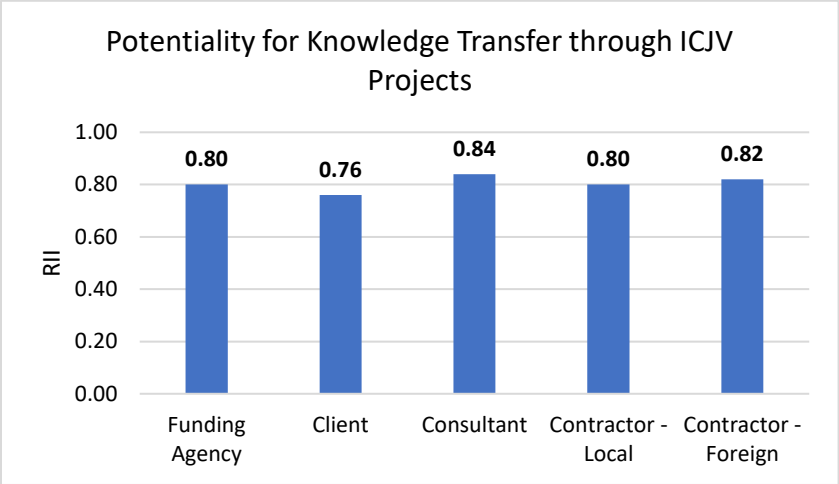

Figure 4-42: Potentiality for knowledge transfer through an ICJV

As denoted by above figure: 4-42, RII value for the given statement is more than 0.7 as responded by Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign. This indicates all the parties have accepted that the knowledge transfer of dispute resolution can be facilitated through the formation of a Foreign and Local Joint Venture (ICJV) in water sector projects. This further validates the findings of (Bandara 2004), "When local and foreign contractors work together, it is the most appropriate method and easiest way of knowledge and technology transfer". When both foreign and local contractors work together in ICJV, foreign contractors share the knowledge and experience with the local partner, hence ultimately the local construction industry will absorb the required knowledge to compete in the global industry.

E. In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of disputes resolution to the local firm

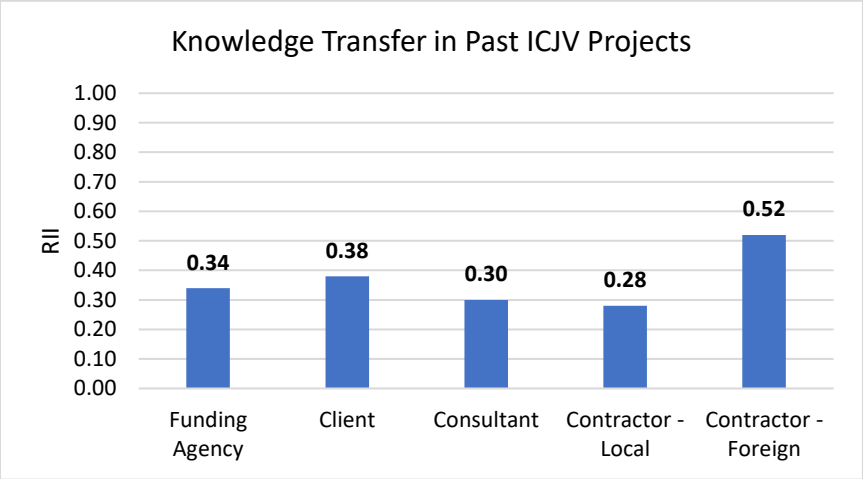

Figure 4-43: Knowledge Transfer in past ICJV Projects

According to the above figure: 4-43, RII value for the given statement is less than 0.4 as responded by Funding Agency, Client, Consultant, Contractor – Local. The RII value for Contractor – Foreign is 0.52 indicates some knowledge transfer has happened. But the majority of parties responded against it**.** This indicates that in past ICJV water projects the knowledge transfer of dispute resolution has not happened and there were less practical opportunities for knowledge to be get transferred. This has also been highlighted by the experts at the unstructured and structured interviews. There are similar reasons for all the other knowledge areas in which knowledge transfer has not happened or partially happened. These facts will be further discussed in the latter part of the report.

4.3.8 Overall Evaluation of Knowledge of Contractors

The respondents were requested to answer the degree of knowledge of both local and foreign contractors on a scale of agree 1 to 3. The responses were analysed using the Relative Important Index (RII) of each knowledge area and based on the results each contractor has evaluated. The evaluation was done considering the responses given by all the relevant parties to contract namely Funding Agency, Client, Consultant, Contractor – Local and Contractor – Foreign.

4.3.8.1 Funding Agency

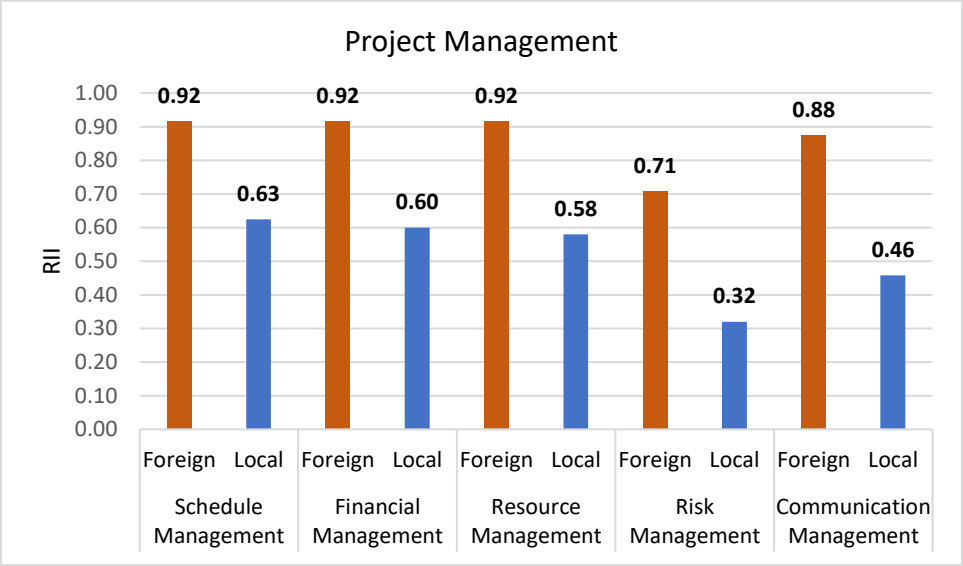

Figure 4-44: RII for Project Management as responded by Funding Agency

As per the responses given by experts in Funding Agencies and according to the above figure 4-44, the Relative Important Indexes for all the Project Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to project management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Communication Management, Risk Management and Resource Management.

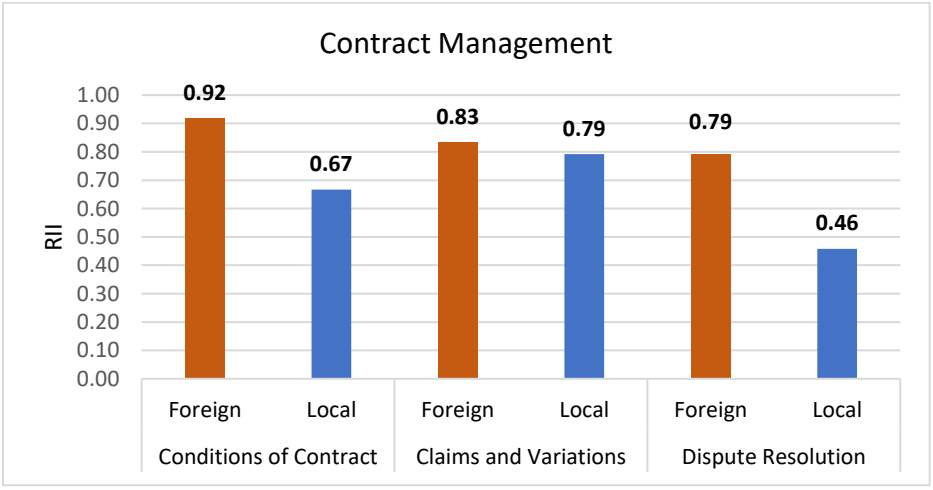

Figure 4-45: RII for Contract Management as responded by Funding Agency

As per the responses given by experts in Funding Agencies and according to the above figure 4-45, the Relative Important Indexes for all the Contract Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to contract management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Dispute Resolution and Conditions of Contract.

4.3.8.2 Client

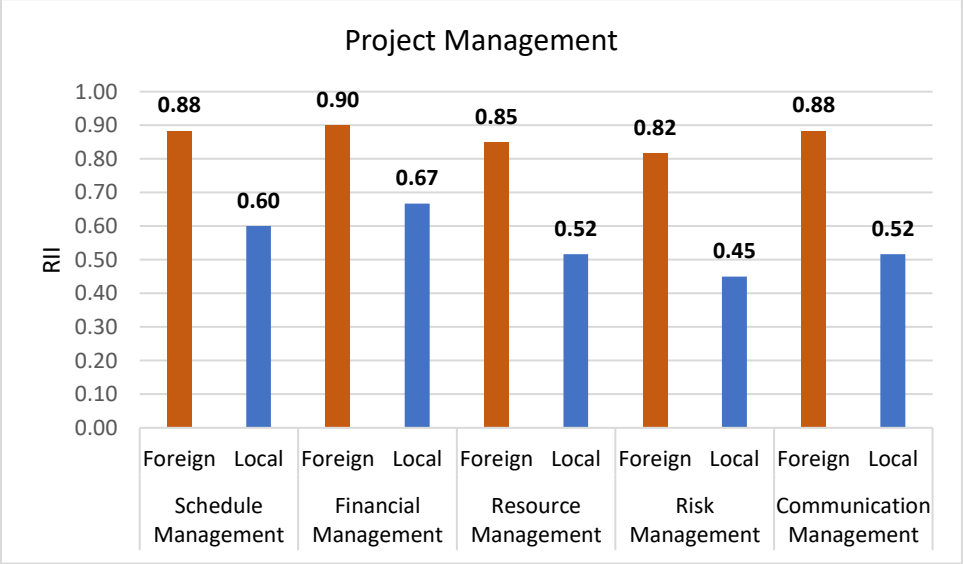

Figure 4-46: RII for Project Management as responded by Client

As per the responses given by experts in Client and according to the above figure 4-46, the Relative Important Indexes for all the Project Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to project management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Risk Management, Communication Management and Resource Management.

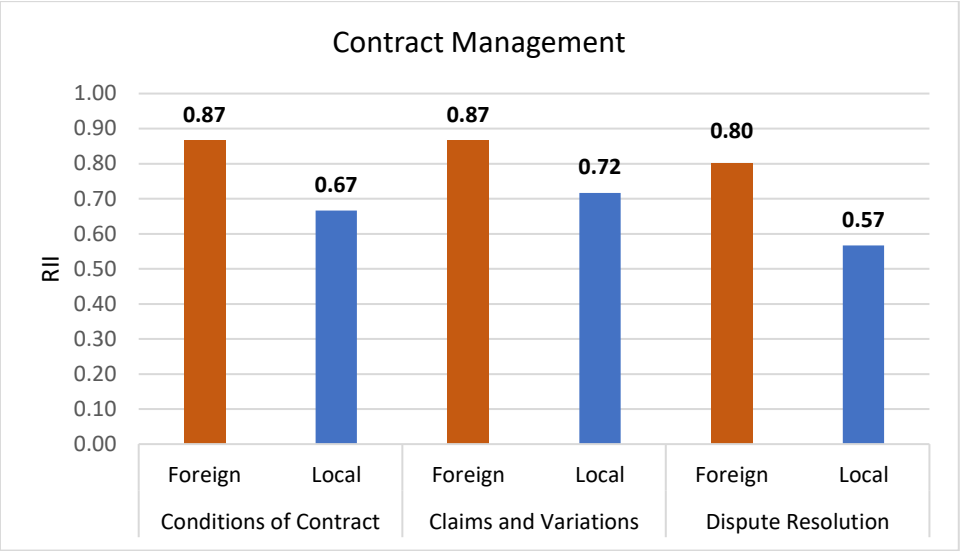

Figure 4-47: RII for Contract Management as responded by Client

As per the responses given by experts in Client and according to the above figure 4-47, the Relative Important Indexes for all the Contract Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to contract management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Dispute Resolution and Conditions of Contract.

4.3.8.3 Consultant

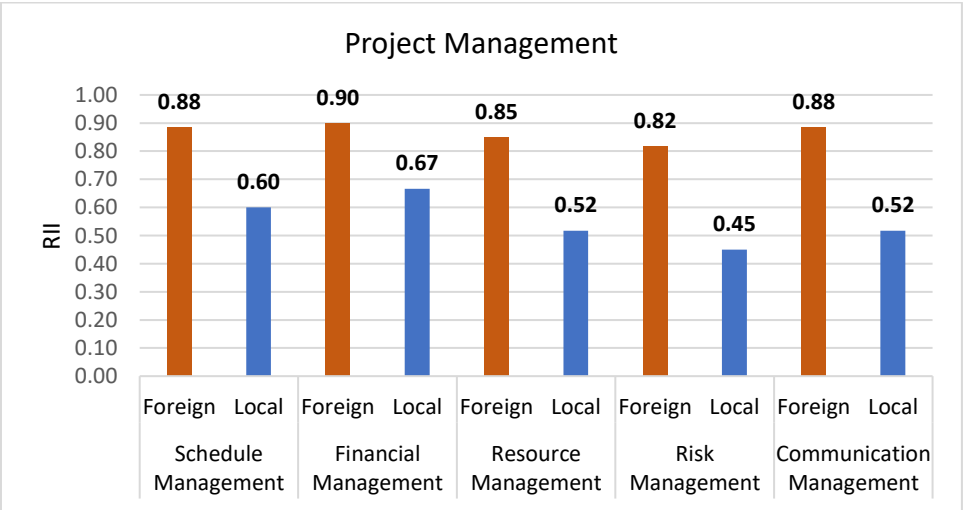

Figure 4-48: RII for Project Management as responded by Consultant

As per the responses given by experts of Consultant and according to the above figure 4-48, the Relative Important Indexes for all the Project Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to project management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Risk Management, Communication Management and Resource Management.

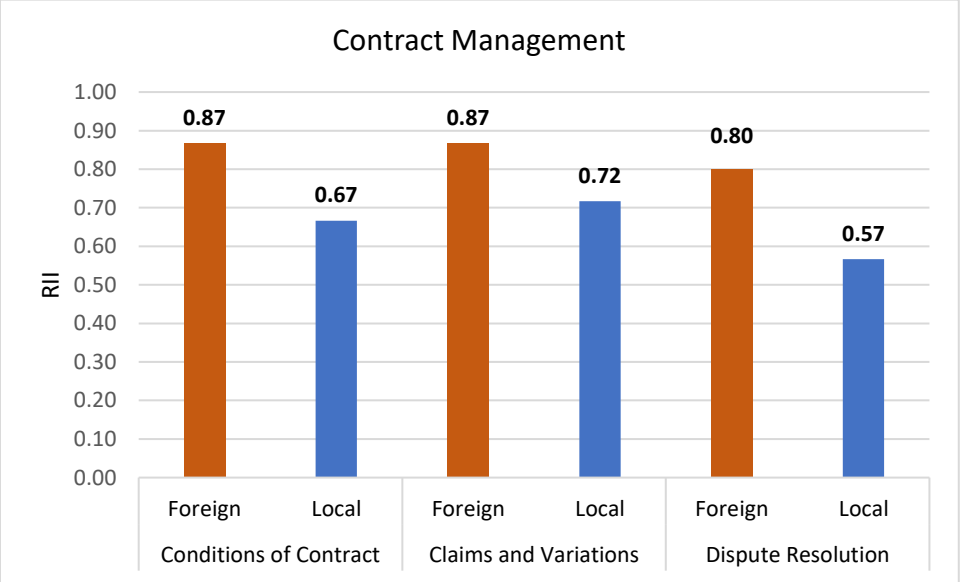

Figure 4-49: RII for Contract Management as responded by Consultant

As per the responses given by experts of Consultant and according to the above figure 4-49, the Relative Important Indexes for all the Contract Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. From the above analysed details, it can be concluded that for all the knowledge areas, the level of knowledge of foreign contractors is higher than the local contractors. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to contract management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Dispute Resolution and Conditions of Contract.

4.3.8.4 Contractor - Local

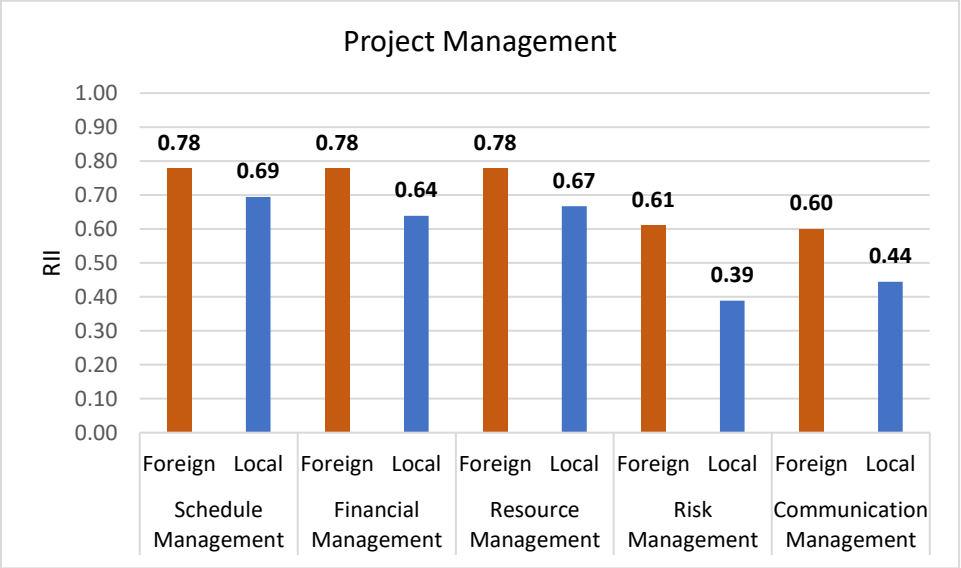

Figure 4-50: RII for Project Management as responded by Contractor - Local

As per the responses given by experts of Contractor - Local and according to the above figure 4-50, the Relative Important Indexes for all the Project Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. Thus the local contractors themselves accepted that the existing knowledge deficiencies in the local water sector construction industry. It is observed in some cases local contractors believe their knowledge is equal or better than the foreign contractors, which shows the wrong perception. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Risk Management, Communication Management and Financial Management.

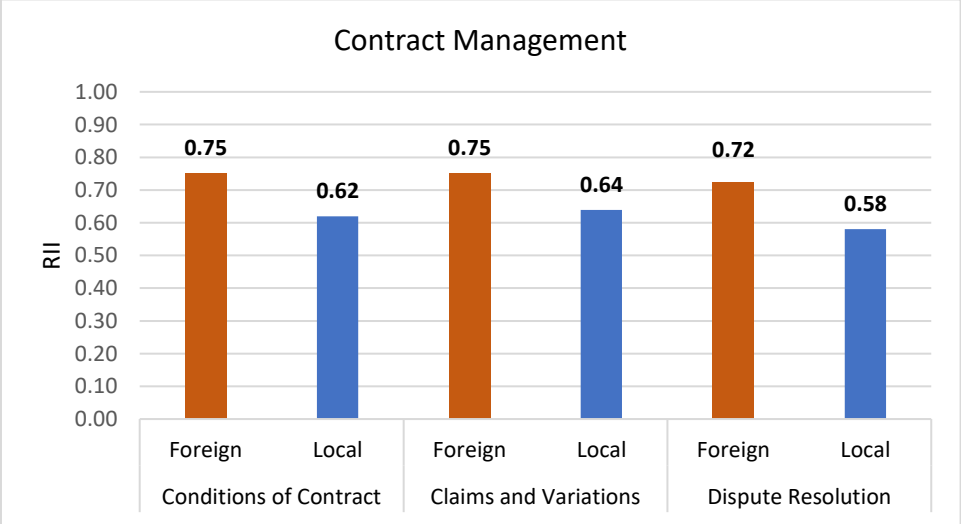

Figure 4-51: RII for Contract Management as responded by Contractor - Local

As per the responses given by experts of Contractor - Local and according to the above figure 4-51, the Relative Important Indexes for all the Contract Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. Thus the local contractors themselves accepted that the existing knowledge deficiencies in the local water sector construction industry. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to contract management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Dispute Resolution and Conditions of Contract.

4.3.8.5 Contractor - Foreign

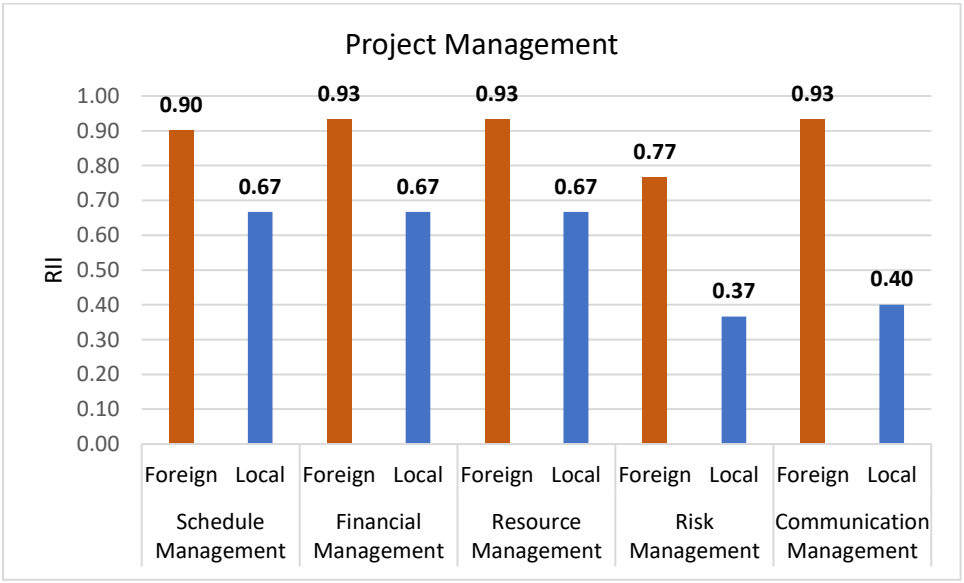

Figure 4-52: RII for Project Management as responded by Contractor - Foreign

As per the responses given by experts of Contractor - Foreign and according to the above figure 4-52, the Relative Important Indexes for all the Project Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Communication Management, Risk Management and Resource Management.

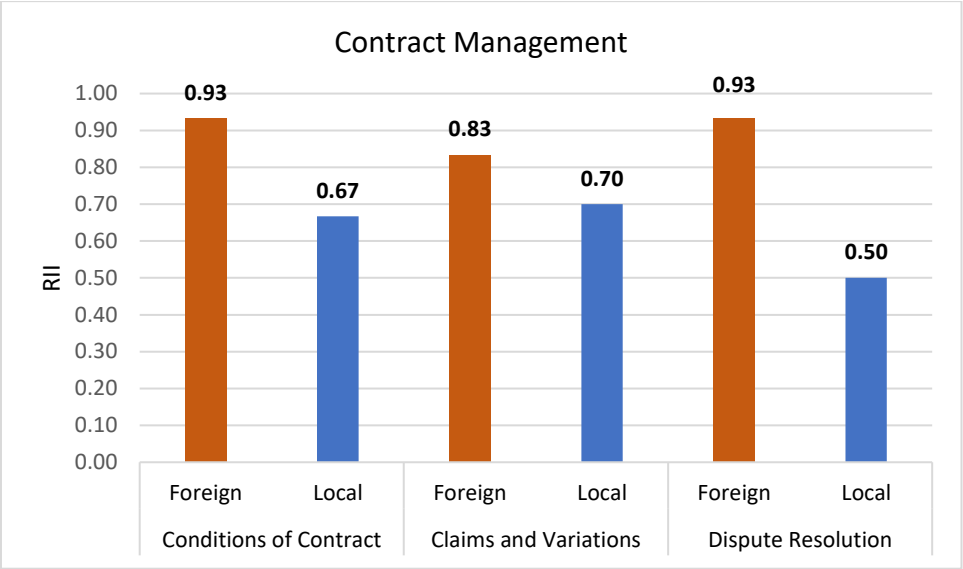

Figure 4-53: RII for Contract Managemet as responded by Contractor - Foreign

As per the responses given by experts of Contractor - Local and according to the above figure 4-51, the Relative Important Indexes for all the Contract Management knowledge areas for foreign contractors are above the value of local contractors. Hence the foreign contractors ranked 1st for all the considered cases. This indicates that there is a clear knowledge gap between foreign and local contractors with respect to contract management in the water sector construction projects. As per the analysis, it is revealed that the largest knowledge gap encountered in the areas of Dispute Resolution and Conditions of Contract.

4.4 Barriers for Knowledge Transfer in ICJV

Considering the responses given by the experts in the interview sessions (structured and unstructured) the following points can be highlighted in which knowledge transfer has not/or partially happened in present and past ICJV projects. Hence one of the objectives of forming ICJV (knowledge transfer) is not fulfilled. This is applicable for all the knowledge areas as discussed in the report.

- In most of the ICJV construction projects in water sector, foreign and local firms form a joint venture (JV) in order to get the advantage in competitive bidding process by claiming the experience and qualifications of the foreign firm. Because most of the local companies cannot comply with the technical and financial requirements (large scale requirements) as per the bidding documents.

- Only the local partner of the JV physically participate for the contract implementation. i.e. foreign partner of the JV is not available for implementation and responsibility is fully transferred to local partner.
- Employers have not monitored the JV agreement, whether the contractors adhere to the conditions in every stage of the contract. i.e. Whether they follow the relevant percentage (%) of the work share, responsibilities etc.
- In some JV projects, local contractors involvement for contract management is minimal. As per the JV agreement, tasks and responsibilities of the contract are shared between local and foreign partner, but the responsibility to handle major tasks such as project management, contract management, financial management etc. are vested on the foreign partner. Hence both partners do not involve in the contract implementation process in an integrative manner.
- The local partner does not have the required absorption capacity to receive the knowledge from the foreign partner.
- The foreign partner is not willing to transfer the knowledge to the local partner. Since knowledge and technology transfer is not a part of the contract obligations, the foreign partner is not willing to transfer the same due to no incentive or benefit received.
- Knowledge and Technology can be received from the foreign, but there should be a will and local companies should be ready to learn from the foreigners. Most of the locals hold the idea that they are as good as foreigners, which is not acceptable.
- Because of communication/language barrier of the local people, knowledge transfer has become more difficult.

4.5 Enablers for Knowledge Transfer in ICJV

- The performance of the contract highly depends on the quality of the Project Manager. In that case, appointing a Project Manager from a foreign country with thorough knowledge and experience would work better.
- Foreign Project Managers are much capable of analysing and interpreting the Conditions of the Contract. If the local personals seconded to such PMs, the knowledge transfer process would be more effective.
- In the Bidding document suggests to insert a clause: If the contract is awarded to the JV, both partners should implement it collaboratively. The staffing should

be as per the agreement and work scope. The key management personals should participate from the foreign partner.

- As per the current industry, ICJVs do not effectively transfer the intended knowledge to the local partner. Hence the Government, Donor agencies and other agencies should work towards the goal of achieving this.
- There should be a government policy to get the knowledge and technology transferred from foreign countries, in order to develop the construction industry in Sri Lanka.
- BOQs should provide the margin for contractors to propose newer technologies and knowledge transferring opportunities (D&B contracts etc.).
- Performance-based payments will encourage the contractors to perform to a higher level and achieve the targets (hence favour the knowledge transfer). Time, Cost and Quality targets should be given and incentives will be given according to the performance level.

4.6 Chapter Summary

This chapter presented a detailed analysis of knowledge factors that contribute to the knowledge transfer and effectiveness of the knowledge transfer under ICJVs in local water sector construction projects. The analysis was done qualitatively and quantitatively. Under qualitative analysis, the data gathered from unstructured and structured interviews were analysed. Under the quantitative analysis data gathered from the questionnaire survey was analysed. It was found that local contractors are lack all the considered knowledge areas of Project Management (Schedule Management, Finance Management, Resource Management, Risk Management and Communication Management) and Contract Management (Conditions of Contract, Claims and Variations and Dispute Resolution) in the local water sector construction projects compared to that in foreign contractors. As per the data analysed through the quantitative process and considering the different responses given by Funding Agency, Client, Consultant and Contractor – Foreign highest knowledge gap in Project Management is identified in the areas of Communication Management, Risk Management and Resource Management. It is comparatively less for Schedule Management and Financial Management. As responded by contractor – local highest knowledge gap identified in the areas of Risk Management, Communication Management and Financial Management. Furthermore, the analysis of data for Contract

Management illustrates that the highest knowledge gap exists for Dispute Resolution and Conditions of Contract as responded by all parties. It is comparatively less for claims and variations. As per the responses given by the Contractor – local, it was observed a misperception that they perform equally and/or better than foreign contractors. This was identified as other parties responded against it.

It was revealed that these knowledge gaps can be overcome by potential knowledge transfer through the formation of ICJVs with foreign contractors in local water projects. Further knowledge transfer with respect to the considered knowledge areas has not happened or relatively very low in past ICJVs in water sector projects. This is mainly due to the following reasons.

- Many ICJVs have formed only with the intention of claiming the technical and financial experience of the foreign partner to obtain the advantage in competitive bidding process (As per the procurement regulations, if it is a JV one partner's experience would be sufficient to qualify). Owing to this, at the implementation stage foreign partner is not available for contract execution and all the responsibilities are transferred to the local partner.
- The existing JV agreements are not being properly reviewed by the client at the time of bidding, awarding and implementation. Hence responsibilities are not followed by the contractors as agreed in the JV agreement. Further, it has been revealed that responsibilities are not properly shared between both partners in the JV and in some JV agreements no clause could be found to cover the responsibilities of project management and contract management areas.
- Most of the management responsibilities (Project Management, Contract Management etc.) are solely vested on the foreign partner. But there is no willingness to transfer the knowledge to the local partner. As per the JV agreement and contract agreement no specific clause included for knowledge and technology transfer.
- High quality contractors with rich knowledge and technology base have not participated in the water sector construction projects. This is mainly due to the lower financial capacity of the projects. Hence there is no proper knowledge transfer takes place.

- There is no government policy or a guideline to enhance the knowledge and technology transfer in the local construction industry. Specially for the tacit knowledge transfer.
- The absorption capacity of the local contractors is less, hence the required knowledge and technology transfer does not happen very effectively.

The study of secondary data sources revealed that no contractual provisions could be found in contract documents of FIDIC, ICTAD with regard to the knowledge and technology transfer under the ICJV in construction projects.

CHAPTER 05: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Many past studies have recommended that technology and knowledge can be transferred by forming Joint Ventures between foreign and local construction firms. But as per the literature, little effort has put to evaluate the knowledge and technology transfer under the ICJVs in the local construction industry. This study has closely examined the individual knowledge capacities, the knowledge gap between the foreign and local contractors, knowledge transfer and factors influencing the knowledge transfer under ICJV projects with regard to the Project Management and Contract Management knowledge areas in the local water sector construction projects.

Based on the research findings following conclusions can be made.

1. The study has revealed there is a considerable knowledge gap between the local and foreign contractors in all the considered knowledge areas of project management and contract management in the water sector construction projects.
2. As per the data analysed through the quantitative process and as responded by Funding Agency, Client, Consultant and Contractor - Foreign, the highest knowledge gap in Project Management was identified in the areas of Communication Management, Risk Management and Resource Management. It was comparatively less for Schedule Management and Financial Management. As responded by Contractor – Local highest knowledge gap identified in the areas of Risk Management, Communication Management and Financial Management.
3. Furthermore, as per the data analysed through the quantitative process and as responded by Funding Agency, Client, Consultant, Contractor – Foreign and Contractor – Local for Contract Management illustrated that the highest knowledge gap exists for Dispute Resolution and Conditions of Contract. It was comparatively less for claims and variations.
4. The qualitative and quantitative analysis provided that for all the knowledge areas local contractors need to improve their knowledge for Project Management and Contract Management.
5. As per the data analysed through the qualitative and quantitative process, it was identified that the knowledge gap can be narrowed by transferring the required

knowledge through the effective formation of an ICJV. This has also been highlighted in the literature findings by the previous researchers. In the current water sector industry, the ICJVs are not formed with the intention of knowledge and technology transfer. Hence existing ICJVs are not effective in terms of knowledge transference to the local water construction industry.

6. Additionally, it has been revealed that the knowledge transfer in past ICJV projects in water sector projects was very low. This is mainly due to the absence of foreign contractor during the contract implementation, JV agreement has not been properly followed by the contractors, neither monitored by the consultants/clients, most of the management responsibilities are solely vested on the foreign partner, No terms and conditions related to knowledge and knowledge transfer can be observed in the ICJV agreement and there is no guideline or policy in the government to enhance the knowledge transference through ICJVs to the local construction industry.

5.2 Recommendations

This research has aimed to assess the individual knowledge capacities, knowledge gap between the local and foreign contractors and how to bridge the knowledge gap by forming effective ICJVs with local and foreign contractors. The research has identified the enablers and barriers for knowledge transference through forming ICJVs, considering the experience in the local water sector projects. It is an evident fact that the current JV mechanism should be amended for the knowledge transfer process to be effective. The following recommendations can be made to fill the knowledge gaps through the effective formation and implementation of ICJVs in the local water sector construction industry.

- The existing JV agreement shall be drafted in a way that both partners of the JV share the responsibilities of the contract collaboratively. In the present nature, there is no standard template for JV agreement and contractors used to have self-preparatory templates. Therefore, it is necessary to have a standard template including all the requirements and this shall be monitored by a central body of the government (CIDA, DRC etc.).
- There is no legislative facility to enforce the conditions stipulated in the JV agreement into practice. The government must bring laws pertaining to ICJV agreement, knowledge and technology transfer that the local construction

industry will be benefited through such an arrangement. This has also been identified by Purangedara (2007), “Insufficient legislation facilitating technology transfer enabling to establish required clauses at the signing of agreements”.

- The bidding documents and contract agreements shall stipulate contractual clauses if the contract is a Joint Venture, both partners qualification shall be evaluated and at the time of contract implementation, both partners should participate for contract execution to ensure that the responsibilities will be shared as per the JV agreement.
- New contractual clauses shall be introduced in the bidding document and conditions of contract document, where knowledge and technology transfer is a part of the contractors' responsibilities to the contract and it shall be evaluated at the contract completion as a success factor. Hence, this will act as a performance evaluation tool. The contractors shall submit the methodology of knowledge and technology transfer with the bid document and the employer shall monitor the process based on that. In this context, the party who transfers the knowledge and technology would receive an incentive after detailed evaluation at the completion.
- The client will have to monitor the JV agreement at the time of bidding, awarding and during the contract implementation whether both JV contractors (Foreign and Local) follow the conditions and requirements as agreed.
- There should be a clause in the contract agreement that, the key management personals shall participate from the foreign contractor and both local and foreign shall be having a mix of management experts in the project team.
- The government should introduce policies with regard to knowledge and technology transfer through the formation of ICJVs. In recent past, the government imposed a condition as a budgetary proposal that local contractors should form Joint Ventures with foreign contractors when bidding for local contracts. The intention behind this proposal was to get the knowledge and technology transferred to the local construction industry.
- Donor funding agencies and other agencies should work towards achieving the objective of knowledge and technology transfer. At the project formulation stages also, the documents shall be prepared to favour the conditions of

knowledge transfer. The project environment would promote the contractors to transfer the intended knowledge to the local contractors.

- The BOQs should include a provision to propose the knowledge and technology transferring methodology by the contractors. In this context Design and Build (D&B) contracts are most suitable for the knowledge transferring environment.
- Performance-based payments will encourage the contractors to perform to a higher level and to achieve the targets. Hence the knowledge transference will be enhanced by the inclusion of experts.

5.3 Recommendations for Further Study

This study has been focused on eight major knowledge areas in Project and Contract Management identified by expert's opinion and past literature. There can be other areas which will have a knowledge gap between local and foreign contractors in water sector construction projects. Those areas have not been highlighted in this study. The scope of this study is limited to water sector construction projects only. This can be expanded to other civil construction industries such as roads, buildings, irrigation etc. To provide better solutions, all these sectors should be studied and analysed. Following topics can be proposed for future researchers.

- Knowledge Transfer of Joint Venture Contractors in Foreign Funded Projects in other construction sectors
- Case Studies on actual Joint Venture Construction Projects done in past

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APPENDIXES

Appendix 01: Structured Interview Questionnaire

Appendix 02: Questionnaire

Appendix 01: Structured Interview Questionnaire

Questionnaire on Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Sector Construction Projects

The study is being conducted by Eng. M.S. Jayalath, a final year student of Masters in Construction Project Management in Faculty of Engineering, University of Moratuwa. This questionnaire survey is based on **Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Sector Construction Projects**. This questionnaire will take you around 30 minutes. The output of this study is intended for educational purpose only, and not for any commercial purposes.

Part 01: Background of Professionals and Working Experience

Organization :…….

Designation :…….

Educational Background : …….

No of Years of Experience : …….

Email :…….

Date & Time :…….

1. Type of Employment (Please tick the relevant box)

☐ Client ☐ Consultant ☐ Contractor ☐ Funding Agency

☐ Other

2. If you select as Contractor in above (Q1), please tick the relevant box below

☐ Local Contractor ☐ Foreign Contractor ☐ NA

Please answer the following questions according to your experience in water sector construction projects.

Part 02: Questionnaires related to relevant Knowledge areas

1. Project Management

1.1 Schedule Management

1. Did the local/foreign contractors achieve the schedule deadlines as prescribed in the contract?

……

……

……

2. Whether local/foreign contractors have got the required knowledge and experience for plan, implement, monitor and control the schedule as prescribed in the contract?

……

……

……

3. As the local firm in a JV, whether there is a knowledge transfer in terms of schedule management to the local firm?

……

……

……

4. What are the knowledge deficiencies in the local construction industry in terms of schedule management?

……

……

……

5. Any other comments/suggestions

……

……

……

1.2 Financial Management

1. How effective the local/foreign contractors in managing the finances (cash flow, profitability, arranging finances etc.) in the water sector projects?

……

……

……

2. Did local/foreign contractors achieve the cost performance as prescribed in the contract?

……

……

……

3. Whether local/foreign contractors have got the required knowledge and experience in managing the finances?

……

……

……

4. What are the knowledge deficiencies in the local/foreign contractors in terms in managing the finances?

……

……

……

5. You as the local firm in a JV, whether there is a knowledge transfer in terms of financial management to the local firm?

……

……

……

6. Any other comments/suggestions

……

……

……

1.3 Resource Management

1. How effective local/foreign construction firms in managing the resources (equipment, materials, HR) in the water sector projects?

……

……

……

2. Whether local/foreign contractors have got the required knowledge and experience in managing the resources?

……

……

……

3. What are the knowledge deficiencies identified in the local/foreign firms in resource (equipment, materials, HR) management?

……

……

……

4. As the local firm in a JV, whether there is a knowledge transfer in terms of resource management to the local firm?

……

……

……

5. Any other comments/suggestions?

……

……

……

1.4. Risk Management

1. Whether the construction industry related risks are being managed by local/foreign firms? If yes, how? If no, why?

……

……

……

2. How the following risks are being managed by local/foreign firms in water sector projects?

- **Country Level Risks** (Approval and permit, Change in law, Justice Reinforcement, Government influence on disputes, Corruption, Expropriation, Quota allocation, Political instability, Government policies, Cultural differences, Environmental protection, Public image, Force majeure)

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- **Market Level Risks** (Human resource, Local partner's creditworthiness, corporate fraud, Termination of Joint Venture (JV), Foreign exchange and convertibility, Inflation and interest rates, Market demand, Competition)

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- **Project Level Risks** (Cost overrun, improper design, Low construction productivity, Site safety, improper quality control, improper project management, Intellectual property protection)

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……

3. What are the knowledge deficiencies identified in terms of risk management in the local firms?

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……

……

4. You as the local firm in a JV, whether there is a knowledge transfer in terms of risk management to the local firm?

……

……

……

5. Any other comments/suggestions

……

……

……

1.5 Communication Management

1. How effective in managing the communications by local/foreign construction firms in water sector projects?

……

……

……

2. Do local/foreign firms use the advanced techniques (Aconex, SAP, MS SharePoint etc.) for communication management in the water sector projects?

……

……

……

3. Whether local/foreign contractors have got the required knowledge and experience in handling the communications in the projects?

……

……

……

4. As the local firm in a JV, whether there is a knowledge transfer in terms of communication management to the local firm?

……

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……

5. Any other comments/suggestions?

……

……

……

2. Contract Management

2.1 Conditions of Contracts

1. Whether foreign/local firms strictly monitor the contracts with reference to the FIDIC/ICTAD conditions of contract in water sector projects? If yes please discuss?

……

……

……

2. If the answer to the above question is no, what is the reason, any knowledge deficiency?

……

……

……

3. In a JV, any knowledge transfer from the foreign firm to the local firm in terms of monitoring the Conditions of Contracts?

……

……

……

4. Any other comments/Suggestions?

……

……

2.2 Claims/Variations

1. Whether the local/foreign firms got the required knowledge for handling Claims/Variations in water sector projects?

……

……

……

2. If not what are the knowledge deficiencies identified?

……

……

……

3. In a JV, any knowledge transfer from the foreign firm to the local firm in terms of Claims/Variations?

……

……

……

4. Any other comments/Suggestions?

……

……

……

2.3 Dispute Resolution

1. Whether the local/foreign firms got the required knowledge of Dispute Resolutions in the projects?

……

……

……

2. If not what are the knowledge deficiencies identified?

……

……

……

3. In a JV, any knowledge transfer from the foreign firm to the local firm in terms of Dispute Resolution?

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4. Any other comments/Suggestions?

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Appendix 02: Questionnaire

Questionnaire on Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Sector Construction Projects

Dear Sir/Madam

Request for obtaining information for the thesis on **"Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Sector Construction Projects"**

I'm a postgraduate student of the Department of Civil Engineering, University of Moratuwa following MSc. Degree in Construction Project Management. As a part of the degree course, I'm conducting a research on the topic of **"Knowledge Transfer of Joint Venture Contractors in Foreign Funded Water Sector Construction Projects"**

I would like to thank you for dedicating your valuable time to fill this questionnaire and the information you can provide would be greatly appreciated. This questionnaire will only take few minutes to complete. All the information gathered from this questionnaire will be kept strictly confidential and this research is intended for educational purpose only, and not for any commercial or other purposes.

Background Information

3. Type of Employment?

☐ Client ☐ Consultant ☐ Contractor ☐ Funding Agency ☐ Other

4. If your answer is Contractor in above (Q1), please tick the relevant box below

☐ Local Contractor ☐ Foreign Contractor ☐ NA

5. Designation of the person completing this questionnaire?

☐ Chartered Engineer ☐ Engineer ☐ Other

6. Current working experience?

☐ 0-5 years ☐ 6-10 years ☐ 11-15 years ☐ 16-20 years ☐ 20+years

Please answer the below questions based on your previous experience in water sector construction projects.

Please answer each question by indicating the extent to which you "Agree", on a scale of 1 to 5 as follows. (5 = Strongly Agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1= Strongly Disagree)

A. Questionnaire for Project Management in Water Sector Construction Projects

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.0	**Schedule Management**						
A	Contractors have used tools and techniques (such as Primavera, MS Project) to plan, implement, monitor and control the schedule of projects	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	The local contractors need to improve their knowledge and practices for the proper schedule management of projects		1	2	3	4	5
C	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of schedule management		1	2	3	4	5
D	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of schedule management to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
E	……		1	2	3	4	5

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.0	**Financial Management**						
A	Contractors have effectively managed the finances (cashflow, profitability, arranging finances etc.) of the projects	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	The local contractors need to improve their knowledge and practices for the proper schedule management of projects		1	2	3	4	5
C	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of schedule management		1	2	3	4	5
D	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of schedule management to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
E	…… ……..		1	2	3	4	5

				Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3.0	**Resource Management**							
A	Contractors have effectively managed the Resources (Equipment, Material and HR) in the construction projects		Foreign	1	2	3	4	5
			Local	1	2	3	4	5
B	Foreign Contractors	Use best practices for equipment management to receive increased efficiency		1	2	3	4	5
		Use best practices for material management to receive increased efficiency		1	2	3	4	5
		Practice well-defined HR principles (Recruitment, Training and Development, Performance Appraisals etc.)		1	2	3	4	5
C	Local Contractors	Use best practices for equipment management to receive efficient output		1	2	3	4	5
		Use best practices for material management to receive increased efficiency		1	2	3	4	5
		Practice well-defined HR principles (Recruitment, Training and Development, Performance Appraisals etc.)		1	2	3	4	5
D	The local contractors need to improve their knowledge and practices for proper resource management in the projects			1	2	3	4	5
E	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of resource management			1	2	3	4	5
F	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of resource management to the local firm			1	2	3	4	5
	Others (specify, indicating the extent to agreement)							
G	……			1	2	3	4	5

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.0	**Risk Management**						
A	Contractors have used risk management practices (Identify, Analyze and Mitigate risks) in the construction projects	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	Management of risks has helped contractors for successful completion of construction projects	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
C	Local contractors need to improve their existing knowledge and practices for proper risk management in construction projects		1	2	3	4	5
D	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and practices to local contractors in terms of risk management		1	2	3	4	5
E	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of risk management to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
F	…… ……..		1	2	3	4	5

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5.0	**Communication Management**						
A	Contractors have effectively and efficiently managed the communications in the construction projects (Plan, Manage, Control)	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	Contractors have used advanced tools and techniques (Such as Aconex, SAP, MS Sharepoint, Asana) for communication management in the construction projects	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
C	The local contractors need to improve their knowledge and practices for proper communication in the construction projects		1	2	3	4	5

D	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer the knowledge and best practices to local contractors in terms of communication management		1	2	3	4	5
E	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of communication management to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
F	…… ……..		1	2	3	4	5

B. <u>Questionnaire for Contract Administration/Contract Management in Water sector Construction Projects</u>

			Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1.0	**Conditions of Contract**						
A	Contractors have effectively monitored the contracts with reference to the Conditions of Contract (FIDIC, ENAA etc.)	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	Contractors have got experts within the organizations to practice conditions of contract (FIDIC, ENAA etc.)	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
C	Local contractors need to improve their existing knowledge and practices to effectively monitor contracts with reference to conditions of contract		1	2	3	4	5
D	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in practising conditions of contract		1	2	3	4	5
E	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of conditions of contract to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						

F	…… ……..		1	2	3	4	5

			Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
2.0	**Claims and Variations**						
A	Contractors have got knowledge and experience to handle legitimate claims and variations in the contract	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	Contractors have got experts within the organizations to handle claims and variations in the contract	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
C	Local contractors need to improve their existing knowledge and practices for handling claims and variations		1	2	3	4	5
D	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in handling claims and variations		1	2	3	4	5
E	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of handling claims and variations to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
F	…… ……..		1	2	3	4	5

			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3.0	**Dispute Resolution**						
A	Contractors have got knowledge and experience to handle disputes in the contract	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
B	Contractors have got experts within the organizations to handle disputes in the contract	Foreign	1	2	3	4	5
		Local	1	2	3	4	5
C	Local contractors need to improve their existing knowledge and practices for handling disputes		1	2	3	4	5
D	International Construction Joint Ventures (ICJVs) will facilitate foreign contractors to transfer their knowledge and practices to local contractors in handling disputes		1	2	3	4	5
E	In past Foreign – Local Join Venture (JV) construction projects, there was a considerable knowledge transfer in terms of disputes resolution to the local firm		1	2	3	4	5
	Others (specify, indicating the extent to agreement)						
F	…… ……..		1	2	3	4	5

C. Overall Knowledge level of the Foreign and Local Contractors

How you rate the overall existing knowledge of following knowledge areas in different contractor firms.

On a 3-point scale where 1 is Lowest and 3 is Highest (You should select rank order of degree of knowledge as 1, 2, and 3).

1.0	**Project Management**				
1.1	Schedule Management	Foreign	1	2	3
		Local	1	2	3
1.2	Financial Management	Foreign	1	2	3
		Local	1	2	3
1.3	Resource Management	Foreign	1	2	3
		Local	1	2	3
1.4	Risk Management	Foreign	1	2	3
		Local	1	2	3

1.5	Communication Management	Foreign	1	2	3
		Local	1	2	3
2.0	**Contract Management**				
2.1	Conditions of Contract (FIDIC/ICTAD)	Foreign	1	2	3
		Local	1	2	3
2.2	Claims/Variations	Foreign	1	2	3
		Local	1	2	3
2.3	Dispute Resolution	Foreign	1	2	3
		Local	1	2	3