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Managing Risks in Forming International Construction Joint Ventures in Thailand

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Abstract International construction joint ventures (ICJVs) are a business form that is widely used by construction contractors to enhance their capacities and competitiveness in large construction projects. The partners in an ICJV must encounter various types of risk throughout its life cycle. Most of the past research works on ICJVs have mainly focused on risk management in the construction phase. Yet, there has been a very limited number of studies on risk inherent in the formation of ICJVs. This paper investigates primary risks associated with the formation of ICJVs in Thailand. Based on comprehensive literature review and a pilot survey, 20 ICJV risks associated with the formation phase of ICJVs were identified, verified, and grouped into three categories: (1) internal risk, (2) external risk, and (3) project risk. The consequence and likelihood of occurrence (risk parameters) for each risk were assessed by 34 experts on ICJV using questionnaire surveys and in-depth interviews, which were integrated with the Delphi technique. The risk parameters of each ICJV risk were used to rank the criticality of the ICJV risks in each category. Appropriate responsive measures for each ICJV risk were analysed and proposed. In this paper, the relation between ICJV risks and ICJV organization structures was also examined. It was found that the risk parameters of five ICJV risks are influenced by the difference of ICJV organization structures. The results from this paper can guide contractors to recognize the critical risks while setting up their business for an ICJV so that they can subsequently establish an appropriate and comprehensive strategic plan.

Keywords Joint venture, Forming cooperative unit, Organization structure, Risk identification, Risk assessment, Risk management, Project life cycle

1. Introduction

In developing countries, infrastructure projects are commonly the top priority of the nation's investment [6]. Infrastructure development encompasses large and complex engineering projects that require a large amount of construction resources, which is beyond the capacity of a single contractor. A joint venture (JV) is an alternative to address such challenge [42]. A construction joint venture (CJV) is a form of construction business, in which at least two entities (partners) collaborate to complete a certain construction project and achieve their goals [34]. The partners usually enter into a JV agreement, which stipulates the conditions of their collaboration concerning work allocation, resource sharing, profit distribution, and conflict settlement [4, 9]. For international construction projects, the collaboration between local and foreign contractors, which is generally called an international construction joint venture (ICJV) [5], is widely used to enhance the competitiveness of the ICJV and the capacities of its partners [17].

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An ICJV encompasses project-based operations with the definitive time frame [16]. The life cycle of an ICJV project can be divided into phases, each of which entails unique objectives [23]. Since achieving the objectives in a certain phase usually affects the ICJV's performance in subsequent phases [24, 30], efficient management in every phase throughout the project life cycle is vital for achieving overall project objectives [29, 39].

The partners of an ICJV must align their needs while forming a formal cooperation, which is considered a principal objective in the early phase of ICJV life cycle [2, 37]. Many ICJV partners, especially inexperienced contractors, could not achieve such key objective [16, 24, 28, 32, 36]. Failing to form an ICJV makes a contractor impossible to enter into the bidding process [2]. Such failure results from a variety of risks, which are related to the contractor itself, its partners, the owner, and the characteristics of project [4, 22]. In Thailand, most contractors must encounter these ICJV risks [31]. As a result, they often fail to form ICJVs and lost their business opportunities in large construction projects [33].

Most of the previous research works mainly focused on risk management during the construction phase of ICJVs [e.g., 2, 4, 36, 41, 42]. Risk management concerning the formation of ICJVs has been limitedly investigated.

Surprisingly, it was found that many partners have frequently failed to set up their ICJV to join the bidding process of a project [6, 26].

Moreover, the one of major decisions during this early stage of this cooperation, partners have to select a type of ICJV organization structures [17, 24, 31, 33]. While the influence of organization structures can affect the performance of an ICJV [1, 24, 30, 33], the previous research works about this topic are limited.

2. Literature Review

2.1. Construction Joint Venture Risk Management

One of the early research works on ICJV risk management was conducted by Kumaraswamy [18], that focused on the appraisal and apportionment of ICJV project risks associated with all partners. It aimed to find a balance point among the partners to keep them working together smoothly. It also proposed criteria, sub criteria, and indicators for risk evaluation as well as risk allocation among ICJV partners.

Seneviratne and Ranasinghe [35] evaluated financial risks in real-world mega transportation infrastructure projects where ICJV was adopted. Bing et al. [4] identified and evaluated ICJV project risks, which were divided into three main groups: internal risk, project-specific risk, and external risk. Bing and Tiong [5] proposed a risk management model for ICJVs, which was divided into three main parts: identification, analysis, and treatment. Their model was applied to three case studies. The risk classification into three main groups has been widely used by several research works concerning ICJV risk assessment. Shen et al. [36] also identified and evaluated ICJV risks, but the risks were classified into six groups: financial risk, legal risk, management risk, market risk, policy and political risk, and technical risk. These six risk groups entailed different risks with different levels of impact. Mohamed [24] investigated the influence of risks on ICJV performance factors by using Structural Equation Modeling (SEM) techniques. Zhang and Zou [41] proposed a new approach to evaluate CJV risks by applying fuzzy logic and the analytic hierarchy process (AHP) technique. Their data were collected in the Likert scale to quantitatively measure the respondents' opinions by using questionnaires. Risk information in their work was based on the results by Bing et al. [5]. Recently, Zhao et al. [42] identified ICJV risks for operating an underground rail in Singapore. They examined the difference of risks between different respondents, which were grouped by the company's nationality, size, and experience.

2.2. ICJV Life Cycle

According to previous research works, the life cycle of ICJV can divided into three, four or five phases. Yet, the first phase usually concerns the formation of CJV [4, 16, 24, 33, 39]. For example, the five phases of ICJV life cycle are (1) the formation phase, (2) the bidding phase, (3) the construction phase, (4) the warranty phase, and (5) the termination phase [31]. Each phase entails its unique objectives, which affect the performance in other phases. Figure 1 illustrates the objectives and the main activities of all five phases of ICJV life cycle [17, 33].

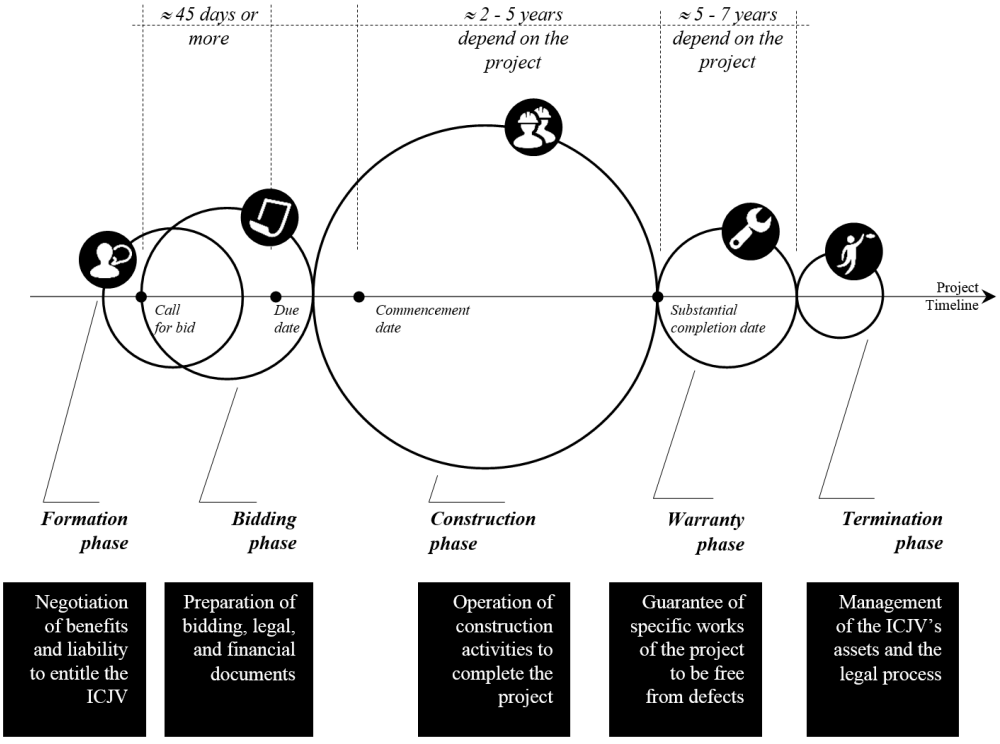

Figure 1. Five phases of ICJV life cycle

As can be seen in the figure, each circle represents the tasks of each phase of ICJV life cycle. Moreover, the size of circle are also represents the workload of each phase. The presented format of the circles is not fixed [39]. ICJVs would have different format of the circles depending on the preparation and plan of partnership and detail of construction contract of the project [6, 31].

For the overlap between the circle of the formation phase and the bidding phase, it reflects the real situation that the operations of these are often managed during the same time period. However, for ICJVs which its negotiation has be prepared in advance, the pattern between these two circles can be changed, like shown in Figure 2 [33].

2.3. Forming ICJV

To form an ICJV, each contractor, as a partner, needs to define their goals for working together and to choose their prospective partners. The main objectives of this phase are aligning the needs of all partners, signing a JV agreement, and establishing a formal cooperative unit [33]. If at least one of these elements cannot be achieved, the ICJV cannot be formed [22]. Time constraint is often a major challenge of ICJVs in the formation phase. Typically, the ICJV partners are requested by the owner to submit a JV agreement as part of their bidding documents [17, 32].

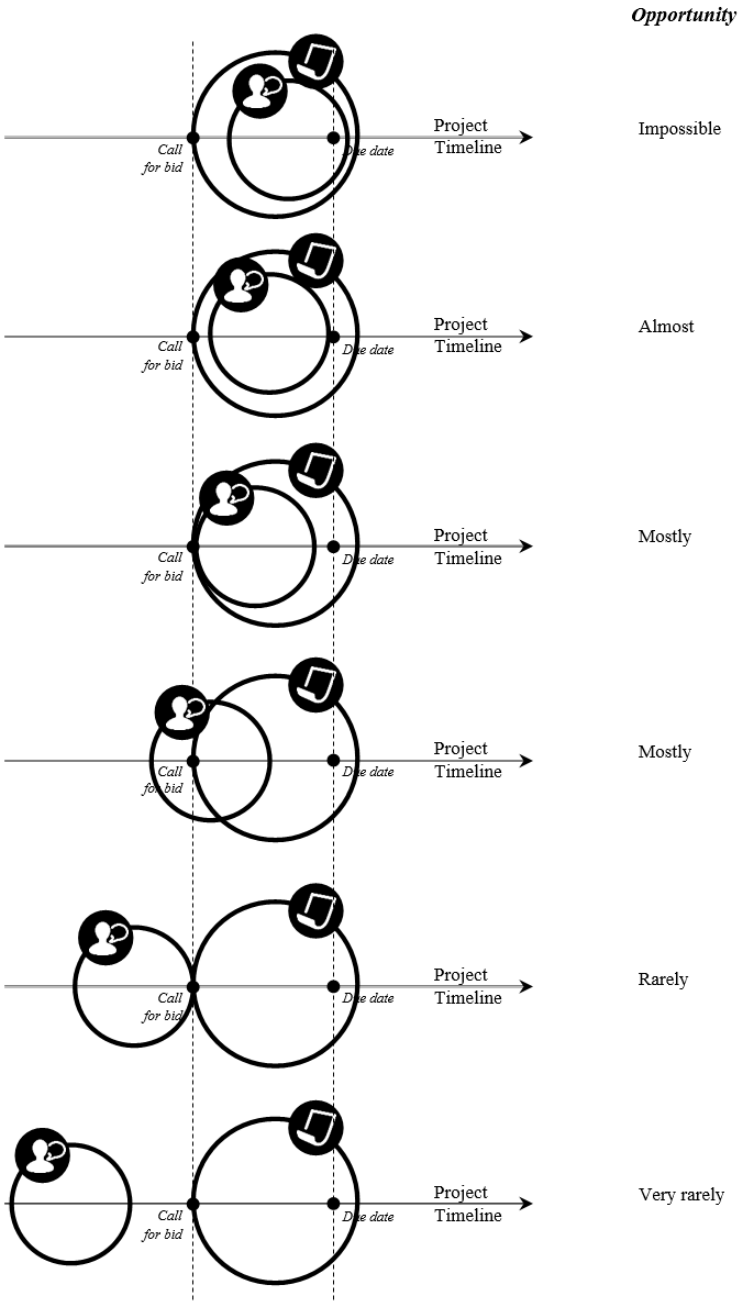

Figure 2. Patterns of relationship between formation phase and bidding phase of ICJV life cycle

In reality, many ICJV partners failed to achieve these key objectives within time constraints [7]. This resulted from disagreement of ICJV partners about their proportion of investment, their profit, responsibility, and liability sharing, as well as delay on the preparation of a JV agreement [2, 26, 34].

2.4. ICJV Organization Structure

ICJV organization structures represent the relation among partners in various aspects such as work allocation, coordination process, supervision, and liability, all of which have a direct impact on ICJV success [1, 17, 30]. They are also related to the goals of the partners and the risks the partners must encounter [6]. The organization structure of an ICJV is a main issue in the agreement, which is almost impossible to alter [2, 22]. Thus, it is a very important decision the partners have to make while setting up their ICJVs [7, 21]. Even though ICJV organization structures were quite diverse, they can be categorized into two main forms: the collaborated governance structure and the separate governance structure [30, 33].

In a collaborated governance joint venture (CG-JV), all tasks are handled by a collaborative team, which consists of personnel from each partner, and no main tasks are allocated to an individual partner. The capital money, net profit or loss for the entire ICJV project, as well as, the liability for the project owner and the third person are usually determined and allotted for each partner based on its proportion of contribution [33].

In a separate governance joint venture (SG-JV), most of the main tasks are grouped into work packages, which are executed by a certain partner. Each partner must take responsible for the capital money and net profit or loss of its work packages [33]. All partners however must be jointly and severally liable for obligations of the entire ICJV project to the project owner and the third person [22].

Different ICJV organization structures could affect the characteristic of ICJV risks [30]. In additional, details of negotiation processes and agreements during the formation phase are also influenced by the desired forms of ICJV organization structures [7]. Thus, the ICJV organization structure is a very important feature which partners have to carefully design for efficient risk management throughout its life cycle [17].

3. Objectives

The goal of this paper is to suggest the risk information used for the risk management of an ICJV in Thailand during the phase of forming the cooperative unit by contractors. Moreover, the influence of ICJV organization structures on the consequence and likelihood of the ICJV risks in this phase was also analysed, as well.

To reach this main goal, the specific objectives of this paper are:

1. To identify and assess critical ICJV risks associated with ICJVs in Thailand during the formation phase.
2. To proposes risk-responsive measures for such ICJV risks.
3. To analyse the influence of ICJV organization structures on the consequence (CSQ) and likelihood (LLH) of the ICJV risks during the formation phase.

For answering the third objective, the hypothesis was developed as:

"For an ICJV risk during the formation phase, its parameter including CSQ and LLH may be different, when it is evaluated under the difference of the ICJV organization structures."

This hypothesis was tested by methods of the nonparametric statistic.

4. Research Methodology

In this paper, relevant data concerning ICJV risks were compiled from many sources, including past research works, a pilot survey, questionnaire surveys, and in-depth interviews. The Delphi technique and the nonparametric statistic test were integrated into the data collection process to enhance the reliability of results [3, 8]. To accomplish the objective of this paper, there are four steps of the research methodology.

4.1. Risk identification

To identify ICJV risks, the consideration was based on the previous research works relating to the risk assessment, the critical success factors, the performance management and the cooperative success. There are five journal papers which were selected as the draft framework for identifying risk factors. They are:

1. Appropriate appraisal and apportionment of megaproject Risks by Kumaraswamy [18]
2. Risk management in international construction joint ventures by Bing et al. [5]
3. Risk assessment for construction joint ventures in China by Shen et al. [36]
4. Fuzzy analytical hierarchy process risk assessment approach for joint venture construction projects in China by Zhang and Zou [41] and
5. Identifying the critical risks in underground rail international construction joint ventures: case study of Singapore by Zhao et al. [42].

There are more than 60 ICJV risks in the first draft of risk identification. However, these ICJV risks were listed from worldwide ICJVs and could occur throughout the project life cycle. So, a pilot survey was conducted to justify the suitability of these ICJV risks for the Thai construction industry by focusing on the ICJV formation phase. Five project managers, who worked in at least three ICJV projects in Thailand, had participated in this pilot survey to review these 60 ICJV risks. The process of requesting opinions for each expert in the pilot group would happen around two or

three times during October 2011 to January 2012. By starting from the second round and over, the expert would recognize the overall data, which was the conclusion from previous round, and could change or confirm his or her opinions. It can be said the process according to the principle of Delphi technique [8]. After reviewing, 20 ICJV risks for the formation phase were listed and grouped into three categories:

1. Internal risk category,
2. Project risk category, and
3. External risk category.

Table 1 shows the identified ICJV risks and their categories.

Table 1. ICJV risks in the formation phase

Category	List of Risk	
	Code	Description
Internal risk category (I)	1I	Cash flow problems of partners
	2I	Lack of construction capability of partners
	3I	Changing in partners
	4I	Lack of local experience of partners
	5I	Lack of JV experience of partners
	6I	Difference in requirements between partners
	7I	Different practices for resource allocation between partners
	8I	Improper intervention by partners
	9I	Different organizational structure and culture between partners
	10I	Distrust between partners
	11I	Lack of communications between partners
Project risk category (P)	12P	Improper project profit and risk sharing
	13P	Intervention and delay by owner or its representatives
External risk category (E)	14E	Differences in social, cultural, and religious issues
	15E	Language barrier
	16E	Resistance from society
	17E	Security problems and social disorder
	18E	Inconsistency in government policies
	19E	Investment restriction
	20E	Corruption and bribery

4.2. Development of Questionnaire

Based on our literature review and the information compiled from the pilot survey, a questionnaire was developed to solicit ICJV experts' opinions about the risk parameter which means the values, including consequences (CSQ) and likelihood (LLH), for evaluating, categorizing, and prioritizing an ICJV risks [15]. For CSQ, it means the impact of the risk event on an aspect, which caused by the ICJV risks [14]. For LLH, it means the chance of an ICJV risk occurring within a defined time period [14]. So, the possible value of CSQ and LLH of the 20 ICJV risks previously identified. Each risk parameter for CSQ and LLH was divided into a number of levels based on the five-point Likert scale [13, 25]. Table 2 shows the classifications of five-point Likert scales for assessing the CSQ and the LLH of each ICJV risk.

Table 2. Details of five-point Likert scales for consequence (CSQ) and likelihood (LLH)

Scale	Consequence (CSQ)	Likelihood (LLH)
	Description	Description
1	Very small	Unlikely
2	Small	Seldom
3	Average	Occasional
4	Comparatively large	Likely
5	Serious	Frequent

Note * Each value represents an approximate deviation of the CSQ from the typical value resulting from the risk being considered.

For CSQ, the least possible duration between the date of call for bid and the due date is 45 days [22] which is used as a standard for setting up the scale. With the development with the pilot survey, Table 3 indicates the sets of the five point likert scale for CSQ.

For LLH, because this phase is only 45 days which is very short, the scale values for the frequency viewpoint or for the continuation viewpoint are too less. Table 4 shows the detail of the five point Likert scale for LLH value at the formation phase.

As can be seen, there are two types of scale for LLH Value that are set by the frequency and continuation viewpoint as criteria. First, the scale is set by the frequency viewpoint. Another scale used the continuation viewpoint as criteria. These are the attempt to convert the format of possible of occurrence for ICJV risks, as close to the real situation. The respondents in the professional group can select one of these two scale types to evaluate the LLH Value for ICJV risks. The deviations of the CSQs as shown in Table 3 and 4 were evaluated by using the results from the in-depth interview in the pilot survey, which was integrated with the Delphi technique.

For example, if the CSQ for a certain risk is estimated to be level 5, this risk would delay the formation of an ICVJ for more than 50% of the typical duration, which is 50% of 45 days (as shown in Figure 1) or 23 days. The delay of 23 days or more during the ICJV formation is considered a serious risk. Typically, the bidding duration for public construction projects in Thailand is around 45 days. This means that the partners of an ICJV must enter into the JV agreement and submit the relevant ICJV contract documents to the project owner within such duration. By delaying 23 days or more, the partners cannot form an official ICJV and reach their agreement in time.

Table 3. Meaning of Scale for Evaluating CSQ in the Formation Phase

Scale	Description	Reference	Example Interpretation*
5	Serious	$x > 50\%$	Delay 23 days or more
4	Comparatively Big	$30\% < x \leq 50\%$	Delay 14 days to 22 days
3	Average	$15\% < x \leq 30\%$	Delay 7 days to 13 days
2	Small	$5\% < x \leq 15\%$	Delay 3 days to 6 days
1	Very small	$x \leq 5\%$	Delay less than 2 days

Note * "x" means the impact, delay from schedule, of the risk factor.
** The calculation was done based on 45 days.

Table 4. Meaning of Scale for Evaluating LLH in the Formation Phase

Scale	Description	Reference	Continuation	Reference*
5	Frequent	10 times or more	Continuously occur	Occurring > 50% during period
4	Likely	6 – 9 times	Irregularly occur	Occurring 31 % - 50% during
3	Occasional	4 – 5 times	Occur for periods	Occurring 16 % - 30% during
2	Seldom	2 – 3 times	Occur for a while	Occurring 5 % - 15% during period
1	Unlikely	0 – 1 times	Momentarily occur	Occurring < 5% during period

Note * The period of the formation phase is 45 days to 60 days, in general.

4.3. Determining the Level of Risk

According to the standard of the International Organization for Standardization (ISO) on risk management [15], the level of risk (LOR), which means the magnitude of a risk, for a certain ICJV risk is the product of consequence (CSQ) and likelihood (LLH) [21]. In this research, the values of CSQ and LLH are the mean scores assigned by the respondents. Equations (1) to (3) were used to calculate CSQ, LLH, and LOR, respectively [25, 42].

$$CSQ^i = \frac{1}{n}\sum_{j=1}^{n} CSQ^i_j \quad (1)$$

$$LLH^i = \frac{1}{n}\sum_{j=1}^{n} LLH^i_j \quad (2)$$

$$LOR^i = CSQ^i \times LLH^i \quad (3)$$

where n is the number of the respondents, CSQ^i is the mean score of consequence of risk i, CSQ^i_j is the consequence of risk i assigned by respondent j, LLH^i is the mean score of likelihood of risk i, LLH^i_j is the likelihood of risk i assigned by respondent j, and LOR^i is the level of risk for risk i.

4.4. Respondent Characteristics

The respondents in this research were the professional group who are the middle top managements and engineers from construction firms who are experienced in two or more ICJVs operating in Thailand. The respondents in our data surveys were carefully selected from such group of professionals. As well, these ICJVs have to be set up by one Thai local partner and one or more foreign partners.

4.5. Process of Surveys and in-depth Interviews

To conduct questionnaire surveys, in-depth interviews by open-ended questions were adopted as another principal data collection tool to fully and accurately comprehend the characteristics of ICJV risks [10].

To study the characteristics of these risks, the process began with the questionnaire survey and in-depth interview with the professional group. They would give the answers and opinions for CSQ and LLH by considered the work experience in the past. This step processes were separated into two parts including (1) the part of data survey and (2) the part of data analysis.

Based on the structure of the modified Delphi technique were developed [8, 11]. This paper can took advantages for adapting the Delphi method to the survey process. The survey can get the in-depth anonymous data and information about ICJV risks under the consideration topics by avoiding the conflict situation in the panel of professional group [8]. So, the interview and surveys with each engineer in the professional group were conducted in two or three rounds to reduce bias of respondents and enhance reliability of the results.

The process was repeated three times from April 2012 to February 2013 until the consensus of data emerged. In the first round, 120 questionnaires were sent to the professional group in Thailand in April, 2012. At the end of July 2012, 44 questionnaires were returned, giving a response rate of 36.7%. After analyzing these results and identifying conflicting viewpoints, the second and third rounds of survey and in-depth interviews were performed according to the Delphi technique. The second round started in September 2012 and ended in November 2012 with 38 respondents. The second data analysis was done in December 2012. However, the respondents were reduced to 34 persons of the professional group in the final round which occurred during January 2013 to March 2013. These persons made the final response rate of 28.3%. The 34 respondents of the

professional group for this study were a group of middle or top managements and engineers having ICJV experiences in Thailand.

4.6. Statistical Hypothesis Testing

To select the right statistic test, it is very important to understand the important characteristics of samples and the data gotten from the survey [19, 20]. For this study, they are:

1. Size of sample
   a) There are 34 respondents in the professional group as sample size.
   b) There are 17 cases in each group of the sample, being the CG-JVs group and the SG-JVs group.
   c) The assumption for the CG-JVs group and the SG-JVs group is both independent for each other.

   In statistical viewpoint, this amount is considered as the small-medium sample size [19]. Moreover, the samples was not random according to the statistic theory [3].
2. Types of data
   a) All data in all phases are in the format of the ordinal scale [12].
   b) Each of CSQ and CSQ for each phase were evaluated by the exclusive set of the five-point likert scale.
3. Distribution of data
   a) All data in five phases are not the normal distribution [12, 38].

Although, the sample size is 34 cases which can be applied with the central limit theorem which infer to the normal distribution among samples [20]. However, the data granted in this research were not distributed normally anymore via the process to reduce bias of respondents with the Delphi [3, 38].

With the characteristics of sample and their data mentioned above, the data of this study cannot be tested by the method of parametric statistic. The main reason for this decision is that the data of the study are not the normal distribution. Therefore, this study decided to use the methods of the nonparametric statistic. Form existing methods in this type of statistic test, with the format groups of sample, the sample size and type of data, "the Mann–Whitney U test" was selected.

The Mann–Whitney U test is the method to compare whether the data distributions of the independent groups of the sample would be differ [38]. Because the concepts of the Mann–Whitney U are close as the t-test or ANOVA in the parametric statistic test, many researchers mentioned that the efficiency of this test are higher than that of many method of the nonparametric statistics [3]. The equation for the Mann–Whitney U test is Equations (4).

$$U = N_1 \bullet N_2 + N_x \bullet \frac{N_x + 1}{2} - T_x \tag{4}$$

Where T_x denote the maximum sum of rank values between the sample groups of CG-JV and SG-JV, N_1 is the number of size for the sample group of CG-JV, N_2 is the number of size for the sample group of SG-JV and N_x is the number of size for the group which have maximum T_x.

The rank values for each sample can be scored by scoring all CSQ values or LLH values, ignoring which group they belong to. For the lowest value, it would get rank value of "1". The next lowest would get a rank value of "2", and so on. In the case which two or more values are equal, they would get the average of the rank values [3, 12].

5. Survey Results and Analysis

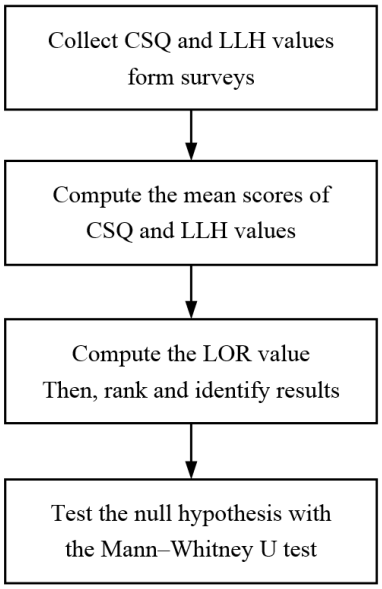

Figure 3. Analyzing process for ICJV risks

The overall analyzing process for this paper is indicated in Figure 3. As can be seen, once the mean scores of CSQ and LLH for each ICJV risk were computed by applying Equations (1) and (2), the LOR for each risk was calculated by Equation (3). A following example of a computation for *"Lack of communications between partners"* (11I) can clarify better. With the final values of CSQ for this ICJV risk after three rounds of survey process is shown in Table 5, the computation of CSQ, LLH and LOR are:

$$CSQ^{11I} = \frac{1}{34}\sum_{j=1}^{34} CSQ_j^{11I} = \frac{1}{34}(54+67) = 3.6$$

$$LLH^{11I} = \frac{1}{34}\sum_{j=1}^{34} LLH_j^{11I} = \frac{1}{34}(32+46) = 2.3$$

$$LOR^{11I} = CSQ^{11I} \times LLH^{11I} = 3.6 \times 2.3 = 8.3$$

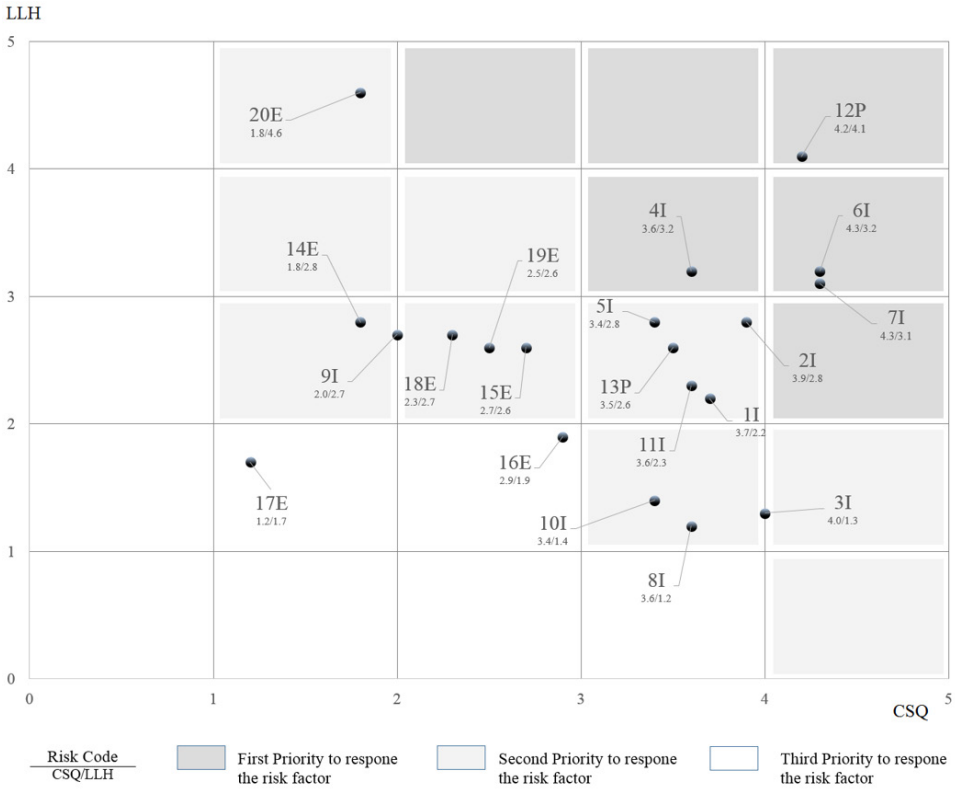

Figure 4. Patterns of relationship between formation phase and bidding phase of ICJV life cycle

Table 5. CSQ values of "*Lack of communications between partners*" (11I)

Sample Group of CG-JV			Sample Group of SG-JVs		
Sample No.	CSQ Values	LLH Values	Sample No.	CSQ Values	LLH Values
CG-No. 1	3	1	SG-No. 1	4	2
CG-No. 2	3	2	SG-No. 2	4	2
CG-No. 3	3	2	SG-No. 3	4	2
CG-No. 4	4	2	SG-No. 4	4	3
CG-No. 5	3	1	SG-No. 5	3	3
CG-No. 6	3	2	SG-No. 6	4	2
CG-No. 7	3	1	SG-No. 7	4	3
CG-No. 8	3	3	SG-No. 8	4	2
CG-No. 9	3	2	SG-No. 9	4	3
CG-No. 10	3	2	SG-No. 10	5	3
CG-No. 11	3	3	SG-No. 11	4	2
CG-No. 12	3	1	SG-No. 12	4	3
CG-No. 13	3	2	SG-No. 13	4	3
CG-No. 14	3	2	SG-No. 14	5	2
CG-No. 15	3	2	SG-No. 15	3	3
CG-No. 16	4	2	SG-No. 16	4	4
CG-No. 17	4	2	SG-No. 17	3	4
Total	54	32	Total	67	46

Note $N_1 = 17$,
$N_2 = 17$,
$N_{Total} = 34$

Once the risk parameters (CSQ, LLH and LOR) of all 20 ICJV risks were computed, they were ranked and the critical risks were identified. Figure 4 presents the CSQ and the LLH of each risk in the form of risk matrix. Tables 6 to 8 summarizes the CSQ, LLH, and LOR for ICJV risks in the three categories: the internal risk category, the project risk category and the external risk category, respectively.

Then, the respondents were assigned into two independent groups according to the types of ICJV organization structures (CG-JV and SG-JV). The null hypothesis, which defined that the CSQ and LLH for each risk from both groups are not different, were tested by the Mann–Whitney U test, a nonparametric test, [3].

The sample test for the CSQ value of *"Lack of communications between partners"* (11I) is as follows.

By the "the Critical U Values Table" with the level of significance = 0.10 and sample sizes for CG-JV and SG-JV are 17 for each group, the critical U is 96. With ranking process, it was found that $T_{CG\text{-}JV} = 201$ and $T_{SG\text{-}JV} = 394$. So, the computed U^{11I} by Equations (4) is:

$$U^{11I} = (17) \bullet (17) + (17) \bullet \frac{(17)+1}{2} - 394 \quad = 48$$

Table 6. Risk parameters of the internal risk category (I)

Risk Code	Risks	CSQ		LLH		LOR	
		Mean (SD)	Rank	Mean (SD)	Rank	Mean	Rank
1I	Cash flow problems of partners	3.7 (0.5)	5	2.2 (0.6)	8	8.1	7
2I	Lack of construction capability of partners	3.9 (0.6)	4	2.8 (0.8)	4	10.9	4
3I	Changing in partners	4.0 (0.5)	3	1.3 (0.4)	10	5.2	9
4I	Lack of local experience of partners	3.6 (0.5)	7	3.2 (0.8)	2	11.5	3
5I	Lack of JV experience of partners	3.4 (0.6)	10	2.8 (0.6)	5	9.5	5
6I	Difference in requirements between partners	4.3 (0.5)	1	3.2 (0.6)	1	13.8	1
7I	Difference on staff allocation between partners	4.3 (0.5)	1	3.2 (0.8)	3	13.3	2
8I	Improper intervention by partners	3.6 (0.5)	6	1.2 (0.4)	11	4.3	11
9I	Difference on organizational structure and culture between partners	2.0 (0.3)	11	2.7 (0.6)	6	5.4	8
10I	Distrust between partners	3.4 (0.6)	9	1.4 (0.5)	9	4.8	10
11I	Lack of communication between partners	3.6 (0.6)	8	2.3 (0.8)	7	8.3	6

Table 7. Risk parameters of the project risk category (P)

Risk Code	Risks	CSQ		LLH		LOR	
		Mean (SD)	Rank	Mean (SD)	Rank	Mean	Rank
12P	Improper project profit and risk sharing	4.2 (0.4)	1	4.1 (0.7)	1	17.2	1
13P	Intervention and delay by owner or its representatives	3.5 (0.5)	2	2.6 (0.6)	2	9.1	2

Table 8. Risk parameters of the external risk category (E)

Risk Code	Risks	CSQ		LLH		LOR	
		Mean (SD)	Rank	Mean (SD)	Rank	Mean	Rank
14E	Differences in social, culture, and religion	1.8 (0.4)	6	2.8 (0.8)	2	5.0	6
15E	Language barrier	2.7 (0.5)	2	2.6 (0.7)	5	7.0	2
16E	Resistance from society	2.9 (0.3)	1	1.9 (0.6)	6	5.5	5
17E	Security problems and social disorder	1.2 (0.4)	7	1.7 (0.5)	7	2.0	7
18E	Inconsistency in government policies	2.3 (0.5)	4	2.7 (0.7)	3	6.2	4
19E	Investment restriction	2.5 (0.5)	3	2.6 (0.8)	4	6.5	3
20E	Corruption and bribery	1.8 (0.5)	5	4.6 (0.5)	1	8.3	1

The computed U^{11I} is less than the critical U. So, the null hypothesis is rejected or it can be conclude that the CSQ value for "*Lack of communications between partners*" (11I) between CG-JV and SG-JV are different with statistical significance. The discussion of the nonparametric test results for 20 ICJV risks is in the section 6 of this paper.

6. Risk Parameter Discussion

6.1. Internal Risk Category (I)

Table 6 shows the risk parameters of the eleven risks in the internal risk category. In the formation phase, the risks in the internal risk category significantly affect ICJVs objectives the most. As a result, many risks in this category have high values of CSQ. As shown in Table 6, the two risks with highest CSQ (4.3) in this category (also among the three categories) were "*Difference in requirements between partners*" (6I) and "*Difference on resource allocation between partners*" (7I). According to the interviews, these two issues played a vital role in the negotiation of ICJV partners.

For "*Difference in requirements between partners*", it is normal for each partner to require their needs in several aspects as they expect to gain as much as they can from their investment but they also want to take as less responsibility and risk as they can which follow the business principle of capitalism [7, 24]. However, when they are agree to make the partnership together in the ICJV, each partner cannot focus only on their own benefit, all the time [5]. This situation is occurred when the negotiation process comes in to compromise everyone's requests and come up with the term which satisfies everyone as well as possible. "Difference on resource allocation between partners" is about requirement of each partner in term of delegating or transferring staff, and equipment under their control into several positions within an ICJV [40]. This is an important factor, especially for staff, because the staff who work in key positions will have authority to direct, control and follow the CJV's operation in order to fulfil need of a specific partner [2].

Apart from that, as the partners have to share responsibility, profit and loss, each of them wants to have their own people in management position within ICJV to avoid being exploited by other partners [6]. Nevertheless, this problem does not normally lead to disbanding of the ICJV as it often ends by one partner decide to withdraw although it takes a while. The real issue about this risk is that it creates dissatisfaction among partners.

A significant difference in both issues was a major obstacle for ICJV partners in reaching their mutual agreement. In many cases, the ICJV could not even be established due to such differences. However, the LLH of both risks were considered moderate (LLH = 3.2). Some respondents commented that the LLH could even be lowered if the partners used to work together in the past.

"*Changing in partners*" (3I) was ranked third in this category and ranked fourth among all risks (CSQ = 4.0). This risk refers to changes in major policies by any partner during the formation stage. The little or moderate changes in policy may not have much influence toward ICJVs. It usually results in delayed decision making or unsatisfactory among partners as each of them is willing to avoid violating signed contract.

Another interesting risk in this category was "*Improper intervention by partners*" (8I) (rank sixth with CSQ = 3.6). Even though it is not easy to define clearly which actions should be considered too much intervention [2, 16], the intervention by partners can be put into two characteristics

which were intentionally and unintentionally intervention. The first characteristic is usually happen when the partners have their own secret objectives which they cannot tell anyone. So, they tend to do intervene in any operation to make sure they get what they want [16]. The partners who fall into this type usually want to learn technology, know more supplier, expand market, increase profitability and build fame.

Even though "*Changing in partners*" and "*Improper intervention by partners*" were considered high-impact risks, their likelihoods to occur were quite low (LLHs = 1.3 and 1.2, respectively). A main reason is that the formation process is normally so short that they do not arise.

"*Lack of JV experience of partners*" (11I), the LOR of which was ranked fifth (LOR = 9.5), was found for both local and foreign partners, and usually contributed to delay or obstruction of the ICJV formation. If partners have had the past experience in ICJVs either in Thailand or in other counties, they will be familiar with several key processes of the ICJV management. So, the partners should be able to prepare the ICJV documents, to understand the processes of ICJV operation, to gather labour and other resources, to reduce unnecessary risks and problems in the cooperate unit and to solve the unexpected problems [42]. On the contrary, if partners have no experiences at all, they will lack experience in those mentioned above and will reduce efficiency in the ICJV management. As the results, it will increase time and cost for management. The LLHs of this risk was quite diverse based on each contractor's experience in an ICJV. Thus, it will play just a minor role if partners have ICJV experiences [26].

6.2. Project Risk Category (P)

Typically, an ICJV is established to bid on a certain construction project. Thus, the risks related to the project certainly affect the partners' decisions in the formation stage. A significant portion of contractors' cost stems from operation (construction) risks such as project cash flow, work delay, and design errors [2, 40]. They can accept these risks if the profit and risk allocation between the owner and the contractor is reasonable [16, 27]. Unfortunately, the risk allocation schemes in many construction projects are not fair such as pushing most of the risks towards contractors [25, 36].

Table 7 shows the risk parameters of the two risks in the project risk category. As can be seen, "*Improper project profit and risk sharing*" (12P) was the most critical risk in the group (CCQ = 4.2 and LLH = 4.1). Among all of the twenty risks, the CCQ and LLH of this risk were rated the third rank and the second rank, respectively. This risk related directly to wages payment from the owner and risk taking during the ICJV operation or it can be called sharing project profit and risk among each other [40]. These results correspond to those of Ozorhon et. al. [26], which stated that contractors must always consider whether or not the projects are worth their investment (e.g., appropriate profit and risk sharing) before entering into the bidding (before forming ICJVs). The above proportion between the owner and the ICJV is not a fixed number. The negotiation usually succeed when all parties feel that the they will get more value than possibility of loss and when the partners of an ICJV decide to bid for a specific project, it means everyone has already accepted proportion of project profit and risk sharing beforehand. In ICJV projects, this risk is much more critical than that of in conventional projects with a single contractor because there are more parties (partners) involved in decision makings. This may result in many possible adverse consequences such as delay in decision making.

The CSQ of risk 13P, "*Intervention and delay by owner or its representatives*" was assessed to be 3.5, which is the tenth rank among all the risks. From the interviews, it was found that owners or their representatives often wanted to take part in the details of the ICJV formation. Frequently, owners or their representatives did not understand rules and regulations regarding contractor employment in the form of an ICJV [41]. The result from intervention lead to partner's lacking in decision power, unsatisfactory among partners and owner or its representatives. However, the LLH of this risk can be reduced by the owner's experience in an ICJV.

6.3. External Risk category (E)

Table 8 shows the risk parameters of the seven risks in the external risk category. By considering all the twenty risks, the CSQs of the risks in this category were comparatively low, whereas their LLHs were rated moderate to high.

In Thailand, the ICJV projects usually concern large infrastructure projects that have an undesirable impact on nearby communities. As a result, "*Resistance from society*" (16E) often occurs and directly contributes to the viability of project. Based on the value of CSQ, this risk was ranked in this category. Compared to all the twenty risks, its CSQ (= 2.9) and LLH (= 1.9) were in the 13th and the 16th rank, respectively. The level of damage resulting from this risk can be as severe as the financial failure of the project [28].

The likelihood of "*Corruption and bribery*" (20E) (LLH = 4.6) was the top rank among all the risks. It clearly reflects the existence of this problem in major public construction projects in Thailand. Although, the low value of CSQ (1.8) means that this risk rarely affected the setup of ICJVs because the corruption and bribery in the construction could be beneficial to the partners, such as winning the bid, reducing operating cost, but in long term. However, it becomes disadvantages in several aspects [2, 41]. Moreover, if it can be considered its impact on the industry and the national's interest, the corruption and bribery has many terrible disadvantages [28, 40, 42].

The values of CSQ and LLH of "*Language barrier*" (15E) was assessed to be 2.7 and 2.6, respectively, and its LOR was ranked second in this group. Although English is a famous medium language for communication [42], not all staffs in construction industry can speak English well especially for local contractors in Thailand or even contractors from abroad

which English is not their standard language. The impact from the language barrier among staff can be varied [41]. First, there is too few communication occurs as staff try to avoid communication among each other as they are afraid that they may not communicate well [42]. Next, the communication may take long time [36]. For example, when a staff wants to write something to another staff, he/she tends to spend time trying to find words which can express what they mean while the receiver may interpret the message in another direction (especially paper work) [31]. To form an ICJV in Thailand, all important documents must be authorized by government agencies and financial institutes. These documents are required to prepare in the local language (Thai), and they will be translated into the international partner's language.

7. Relation between ICJV Organization Structure and Risk

To investigate the relation between the ICJV organization structures and their associated risks as well as to test the hypothesis of this paper, the respondents were divided into two independent sample groups: the collaborated governance joint venture (CG-JV) group and the separate governance structure (SG-JV) group.

Table 9 shows the means of risk parameters, including CSQ and LLH, of all the twenty risks assessed by the two sample groups with 17 respondents as the sample size for each group. The computations of CSQ and LLH values were also done by applying Equations (1) and (2). Here is the examples of CSQ and LLH calculation for *"Lack of communications between partners"* (11I) using information in Table 5.

For CG-JV,

$$CSQ^{11I} = \frac{1}{17}\sum_{j=1}^{17} CSQ_j^{11I} = \frac{1}{17}(54) = 3.2$$

$$LLH^{11I} = \frac{1}{17}\sum_{j=1}^{17} LLH_j^{11I} = \frac{1}{17}(32) = 1.9$$

For SG-JV,

$$CSQ^{11I} = \frac{1}{17}\sum_{j=1}^{17} CSQ_j^{11I} = \frac{1}{17}(67) = 3.9$$

$$LLH^{11I} = \frac{1}{17}\sum_{j=1}^{17} LLH_j^{11I} = \frac{1}{17}(46) = 2.7$$

Table 9 also shows the results of the hypothesis test with the nonparametric methods, by the Mann–Whitney U test to check whether or not the difference between the mean values of CSQ and LLH for both groups is statistical significant.

As can be seen, there was no risk in the project risk category and the external risk category, whose the risk parameters for the CG-JV and the SG-JV were different with statistical significance (i.e., all the null hypothesis tests were accepted). Meanwhile, the risk parameters of some risks in the internal risk category (i.e., 1I, 5I, 7I, 8I, and 11I) for the CG-JV and the SG-JV were different with statistical significance. It means that only the risks in the internal risk category were influenced by the ICJV organization structures, whereas the organization structures did not have a significant impact on the risks in the other two categories.

7.1. Comparison of Risks Focusing on Consequence

By focusing on the consequence (CSQ) or impact of the risks on ICJVs in Table 9, it is clear that the ranks of risks for the CG-JV and the SG-JV were not exactly the same. The top three ranks of risks for the CG-JV and for the SG-JV were "*Difference in requirements between partners*" (6I), "*Difference on resource allocation between partners*" (7I), and "Improper project profit and risk sharing" (12P). Yet, their orders were slightly different. The ranks of some risks for the two organization structures were quite different. For example, "Cash flow problems of partners" (1I) was ranked sixth for the CG-JV, but was ranked eleventh for the SG-JV.

The CSQ of "*Improper intervention by partners*" (8I) for the CG-JV and the SG-JV were 3.3 and 3.9, respectively. Their difference was considered statistically significant. For CG-JV, the responsibility of each partner for a certain construction work may not be defined clearly in the formation phase because all partners are supposed to work together in every work. In contrast, each partner of a SG-JV usually expects the clear boundary of its work while forming the ICJV, which is almost impossible in practice. Thus, it is often that such boundary was intervened by its partner intentionally or unintentionally and may lead to the end of ICJV formation. As a result, the consequence of this risk for the contractors in the SG-JV was greater than those for the contractors in the CG-JV.

The criticality of "*Lack of JV experience of partners*" (5I) for the CG-JV (CSQ = 2.9) and for the SG-JV (CSQ = 3.8) was significantly different. This is because the SG-JV formation is more complicated than the CG-JV in many aspects such as scope of work for each partner, and legal issues [22]. As a result, the JV experience is very important for the setup of ICJV, especially for the SG-JV.

Similar to the 5I risk, the criticality of "*Lack of communication between partners*" (11I) for the CG-JV (CSQ = 3.2) and for the SG-JV (CSQ = 3.9) was also significantly different. The word of "*Communication*", in this paper, means the processes of exchanging information and data in all aspects, such as technical, administration and financial between staff in every level [36, 40]. It can be in the form of discussion, meeting, and paper work. There are many reasons for such issue. For example, when staff have no experience in the ICJV and do not know how important effective communication is within the ICJV. So, they tend to ignore meeting among the staffs from different partners. The higher risk of the SG-JV results from the necessity to define a clear scope of work and inform the responsibility of every partner of the ICJV in the formation stage. Efficient communications among the ICJV partners can avoid misunderstanding and delay during the operation stage.

Table 9. Comparison of risk parameters between CG-JV and SG-JV

Risk Code	Risks	CSQ			LLH		
		CG-JV Mean (Rank)	SG-JV Mean (Rank)	H0 Test	CG-JV Mean (Rank)	SG-JV Mean (Rank)	H0 Test
1I	Cash flow problems of partners	3.7 (6)	3.7 (11)	A	2.5 (13)	1.8 (16)	R
2I	Lack of construction capability of partners	3.8 (5)	4.1 (4)	A	2.8 (6)	2.9 (6)	A
3I	Changing in partners	4.0 (4)	4.1 (4)	A	1.3 (19)	1.2 (19)	A
4I	Lack of local experience of partners	3.3 (7)	3.9 (8)	A	3.1 (4)	3.2 (4)	A
5I	Lack of JV experience of partners	2.9 (12)	3.8 (9)	R	2.8 (6)	2.8 (7)	A
6I	Difference in requirements between partners	4.3 (1)	4.2 (2)	A	3.2 (3)	3.2 (4)	A
7I	Difference on resource allocation between partners	4.2 (3)	4.3 (1)	A	2.8 (6)	3.5 (3)	R
8I	Improper intervention by partners	3.3 (7)	3.9 (6)	R	1.2 (20)	1.2 (20)	A
9I	Difference on organizational structure and culture between partners	1.9 (17)	2.1 (17)	A	2.6 (11)	2.7 (9)	A
10I	Distrust between partners	3.1 (11)	3.7 (11)	A	1.4 (18)	1.5 (18)	A
11I	Lack of communication between partners	3.2 (10)	3.9 (6)	R	1.9 (15)	2.7 (9)	R
12P	Improper project profit and risk sharing	4.3 (1)	4.2 (3)	A	4.1 (2)	4.1 (2)	A
13P	Intervention and delay by owner or its representatives	3.3 (7)	3.8 (9)	A	2.5 (13)	2.7 (11)	A
14E	Differences in social, culture, and religion	1.7 (18)	1.8 (19)	A	2.8 (5)	2.8 (7)	A
15E	Language barrier	2.8 (14)	2.6 (15)	A	2.8 (6)	2.4 (14)	A
16E	Resistance from society	2.8 (13)	2.9 (13)	A	1.8 (16)	1.9 (15)	A
17E	Security problems and social disorder	1.2 (20)	1.1 (20)	A	1.8 (17)	1.7 (17)	A
18E	Inconsistency in government policies	2.2 (16)	2.3 (16)	A	2.7 (10)	2.7 (11)	A
19E	Investment restriction	2.3 (15)	2.8 (14)	A	2.7 (11)	2.7 (11)	A
20E	Corruption and bribery	1.7 (18)	1.9 (18)	A	4.5 (1)	4.7 (1)	A

Note A = Accept the null hypothesis,
R = Reject the null hypothesis and the significance level is 0.10

7.2. Comparison of Risks Focusing on Likelihood

By focusing on the likelihood (LLH) of the risks in Table 9, "*Corruption and bribery*" (20E) and "Improper project profit and risk sharing" (12P) were the most likely risks of both CG-JV and SG-JV.

For "*Cash flow problems of partners*" (1I), the likelihood of occurrence for the CG-JV (LLH = 2.5) was greater than that for the SV-JV (LLH = 1.8) with statistical significance. This difference stems from different financial management characteristics between both organization structures. Since each partner of a SG-JV often bears financial burden for its construction work independently, it must have a strong financial record to sustain this independent financial scheme. On the contrary, a CG-JV is usually formed due to inadequate finance of the partners. Thus, the partners of a CG-JV can contribute to a pool of finance, from which each partner can withdraw and repay per the JV agreement. In other words, the financial status of the CG-JV partners is not as strong as that of the SG-JV partners. Consequently, the cash flow problems of partners for the CG-JV are more likely to occur.

In contrast with risk 1I, the LLH of "*Difference on resource allocation between partners*" (7I) for the SG-JV (LLH = 3.5) was greater than that for the CG-JV (LLH = 2.8) with statistical significance. This risk usually results from two main sources, namely, clarity of work scope and personnel placement [6, 24, 42]. As discussed previously, since the partners of the SG-JV work quite independently, they want their responsibilities to be defined clearly and as soon as possible. The clarity of work scope is very important for this type of ICJV organization structure. Thus, risk 7I is more likely to occur in the SG-JV than in the CG-JV.

The other risk with significant difference of LLH between both organization structures was "*Lack of communication between partners*" (11I) (i.e., LLH = 1.9 and 2.7 for the CG-JV and the SG-JV, respectively). Again, this risk results from the nature of SG-JVs where each partner is responsible for it work independently. The communication among the SG-JV partners are not as efficient as that of the CG-JV partners. A respondent reported that in some SG-JV projects the partners believed that communication and information sharing were not important at all.

8. ICJV Risk Treatment

Once the partners have realized the risks associated with their ICJV formation, especially critical risks, they should consider all possible options to respond to each risk. The possible risk response alternatives include mitigate, change, avoid, defer, share, transfer, and accept risk [13, 15]. Choosing an appropriate response option for a certain risk depends upon many factors such as type and characteristic of such risk, risk attitude of the partners, project characteristics, and environments [21]. Figure 4 illustrates a risk matrix that contains all the ICJV risks and the priority to respond them.

For example, the impact and the likelihood of "*Difference in requirements between partners*" (6I) and "*Difference on resource allocation between partners*" (7I) can be reduced by the compromise of the ICJV partners [24]. That is a partner should "Inform clear own requirements" for joining an ICJV. Another option for treating these both risks, they should try to "Set clear role and responsibility" in an ICJV between them. Both options require that partners have to compromise on some issues in exchange for interests in other issues. With the in-depth interview, it was found that these two risk treatment options have the moderate efficiency to reduce their CSQs and LLHs while they require the low cost and resource. However, "Set clear role and responsibility" is implemented harder than "Inform clear own requirements" [5, 29].

For "*Lack of JV experience of partners*" (5I), a possible risk response alternative is to "Educate the staff members about ICJV". However, due to the time constraint during the formation phase, it may not be possible to arrange a comprehensive training program for the staff members [18, 40]. Thus, ICJV partners must realize the criticality of this risk as soon as possible so that they can respond to it promptly. Many interviewers said that the other options, such as "Select partner which have the experience" or "Provide the advice or assistance by other experienced partners", have higher efficiency to treat CSQ and LLH for this risk but they are not easy to implement.

"*Language barrier*" (15E) could be treated by hiring outside experts for addressing the language problems in conversation and paper works [36]. This response plan usually comes with very high costs. It can be significantly higher if the time is extremely limited. Although the CSQ of this risk can be reduced by such treatment, this option may lead to consequential risks such as confidentiality of project information, correctness and accuracy of translated works, and performance of the external source.

To mitigate "*Lack of communication between partners*" (11I), the high efficient risk treatment options, suggested by the most interviewers, are "Set teams to support the communication", "Set the schedule meeting" and "Employ staff with the experience". Although these options require moderate or high cost and resources, the implementation is not complex to manage [40]. Moreover, it is important that these risk treatment option must be carried out by the persons who understand ICJV very well [2, 26].

The prudent partner selection based on comprehensive and accurate information is a basic treatment option for "*Cash flow problems of partners*" (1I). During the negotiation, the partners must not conceal their financial problems so that all partners understands actual financial conditions of one another. It was found that there were the partners that were willing to bear this risk by accepting other benefits.

For "*Intervention and delay by owner or its representatives*" (13P), the partner may can have some risk treatment options, such as "Alert both the official and unofficial notices, continuously", "Provide the advice or assistance, as possible to the owner", "Prepare the plans which accommodate the delays" and "Provide the staff to

operate the risk events". However, these options has the low efficiency to treat the CSQ and LLH of this risk while they can be implemented hardly.

As shown in Figure 4, two critical ICJV risks are "*Improper project profit and risk sharing*" (12P) and "*Corruption and bribery*" (20E), which are beyond the control of the partners [24]. In general, the partners can retain such critical risks by recognizing their existence, or they can avoid the risks by not entering the bidding process. For the first option, the partners must be prepared for the impact of such risks that could be the burden for future operations of the ICJV.

9. Conclusions

This paper investigates the international construction joint venture (ICJV) risks in Thailand by focusing on the formation phase, in which each contractor has to decide whether to join other contractors to work together in such construction project. In this phase, there will be negotiations and some document preparations among the partners to develop their cooperation model, which then leads to reach their agreement and sign the JV agreement in time. Because the JV agreement, that is an official contract between partners, is always required by the project owner in the bid submission process. In Thailand, the duration between the call for bid date and the bid submission date for the infrastructure projects is generally 45 days. The short duration may be a critical constraint for some unexperienced contractors to complete their JV agreement before the date line. To reduce any risk events, which affects the operation objective for this phase, is that the partners can reach the JV agreement on the proportion of investment, the proportion of profit allocation, their responsibility and liability sharing, and delay of the JV agreement preparation.

After reviewing literature and conducting a pilot survey, 20 ICJV risks associated with the formation of an ICJV were identified and analysed by a group of experts, consisting of 34 respondents. The risk parameters (CSQ and LHH) for each risk were evaluated by using the Delphi technique, which was applied to questionnaire surveys and in-depth interviews. To further investigate the relation between the risks and the two ICJV organization structures (CG-JV and SG-JV), the respondents were separated into two groups and the results were analysed with the nonparametric methods and the hypothesis was tested.

The results showed the ranking of all the ICJV risks based on their consequence (CSQ), likelihood of occurrence (LLH), and level of risk (LOR). The risks were then plotted in a risk matrix and the priority of risk treatment was proposed. The risk response alternatives for some critical risk were discussed. The results also showed that the ICJVs with different organization structures entail different risk parameters. Among the 20 ICJV risks, there were five ICJV risks which their CSQ or the LLH for both organization structures were different with statistical significance. Meanwhile, "Lack of communication between partners" (11I) was the only risk whose both CSQ and LLH of SG-JVs were higher than those of CG-JV with statistical significance.

The results from this paper help contractors, especially unexperienced ICJV partners, recognize the critical risks associated with the formation process of ICJVs and appreciate the impact of the planning ICJV organization structure on the risk parameters. The proposed risk treatment options for each risk can be used as a guideline for ICJVs to prepare an appropriate JV agreement and a comprehensive risk management plan for their projects.

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