กลยุทธ์ตอบสนองความเสี่ยงโดยผู้รับจ้างท้องถิ่นสำหรับโครงการก่อสร้างนานาชาติด้านอุตสาหกรรมในประเทศเวียดนาม

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RISK-RESPONSIVE STRATEGIES BY LOCAL CONTRACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS IN VIETNAM

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering Program in Civil Engineering
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ฮาง ธี ธุ เล : กลยุทธ์ตอบสนองความเสี่ยงโดยผู้รับจ้างท้องถิ่นสำหรับโครงการก่อสร้างนานาชาติด้านอุตสาหกรรมในประเทศเวียดนาม (RISK-RESPONSIVE STRATEGIES BY LOCAL CONTRACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS IN VIETNAM) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: วีระศักดิ์ ลิขิตเรืองศิลป์, 160 หน้า.

การจัดการความเสี่ยงที่ไม่มีประสิทธิภาพเป็นสาเหตุหลักที่นำไปสู่ความล่าช้าและต้นทุนเกิน (cost overrun) ในโครงการก่อสร้างสำหรับบริษัทก่อสร้างเวียดนามในการทำงานกับบริษัทต่างชาติ ภารกิจหลักประการหนึ่งของผู้รับจ้างก่อสร้างเวียดนามคือการตอบสนองความเสี่ยงที่วิกฤตอย่างเหมาะสมเพื่อบรรลุเป้าหมายของโครงการ งานวิจัยนี้ศึกษากลยุทธ์การตอบสนองความเสี่ยงของผู้รับจ้างก่อสร้างเวียดนามในโครงการก่อสร้างนานาชาติด้านอุตสาหกรรมในประเทศ ความเสี่ยงในโครงการดังกล่าวถูกรวบรวมและตรวจสอบความถูกต้องเหมาะสมโดยกลุ่มผู้เชี่ยวชาญทั้งจากผู้รับจ้างก่อสร้างและที่ปรึกษาผ่านการสัมภาษณ์เชิงลึกและการสำรวจโดยแบบสอบถาม งานวิจัยนี้ได้วิเคราะห์การจัดสรรความเสี่ยงดังกล่าวในสัญญาโครงการก่อสร้างจริง จากนั้นจึงรวบรวมกลยุทธ์การตอบสนองความเสี่ยงสำหรับแต่ละปัจจัยเสี่ยงโดยผู้รับจ้างก่อสร้างทั้งหมดที่ร่วมการวิจัย กระบวนการ Delphi แบบสองรอบได้ถูกใช้เพื่อหาข้อสรุปเกี่ยวกับยุทธศาสตร์การตอบสนองความเสี่ยงของผู้รับจ้างก่อสร้าง ผลการวิจัยแสดงว่าปัจจัยเสี่ยงในโครงการก่อสร้างนานาชาติด้านอุตสาหกรรมในเวียดนามมีทั้งสิ้น 29 ปัจจัยเสี่ยง โดยผู้รับจ้างก่อสร้างต้องรับผิดชอบ 25 ปัจจัยเสี่ยง และเจ้าของโครงการต้องรับผิดชอบ 4 ปัจจัยเสี่ยง งานวิจัยยังได้ระบุเกณฑ์หลัก 9 ประการซึ่งผู้รับจ้างก่อสร้างพิจารณาเมื่อต้องเลือกกลยุทธ์การตอบสนองความเสี่ยงที่เหมาะสม ผลวิจัยนี้สามารถนำไปใช้สร้างระบบจัดการความเสี่ยงในโครงการก่อสร้างนานาชาติด้านอุตสาหกรรมในเวียดนาม นอกจากนั้นผู้รับจ้างก่อสร้างสามารถใช้เกณฑ์การตัดสินใจที่นำเสนอเพื่อเลือกกลยุทธ์การตอบสนองความเสี่ยงเพื่อบรรลุเป้าหมายของโครงการต่อไป

ภาควิชา วิศวกรรมโยธา ลายมือชื่อนิสิต .....

สาขาวิชา วิศวกรรมโยธา ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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KEYWORDS: RISK-RESPONSIVE STRATEGY, INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECT, VIETNAMESE CONTRACTOR, PROJECT MANAGEMENT

HANG THI THU LE: RISK-RESPONSIVE STRATEGIES BY LOCAL CONTRACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS IN VIETNAM. ADVISOR: ASSOC. PROF. VEERASAK LIKHITRUANGSILP, Ph.D., 160 pp.

Inefficient construction risk management mainly contributes to project delay and cost overrun for Vietnamese construction firms in international construction environments. The main task of Vietnamese contractors is to respond to critical risks appropriately to achieve project goals. This research investigates risk-responsive strategies by Vietnamese contractors of international industrial construction projects (IICPs) in Vietnam. The risks in IICPs are compiled and verified by a group of IICP experts from contractors and consultants through in-depth interviews and questionnaire surveys. The allocation of such risks is identified through analyzing actual IICP contracts. The research examines the risk-responsive strategies for each risk factor by different contractors. A two-round Delphi process is adopted to conclude the contractors' risk-responsive strategies.

The results shows that there are 29 risk factors for IICPs. Among them, 25 risk factors are responsible by the contractor, and the other 4 risk factors are borne by the owner. The research also identifies nine major criteria that the contractors consider when choosing appropriate risk-responsive strategies. These results can be used to create risk management systems for ICCPs. Furthermore, based on the proposed criteria contractors can adopt appropriate risk-responsive strategies to achieve project goals.

Department:	Civil Engineering	Student's Signature	.....
Field of Study:	Civil Engineering	Advisor's Signature	.....
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CHAPTER 1 INTRODUCTION

1.1 Background

The construction industry is one of the most important industries of the Vietnamese economy. Not only does it affect Gross Domestic Product (GDP), but it also has a significant impact on other industries and services. From 2009 to 2013, the Vietnamese construction industry had had a strong growth rate with the compound annual growth rate of 16.12%. However, the growth had slowed from 19.7% in 2011 to 7% in 2013 due to a slump in the property market, the banking system characterized by non-performing loans, and the sluggish real estate sector. Nevertheless, the overall industry outlook is still favorable because the government continues focusing on the industrial and residential construction. Thus, the construction industry is expected to expand to a compound annual growth rate of 11.43% over the forecast period from 2014 to 2018 (Vietnam International Arbitration Centre, 2014).

After Vietnam has joined the World Trade Organization (WTO) on November 7th, 2006, foreign investment capitals in Vietnam have increased continuously, as shown in Figure 1.1. The manufacturing industry has attracted foreign investors with the total registered capital of over $60.2 billion USD in 2008, tripling the figure of the previous year. The private sector plays a major role in driving the industry's growth. Not only has the private sector invested in the residential construction segment, but it has also greatly invested in the manufacturing and processing industry segments, as shown in Table 1.1. The number of industrial construction projects has been increasing; however, most of the local contractors lack managerial skills, funds, and effective methods to manage risks in construction contracts. As a result, it is very challenging for them to compete in such dynamic and risky marketplace (Vietnam General Statistical Office, 2014).

The Vietnamese construction market enjoys several advantages over other markets in the region due to lower construction costs. The technological capacity of

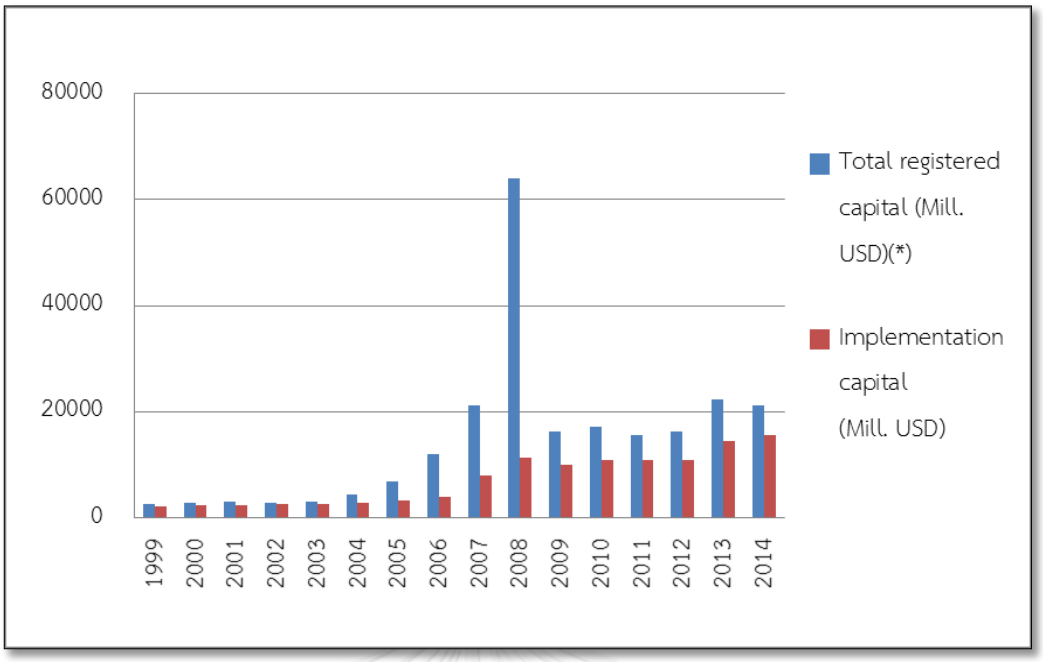

Figure 1.1 Foreign direct investment in Vietnam from 1999 to 2014

(Vietnam General Statistical Office, 2014)

local contractors have improved considerably from one earlier project to the others. In recent years, the number and the size of construction projects in Vietnam have increased continuously. However, many Vietnam contractors cannot enjoy potential profits due to the lack of systematic and effective risk management system. To develop a good risk management system, contractors must understand contract clauses and can identify critical risk factors resulting from ambiguous and incomplete contract clauses. In industrial construction projects, foreign construction firms typically subcontract a majority of construction works to domestic contractors, leading to severe competition among local contractors (Bui, 2010). Among all types of risk, contractual risks are the main cause of disagreement and conflict in construction, as shown in Figure 1.2. The industrial construction projects also entail different sizes, functions, and site conditions contributing to different risks associated with construction works. Thus, there is an urgent need for developing an appropriate risk management system

Table 1.1 Gross output of industry at current prices by types of ownership (Vietnam General Statistical Office, 2014)

Types of ownership	Structure in gross output of industry (%)					
	2005	2006	2007	2008	2009	2010
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
State	24.9	22.1	19.9	18.1	18.3	19.1
Central	19.2	17.3	15.9	15.0	15.3	16.8
Local	5.8	4.8	4.0	3.1	3.0	2.3
Non-State	31.3	33.5	35.4	37.3	38.5	38.9
Collective	0.4	0.4	0.3	0.3	0.4	0.4
Private	22.8	25.6	27.8	30.1	31.4	32.5
Households	8.1	7.5	7.3	6.9	6.7	6.0
Foreign invested sector	43.8	44.4	44.7	44.6	43.2	42.0

for Vietnamese construction companies. The system must be able to identify, assess, analyze, and propose appropriate risk response strategies for each critical risk factor in industrial construction projects.

1.2 Problem statement

With the advantages from the Vietnam investment policies during the renewal process, the number of the foreign investors are increasing especially in the industrial production. The development of economic sector leads to the increasing demand in the built facilities which bring the abundant job source for Vietnam construction companies. Local contractors have more advantages than foreign contractors in the construction sector because they were familiar with the cultural, the political, and legislation of Vietnam. However, there is 30 percent of the total construction capital loss because of the poor of the project management (Nguyen, Ogunlana, & Lan, 2004). Moreover, in reality, most of the Vietnamese contractors do not have any tools to manage the project risks. The process of identifying the risk, assessing the risk and

responding the risk was conducted under the subjective judgments of the project managers and the site managers.

Successful construction projects mainly result from how well project participants manage risks. Risk must be managed through sound business and construction practices, especially careful preparation and review of project contract documents. An important step of successful risk management is identifying relevant risk factors before signing contract. Theoretically, contract documents allocate the responsibility for certain risks to the best party to handle them so that their likelihood and associated cost are minimal (Dale et al., 2004).

In Vietnam, the number of business disputes has been increasing after Vietnam became a member of the World Trade Organization (WTO) and East Asia Community, as shown in Figure 1.3. As a member, Vietnam must allow other member country's construction companies to work in the construction industry. Although Vietnamese contractors have more advantages than the foreign contractors due to their familiarity with local cultures, they still lack experience in the complex project works, the management ability, the financial capacity, the knowledge on new, and the new construction technology (Vietnam International Arbitration Centre, 2014).

Contractors must perform their works efficiently under the contract provisions that they agreed. The contract is the reference where risk allocation schemes between parties is defined and settled. Since contractors usually cannot specify contract terms and conditions. Thus, they need to understand which risks they must be responsible under contract provisions. The complexity of the legal system led to the limited number of research works concerning contractual risks which are the main cause of conflicts and disputes in construction projects (Rahman & Kumaraswamy, 2004).

Typically, a construction contract is prepared by the employer's representative. In most construction projects, most of the project risks are allocated to contractors. Therefore, contractors need to understand and recognize potential risks that are specified explicitly and implicitly in contracts. Contractual risks can affect various

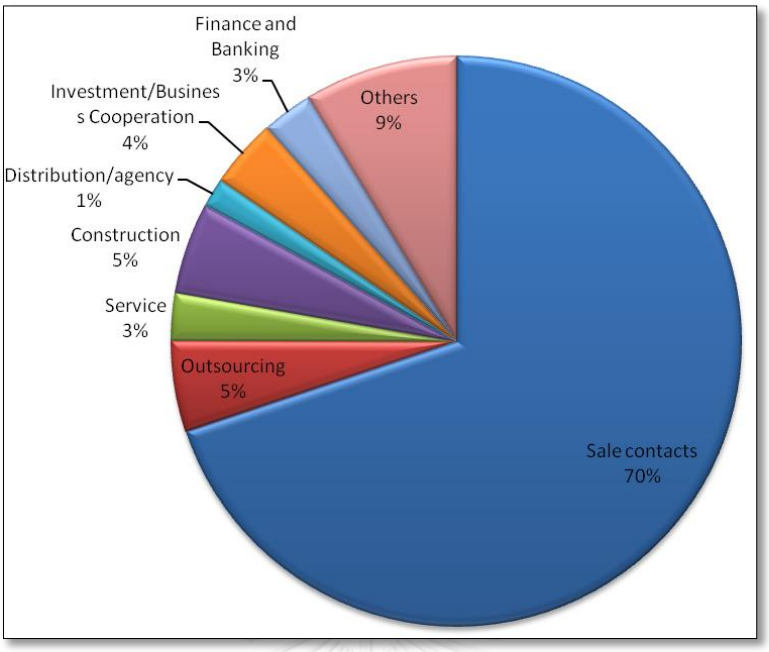

Figure 1.2 Types of disputes (Vietnam International Arbitration Centre, 2014)

project objectives such as scope, schedule, cost, and quality. For example, a dispute event from the ambiguity of contract document can be a cause of the project delay and cost overrun.

To mitigate disputes, improve communication, and maintain relationships among the construction parties. Vietnamese contractors need to identify the risk accurately in the project. Then, he needs to find the agent who has knowledge and experience to respond the risk properly.

1.3 Research objectives

The main objective of this research is to examine the appropriate risk-responsive strategies that help the contractors manage their projects risks effectively in the implementation of contract agreements. Another objective of this study is to identify the major criteria which the contractors consider when choosing alternative risk-responsive strategies for each risk factor in IICPs in Vietnam.

1.4 Scope of the research

This research focuses on risk-responsive strategies employed by local contractors for IICP risks in Vietnam. The necessary data was collected through a questionnaire survey and in-depth interviews based on the principle of Delphi the method. The respondents who participated in this study are top or middle staff members of Vietnam construction firms. The results of risk identification and risk allocation support the process of responding to risks smoothly and precisely.

1.5 Research methodology

Figure 1.4 illustrates this study's proposed methodology, which consists of eleven steps as follows:

Step 1**:** Conduct a literature review.

The first step is to review the relevant knowledge from academic journal papers, textbooks, conference papers, and reports by focusing on risks and risk management processes in construction projects.

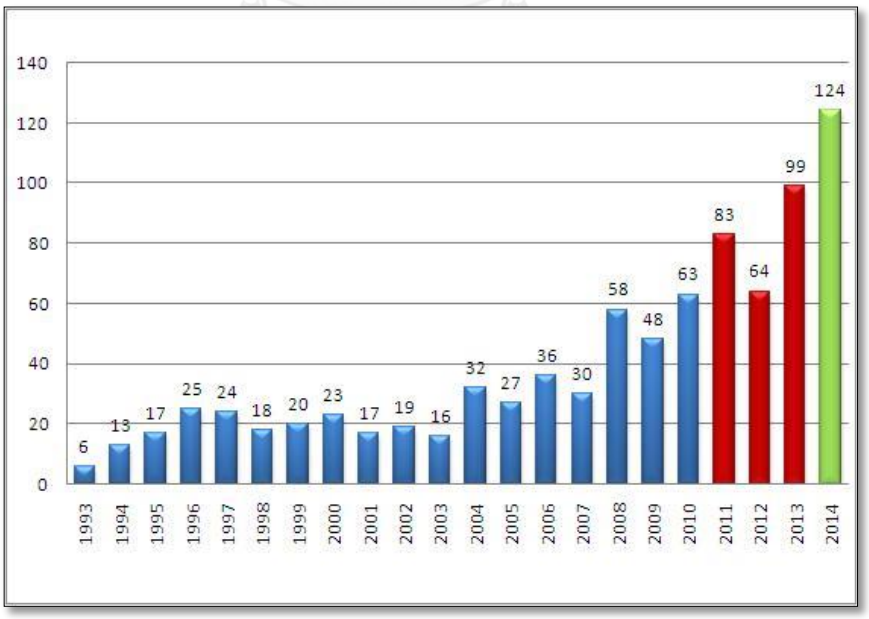

Figure 1.3 Number of disputes from 1993 to 2014

(Vietnam International Arbitration Centre, 2014)

Step 2**:** Identify the preliminary risk checklist.

The second step is to collect the various types of risks encountered in different construction projects described in journal papers. To make sure of the appropriateness of the preliminary risk checklist, this study collected data from high-quality journals of several countries.

Step 3: Verify total risk factors for IICPs in Vietnam.

The third step is to verify those risk factors that can occur in the implementation processes of IICPs in Vietnam by the judgments of experts who have taken and are taking part the IICPs. This step also describes the characteristics of each risk factor approved for the list of IICP risks in Vietnam.

Step 4: Compare the contractual risk allocations in three reference contracts.

The fourth step is to compare and examine the contractual risk allocation in three reference contracts, consisting of the Federation International Des Ingenieurs-Conseils (FIDIC) red book 1999, Vietnam's standard form. For construction contracts (VSFCC), and Southern Steel Factory Construction Contracts (SSFCC).

Step 5: Identify and verify risk allocation for IICPs.

The fifth step is to identify the responsibilities of both the contractor and the owner in the handling of each risk factor that was not stipulated in the three reference contracts, and to clarify, by the in-depth interviews, the risk allocation for each risk factor that was stipulated, but with unspecified allocations, in the contracts.

Step 6: Develop a preliminary list of risk-responsive strategies.

The sixth step is to collect risk-responsive strategies for the construction projects from books and papers. To make sure of the reliability of the data, this study chose high-quality literature.

Step 7: Establish the risk-responsive strategy checklist.

The seventh step is to select the risk-responsive strategies employed by Vietnamese contractors in IICPs. The results of this step were used to design the main questionnaire for this study.

Step 8: Collect the preliminary results of the alternative risk-responsive strategies used by Vietnamese contractors for IICPs.

The eighth step is to gather alternative risk-responsive strategies employed by Vietnamese contractors for each risk factor in IICPs by using the questionnaire and the first round Delphi process.

Step 9: Justify the results of step 8 with in-depth interviews.

The ninth step is to justify the results of step 8 with the in-depth interviews and the second round Delphi process. The respondents were given an opportunity to change their answers in the first round.

Step 10: Present final results, conclusions, limitations, and recommendations.

In step 10, after analyzing and summarizing the results of the two-round Delphi process, we discuss the final results, conclusions, and limitations of this study. Furthermore, this step also recommends the orientations for future research studies.

1.6 Outcomes

The summary of alternative risk-responsive strategies used by Vietnamese contractors for IICP risks and the identification of the criteria that were considered for choosing the appropriate risk-responsive strategies for each risk factor are the outcomes of this study.

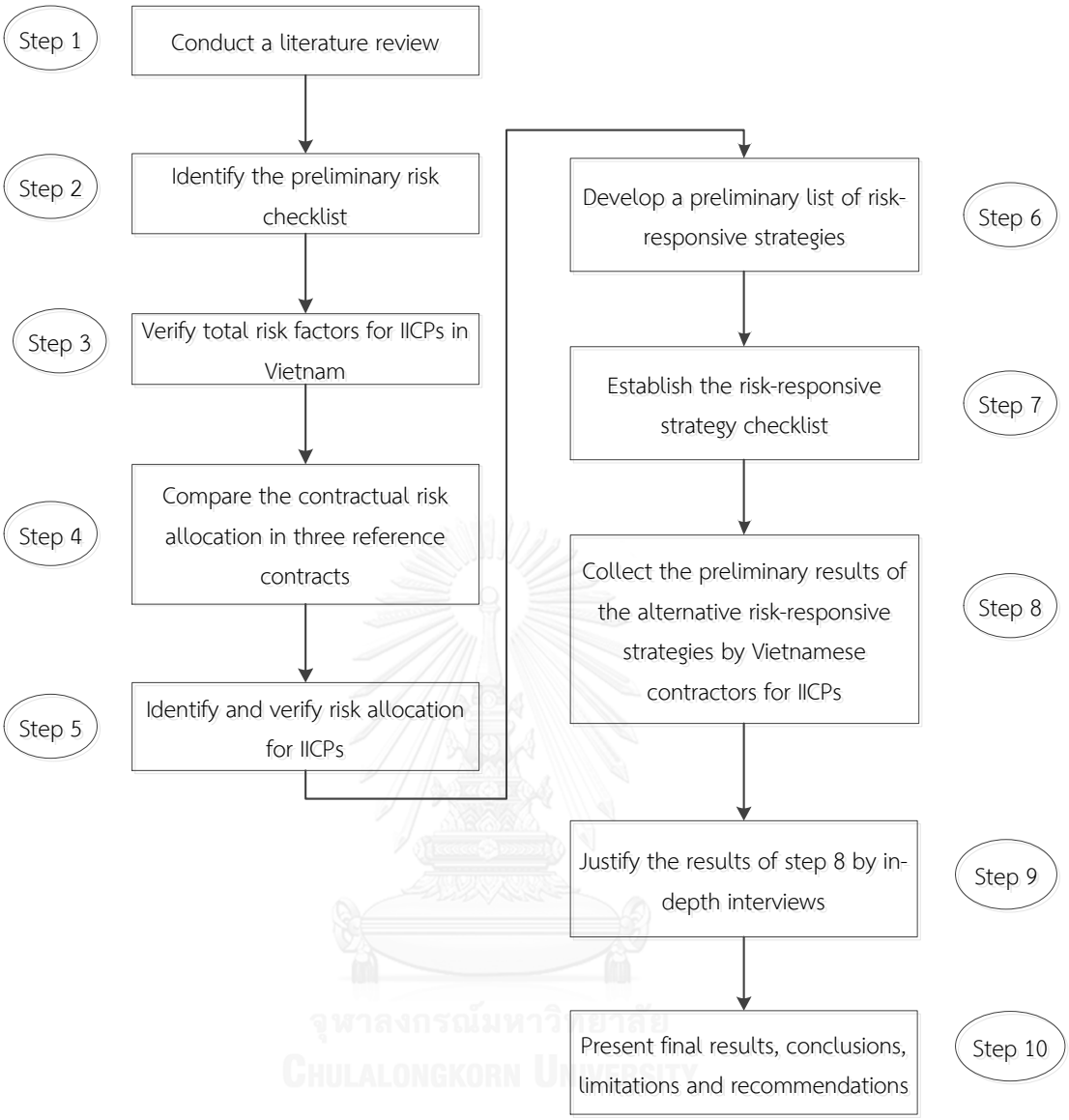

Figure 1.4 Research methodology process

CHAPTER 2LITERATURE REVIEW

This chapter provides the basic knowledge and relevant theories in the construction projects for this study. The first section focuses on types of risk in the construction projects. The second section focuses on risk management process and benefits of risk management. The third section discusses the Delphi method. The final section presents the research gaps.

2.1 Risks in the construction projects

2.1.1 Definitions of risk and risk theories

Risk is an abstract concept that is very difficult to define and impossible to measure with any precision in some cases. Risk can travel in two directions: the outcome may be better or worse than originally expected. These are called the upside and the downside risks, respectively (Smith, 1999).

Risk and the uncertainty is applied to forecast the price and/or time for a part of or the whole works in construction projects. Similarly, risk and uncertainty will be attached to assume inclement weather conditions, inflation, strikes and other external aspects of projects. Risk has also been defined as the exposure to the possibility of economic and financial loss or gain, physical damage or injury, or delay as a consequence of the uncertainty associated with pursuing a particular course of action (Lam & Chow, 1999).

Some people like to distinguish between risk and uncertainty. The distinction is usually that risk is taken to have quantifiable attributes, whereas uncertainty does not. A risk arises when it is possible to make a statistical assessment of the probability of the occurrence of a particular event. The risk is at the most assessable end of the continuum. There may even be some statistical data from which to produce an evaluation of the likelihood and size of the potential risk.

Before going into the details of risk management, there are many related concepts that should be clarified, as done below:

- A risk factor is any attribute, characteristic or exposure of a factor that could affect the outcome of a project for better or for worse.
- Risk identification is the first phase of the risk management process done to:
  - Identify all significant types and sources of risk and uncertainty associated with each objective and key parameter of a construction project.
  - Ascertain the cause of each risk
  - Assess how risks are related to other risks and how risks should be classified and grouped for evaluation.
- Risk allocation is a lengthy process for choosing the appropriate parties to respond to the risks.
- Risk response is a plan that is prepared towards the end of the risk preview in order to control the risks once the implementation begins.
- Risk management is a system consisting of many processes, which are risk identification, risk classification, risk analysis, risk attitude and risk response (Flanagan & Norman, 1993).

2.1.2 Characteristic of risks in the construction project phases

The risks in a traditional construction project are apportioned among the owner, the contractor, the engineer, the subcontractor and the supplier within the various contractual relationships. Flanagan presented the characteristics of risks in construction projects:

- Design risk: the contract parties bear the risk of liability for latent defects occurring as a result of errors in design.
- Construction cost risk: contract parties assume the risk of how much it would cost to do the project.

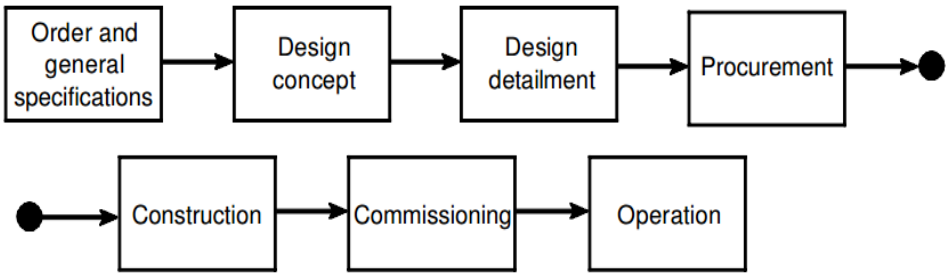

Figure 2.1 Stages of a construction project (M. L. Ribeiro Ferreira, 2010)

- Workmanship and materials risk: the party is responsible for the quantity, the professional team, the prime contractor, the specialist contractors, and the material suppliers to ensure the acceptance of the quality.
- Safety risk: it is customary for one party to agree to indemnify the other for all damages and liabilities due to third parties involved in the works.

When the project is conceived, the client has to undertake an initial risk assessment and evaluate whether the risks associated with the project are high or low. From this, the client will be able to decide whether the risk exposure is acceptable. Risk analysis will be undertaken in order to decide whether to proceed with the project. It may be that the risks associated with the project are high, but the careful development of the project execution plan may eliminate, transfer or insure the risks.

The construction project goes through different stages, as shown in Figure 2.1. The owners and the contractors have different types of risks and the percentages of risks depend on the types of contract formations, as shown in Table 2.1 (M. L. Ribeiro Ferreira, 2010).

Various studies have attempted to identify risks and a wide range of risk issues for specific types of project, location and contractual arrangement. The risk types used in this study were also recognized by later studies.

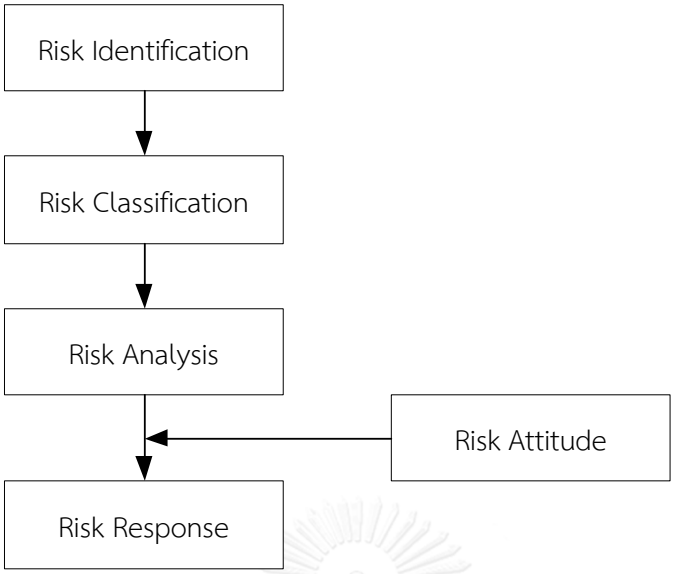

Figure 2.2 Framework of risk management (Flanagan and Norman, 1993)

2.2 Risk management in construction projects

2.2.1 Risk management process

There are many definitions of risk management, such as the risk management process of Flanagan and Norman in Figure 2.2, or the risk management cycle of Nigel J. Smith, as shown in Figure 2.3. Risk management is not simply identifying the risks, but is also about analyzing the implications, and responding to minimize the consequences and the likelihood of risk.

Risk identification is the first step of risk management. Both contract parties need to identify the risks properly by using a variety of techniques suited to the types of construction projects and the appropriate resources. In this process, a clear view of the events is the first requirement, focusing on the sources of risk and the effects of the event.

Based on the findings of Keci and Oztas, we can know about abundant traditional techniques, such as brainstorming, the Delphi technique, checklists and questionnaires, used to identify risks in construction projects (Keci, 2014). Table 2.1 shows the strengths and weaknesses of each technique.

The hierarchical structure of risks is a very practical tool. Haimes (2005) found that by using the risk breakdown structure, an iterative process can be initiated that will persist throughout the project lifecycle. The benefit of hierarchical risk breakdown structure (HRBS), not only in the identification phase as a simple checklist, gives a general overview to ensure complete coverage by mapping the identified risks in each category, offering a synthetic view on risk, but also supporting further stages (Haimes, 2005). Therefore, the HRBS was chosen to identify the risk factors for IICPs in Vietnam. A risk breakdown structure is a hierarchy of potential risk categories for the project.

Risk classification is used to manage risk factors in a systematic way. After identifying the risk factors, we have to classify them. Risk is undertaken during this stage in order to allocate the ownership of risk to the individual best placed to control and manage it. Then, the party responsible for the risk is recorded on the risk register. If a risk not identified, it cannot be evaluated and managed.

Risk analysis: Flanagan and Norman (1993) indicated that the main purpose of a risk management system is to assist businesses in taking the right risks. An integral part of the system is risk analysis. The wider and more efficient use of computers is

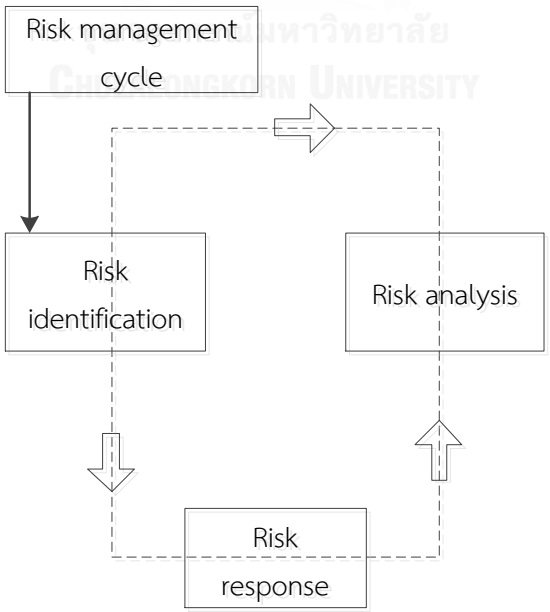

Figure 2.3 Risk management cycle (Nigel J. Smith, 2006)

Table 2.1 Risk identification tools: strengths and weaknesses (Keci, 2014)

Technique	Strength	Weak
Brainstorming	_ Allows all participants to speak their mind and contribute to the discussion. _ Can involve all key stakeholders. _ Creative generation of ideas.	_ Requires attendance of key stakeholders at a workshop, therefore can be difficult to arrange and expensive. _ Prone to groupthink and other group dynamics. _ May produce biased results if dominated by a strong person. _ Often not well facilitated. _ Generates non-risks and duplicates, requires filtering
Delphi technique	_ Captures input from technical experts. _ Removes sources of bias	_ Limited to technical risks. _ Dependent on actual expertise of experts. _ May take longer time than available due to iterations of expert's inputs.
Check list	_ Captures previous experience. _ Presents detailed list of risks	_ Checklist can grow to become unwieldy. _ Risks not on the list will be missed. _ Often only includes threats, misses opportunities.
Questionnaire	Encourages broad thinking to identify risks	_ Success depends on the quality of the questions. _ Limited to the topics covered by the questions. _ Can be a simple reformatting of a checklist.

likely to encourage much more rigorous analysis of risks. The time has now arrived when more significant risks can be evaluated with economic advantages.

This analysis refers to evaluating the opportunity of risk occurrence and the consequences of the risk that will impact the business decisions of both the contractor and the owner. Risk analysis is divided into qualitative analysis and quantitative analysis, and is classified into six steps:

Figure 2.4 Overview of risk treatment (Dale, Stephen, Geoffrey, & W., 2004)

1) Consider alternative options.

2) Take risk attitudes into account.

3) Consider opportunities for risk and the likely impacts.

4) Take both quantitative and qualitative measurements.

5) Interpret the results of the analysis.

6) Develop a strategy to deal with the risk.

Risk response: After the risk factors have been identified, analyzed, and allocated, the next step is to determine how to respond to each risk. The alternative method was decided based on the assessment of the effectiveness and the costs of mitigation. The uncertainty of the probability of occurrence or potential impact should decrease when selecting the appropriate risk-responsive strategy. Four strategies commonly used are: risk retention, risk reduction, risk transfer and risk avoidance (Clayton, 1982). Additionally, the overview of the process of selecting and developing risk-responsive strategies is shown in Figure 2.4.

All projects or business ventures involve risks of various kinds. In practice, it is virtually impossible to avoid all downside risks, but they can often be reduced and sometimes be transferred through contracts, financial agreements, concessions, franchises and insurance policies. However, there is usually some residual risk. For

example, the general contractor or concessionaire can become insolvent and consequently not fulfill its obligations (Smith, 1999).

There is a growing realization that the key to success in investments is not to ignore or be intimidated by risk, but to analyze and manage it effectively. Organizations should not necessarily be risk averse, except for risks that could threaten their survival or expose people to the possibility of serious injury or death. 'Nothing ventured, nothing gained', as the old saying goes. One of the major advantages of risk analysis and control is that it allows profitable opportunities to be exploited, which would otherwise be judged to be too risky. Another advantage is that it leads to positive action in order to minimize the risks of adverse events as far as is practicable and economic. The risk is often most efficiently managed by arranging for it to be carried by the party best able to understand and control each risk at the lowest cost (Smith, 1999).

More attention is now being paid to upside risks that are more favorable than expected. It is becoming recognized that steps can often be taken at the outset, as part of the risk response program, to increase the chances of these favorable outcomes occurring and maximizing the returns if they do occur.

2.2.2 Benefits of risk management

The benefits of risk management for construction projects include:

- To clearly define risks associated with the project.
- To clearly define risks associated with the project.
- To support management decisions through the analysis of data
- To improve and monitor the risk management planning
- To support a part of the risk response plan, such as the provision of alternative plans, appropriate contingencies and experiences.
- To improve the model for future projects.

2.3 Delphi method

The Delphi method was used for the data collection and the consensus of the expert opinions. According to Rowe and Wight (2001), there are four ways to apply the Delphi technique: (1) the participant is allowed to express their opinions without them being made public, (2) the participant is allowed to change their opinions given in a previous round, (3) the participant is shown the feedback of then other participants for the opportunity to change opinions given in previous rounds, and (4) the quantitative method is used to analyze the statistical results (Gregory J. Skulmoski, 2007).

For construction engineering and management (CEM), the Delphi technique is particularly useful for experimental research and the achievement of the consensus of the data through multiple rounds (Hallowell & Gambatese, 2010). According to Dalkey et al., the Delphi results are most accurate after the second round, and become less accurate after additional rounds (Dalkey, 1970).

2.4 Research gaps

Foreign owners have tended to select lump sum contract formation for manufacturing plant projects in Vietnam. Such contracts help the owner transfer the risks of the project cost fluctuations to the contractors.

Table 2.2 Owner's responsibilities x types of contract (Ferreira & Rogerson, 1999)

Type of contract	Order and general specifications	Design concept	Design detail	Procurement	Construction	Commissioning	Operation
Cost reimbursable	●	●	●	●	○	⊙	●
Guaranteed	●	●	●	●	○	⊙	●
Fixed price	●	●	●	●	○	⊙	●
Turnkey	●	○	○	○	○	○	●

● Total; ⊙ Partial; ○ None

Due to innovations in technical construction, Vietnamese contractors are, step by step, affirming their position in the local and international construction markets. However, throughout the literature, we could see that Vietnamese contractors still continued to face difficulties, such as language barriers, new technical knowledge, financial capacity and work experience, in complex projects because of poor risk management systems. Some Vietnam construction companies did not even have a risk management system for their construction projects.

The risk response is a key component of risk management in construction projects, and involves choosing the appropriate measures to avoid or reduce the chances of risk occurrence, as well as to mitigate the impact of risks that are unavoidable. The differences of risk management policy depend on each Vietnam construction firm. So, it is very difficult to evaluate the effective performance of each risk-responsive strategy. Most of the previous research have mentioned only risk identification and assessment in construction projects. Therefore, this research tries to analyze the risk-responsive strategies that were chosen by local contractors for IICPs in Vietnam. Furthermore, this study also identifies the criteria used by Vietnamese contractors to choose alternative risk-responsive strategies.

CHAPTER 3 RESEARCH METHODOLOGY

This chapter presents the research methodology used in this study. Each step in the research consists of a main purpose, the research technique, and the research process. As mentioned in Chapter 2, the questionnaire and the in-depth interview were adopted as the two main tools used to identify the IICP risks, as well as to examine and identify risk allocation for both contract parties for IICPs in Vietnam. The Delphi method was used to collect data and ensure the consensus of the data in the risk response process.

3.1 Overview of research process

Table 3.1 presents a brief overview of the 11 research steps, which were established based on the three processes of the risk management system: identifying, allocating and responding to risk. The differences of the techniques, the sources of the data, and the results of each research step have been summarized.

3.2 Risk identification methodology

3.2.1 Develop risk checklist from literature review

The objective of this step is to develop the preliminary list of risk factors for IICPs in Vietnam through a literature review. To increase the chance of obtaining the proper results, this study searched for and collected the data from high-quality journals. Then, the hierarchy risk breakdown structure was applied to describe the total risk factors.

3.2.2 Verify the results of risk identification

To ensure the appropriateness of the risk categories, this study conducted in-depth interviews of five experts who were working in the IICP.

Table 3.1 Contents of research methodology process

Step	Description	Technique	Source of data	Results
1	Conduct a literature review	Literature review	Books and papers	Research objectives
2	Identify the preliminary risk checklist	Literature review	Journal papers	Hierarchical risk breakdown structure in chapter 4
3	Verify total risk factors for IICPs in Vietnam	Questionnaire and in-depth interview	Literature review	The result of risk factor in IICPs in chapter 4
4	Compare the contractual risk allocation in three reference contracts	Reference documents	FIDIC 1999 Red book, the VSFCC, the SSFP	Result in chapter 5
5	Identify and verify risk allocation in IICPs	Questionnaire and in-depth interview	Risk catergories and reference documents	The result of risk allocation in chapter 5
6	Develop a preliminary list of risk-responsive strategies	Literature review	Books and journal papers	List of risk-responsive strategies in chapter 6
7	Establish the risk-responsive strategy checklist	Checklist technique	List of risk-responsive strategies in chapter 6	The risk-responsive strategies checklist of this study
8	Collect the preliminary results of the alternative risk-responsive strategies used by Vietnamese contractors for IICPs	The first round Delphi process	Questionnaire	The result of alternative risk-responsive strategies in chapter 6
9	Justify the results of step 8 by in-depth interviews	The second round Delphi process	Result from step 8th	Result in chapter 6
10	Present final results, conclusions, limitations, and recommendations		Result from step 1st to step 9th	Result in chapter 7

3.3 Risk allocation methodology

3.3.1 Comparison of risk allocations from three reference contracts

The study compared and examined the risk allocation for both the contractor and the owner for each risk factor identified in the last step through three reference contracts consisting of the Federation International Des Ingenieurs-Conseils (FIDIC) Red Book (1999), Vietnam's Standard Form for Construction Contracts (VSFCC), and the Southern Steel Factory Construction Contract.

3.3.2 Clarify risk allocation

The in-depth interviews were conducted with the pilot expert group to identify those risk factors that had not been stipulated in the contract and to clarify the risk allocations for each risk factor stipulated, but with unspecified allocations, in contract format. The results of this study are divided into three groups: the contractor's risks, the owner's risks, and the shared risks.

(1) The contractor's risks: the risks incurred by the contractor when implementing the works
(2) The owner's risks: the risks borne by the project owner
(3) The shared risks: the risks borne by both contract parties in the construction projects

3.4 Risk response methodology

There are four risk response techniques often used in the construction projects, including risk avoidance, risk transfer, risk retention and risk reduction, as shown in Figure 3.1.

3.4.1 Risk elimination

Risk elimination is sometimes referred to as risk avoidance, which is useful as a fairly common strategy for managing risks. By avoiding exposure to risk, the contractor

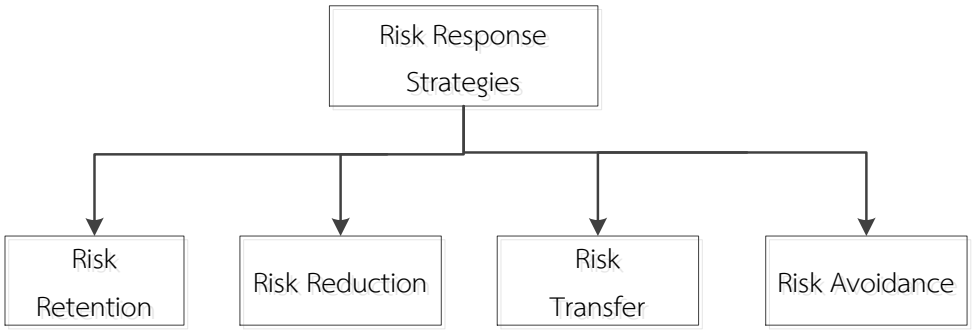

Figure 3.1 Risk-responsive strategies in the construction project

can avoid potential losses. The contractor will reject or change an alternative strategy to remove the hidden risk.

This study gathered some risk avoidance strategies for both the contractor and the project owner of the construction projects:

- Risk avoidance by tendering a very high bid.
- Risk avoidance by placing conditions on the submission of the bid.
- Risk avoidance by not bidding on the high-risk portion of the contract.
- Risk avoidance by not proceeding with the project.
- Risk avoidance by changing the commencement period of the project.

For example, a contractor concerned about the potential losses associated with asbestos material or hazardous waste could avoid risk by never acquiring any object that involves operations with such materials. Similarly, the contractor may avoid the political and financial risks associated with a project in a particularly unstable country by not constructing the facilities in this country.

3.4.2 Risk reduction

There are two main objectives for risk reduction, which are mitigating the probability of the occurrence, and reducing the consequences of risk. For example, a contractor may issue safety regulations to prevent the occurrence of risk while performing the works. A contractor may also adjust the workforce to mitigate a project delay or financial losses due to the occurrence of accidents. The research of Al-Bahar

and Crandall presents some risk reduction methods for construction projects (Al-Bahar & Crandall, 1990):

- Scheduling: For example, for risks involving time or weather, rescheduling all or portions of the project may reduce the risks to acceptable amounts, or possibly eliminate the risk altogether.
- Education: For example, many construction risks are related to safety, and may adversely affect the productivity and quality of the construction.
- Redesign: The losses from the consequences of risk can often be reduced by a judicial redesign to incorporate the construction plan.

3.4.3 Risk transfer

Risk transfer means that the risk will be transferred to other parties by subcontracting. According to the literature review, there are two popular methods for risk transfer, which are subcontracting and the purchasing of insurance.

- Risk transfer by insurance: The contractor may purchase an insurance contract with certain deductibles. The insurance company bears responsibility for the compensation of losses, especially serious ones that are the consequences of risk events.
- Risk transfer by subcontracting: Under subcontracting provisions, the subcontractor bears responsibility for the losses from his work package.

3.4.4 Risk retention

Risk retention can be either planned or unplanned. For unplanned risk retention, the manager, whether conscious of a risk or not, does not take any action to mitigate the risk. For planned risk retention, the manager decides to take no action for a risk even after cautious evaluation. Under such a plan, risks can be retained in any number of ways, depending upon the philosophy, the particular needs, and the financial capabilities of the contractor (Al-Bahar & Crandall, 1990).

3.5 Data collection

3.5.1 Data collection for risk identification and allocation processes

The objective of the risk identification stage was to identify the possible risk factors for IICPs in Vietnam. In addition, the risk allocation stage identifies and clarifies the responsibilities of the contractor and the owner for each risk factor in the IICP. The data were collected from various people who had experience in managing project risks for Vietnamese construction firms. The questionnaire was used to collect the data, because it is a faster and cheaper instrument than are other instruments.

The questionnaire was designed to take the opinions of the top and middle staff members, such as senior site engineers, project managers, and senior managers, as well as those filling the upper positions in Vietnamese construction companies in the IICP. The questionnaire was delivered to five experts to collect data for this study. The data collection processes were executed in August 2015. Following the opinions of the participants, some amendments were made to the questionnaire for it to be easier to read and more precisely gauge the opinions of the respondents.

3.5.1 Data collection for risk response process

A key decision in academic research is the selection of an appropriate research methodology. The Delphi method is a flexible technique used to collect and distil the judgments of experts by using a series of questionnaires interspersed with feedback. This method works especially well when the goal is to improve our understanding of problems, opportunities, and solutions, or to develop a forecast (Gregory J. Skulmoski, 2007). The risk-responsive strategies of Vietnamese contractors are very difficult based on the characteristics of each risk factor in each construction project. The Delphi

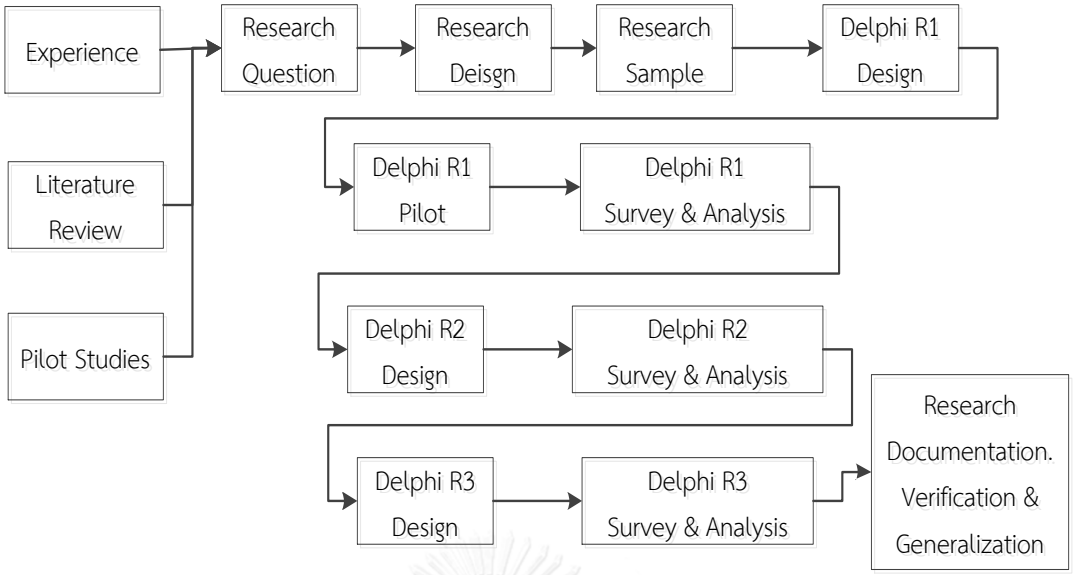

Figure 3.2 Three round Delphi process (Gregory J. Skulmoski, 2007)

method is chosen as an instrument for data collection during the process of choosing risk-responsive strategies employed by Vietnamese contractors in the IICP.

The Delphi technique has many advantages for the data collection (Prasittsom, 2015)

(1) The technique can avoid disputes, as the participants do not require face-to-face meetings.

(2) The technique can obtain highly detailed information, because the participants do not have to make their profile public and are encouraged to express their judgments without having face-to-face meetings with other participants.

The disadvantages of Delphi method are:

(1) The results depend on the actual expertise of experts

(2) The study consumes a longer time than is available due to the repetition of the inputs of the experts.

The three-round Delphi process is summarized in Figure 3.3. This process included some basic steps such as identifying research questions in the literature and pilot interviews, transmitting the questionnaires to experts, collecting and analyzing

the preliminary results, developing the main questionnaire, analyzing the final results, and drawing conclusions.

For this study, the in-depth interview was based on the results of the questionnaire survey. The in-depth interviews were used to justify the results of the first round Delphi process. The respondents had the opportunity to change the answers they had given in the first round. The content and purpose of each round are summarized in Table 3.1.

This study used a two-round Delphi process to collect and justify the reliability of alternative risk-responsive strategies used by Vietnamese contractors in the IICP, as detailed in Table 3.1. During the first round, the participants were required to select risk-responsive strategies for each risk factor in the IICP, as described in the questionnaire. In the second round, the in-depth interviews were conducted with fifteen respondents in order to elicit their explanations of the characteristics of the alternative risk-responsive strategies for each risk factor. The respondents were given the opportunity to change their feedback from the previous round.

The participants were the top or middle staff members, such as senior site engineers, site managers, department manager, and those from the upper positions in Vietnam construction firms working as contractors for IICPs in Vietnam. The surveys were conducted at the construction sites or the headquarters of the construction companies in Ho Chi Minh City.

At the beginning, the participants were invited by telephone and email. Those who agreed to participate were sent the questionnaire by email. After receiving the feedback to the questionnaire, the in-depth interviews were conducted in order to find the explanations and verify the results of the alternative risk-responsive strategies. The respondents were given the opportunity to change their previous selections after the answers of the other respondent were shared. Respondents who maintained their opinions were encouraged to explain their selections in a practical situation. This process helped to improve the reliability of the results. The respondents were chosen following four “expertise” qualifications:

- Knowledge and experience in the issues under investigation
- Capacity and willingness to participate
- Sufficient time to participate in the Delphi process
- Effective communication skills

The data collection process was execute in December 2015. The researcher kept contact with the respondents via email and telephone in order to facilitate the data collection process.

3.5.2 Contents of questionnaire

(1) The first questionnaire

The questionnaire contained two sections. The first section requested the respondent's company and personal information, such as the number of years of experience, current position in the company or project, the number of project participants, the common size of the IICP, and the current risk management system of the company. The next section required verification of the total risk factors that may occur during the process of the IICP in Vietnam. The respondent was also required to explain their selection. The details of the questionnaire's design are given in Appendix A.

(2) The second questionnaire

The questionnaire survey contained two sections. The first section requested the respondent's company and personal information, such as the number of years of experience in construction, the current position in the company or project, the number of project participants, the common size of the IICP, the current risk management system of the company, and the risk allocation in the construction contract documents. The next section required the participants to evaluate risk allocation for both the owner's and the contractor's responsibilities. The details of the second questionnaire are given in Appendix B.

(3) The third questionnaire

This questionnaire contained only one section, and was sent to the pilot expert group by email. The participants were required to verify the risk-responsive strategies

which were or could be applied for responding to the risk of the IICP. The details of this questionnaire are shown in Appendix C.

(4) The fourth questionnaire

This questionnaire survey contained two sections. The first section requested the respondent's company and personal information, such as the number of years of experience in construction, the current position in the company or project, the number of project participants, the common size of the IICP, the current risk management system of the company, the risk allocation in the construction contract documents, and the satisfaction of the respondent with the result of the risk-responsive strategies in their projects. The next section required the participants to choose the appropriate risk-responsive strategies according to the respondent's practical situations or opinions, as shown in Appendix D.

3.6 Conclusion

This chapter describes the guidelines, such as formulating the questionnaire surveys and employing the technology for collecting the data, and ensuring the reliability of the data, for constructing the research methodology of this study. The three risk management processes are based on the principles of risk management systems taken from various textbooks, academic journals, and websites. The data were gathered and verified through many qualitative, semi-quantitative and quantitative techniques. The results of the data collection and data analysis are presented in the following chapters.

Table 3.2 Contents of data collection phases

Phase	Data collection	Content	Purpose
The first	Questionnaires and in-depth interviews	_ Collecting information of participants. _ Identifing risk factors for the IICPs in Vietnam. _ Verifying a list of risk factors for the IICPs in Vietnam by the judgements of experts	To identy total risk factors for IICPs in Vietnam.
The second	Questionnaires and in-depth interviews	_ Collecting information of participants. _ Examining risk allocation between the owner and the contractor under the three reference contracts	To idetify the contractor's risk for IICPs in Vietnam
The third	Questionnaires and in-depth interviews	_Collecting the expert opinions about the risk-responsive strategies can be applied for construction projects in Vietnam	To develop the list of risk-responsive strategies for the questionnaire design
The fourth	Questionnaires and in-depth interviews	_ Collecting information of participants _ Gathering the alternative risk-responsive strategies by Vietnamese contractors for IICPs in Vietnam	To summary the alternative risk-responsive strategies by Vietnamese contractors in the IICPs. And, to idetify the main criteria for choosing risk-responsive strategies

CHAPTER 4 IDENTIFYING RISK FACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM.

This chapter presents risk factors that have already appeared or can arise in International Industrial Construction Projects (IICP) done in Vietnam. The list of risks includes 29 risk factors that were collected from five previous research works. Each risk factor was verified by a pilot expert group. The main objective of this chapter identifies the list of risk factors for the IICPs in Vietnam. The chapter also describes the sources and characteristics of each risk factor, and classifies the factors into five risk categories.

4.1 Development of the preliminary risk checklist

This research collected 32 risk factors found in the five journal papers used for identifying the preliminary risk checklist for this study. The five journal papers chosen were:

(1) Risk management trends in the Hong Kong construction industry: a comparison of contractors and owners perceptions (Ahmed, Ahmad, & De Saram, 1999)

(2) Understanding the key risks in construction projects in China (Zou, Zhang, & Wang, 2007)

(3) Risk management in oil and gas construction projects in Vietnam (Thuyet, Ogunlana, & Dey, 2007)

(4) Perceptions of Singapore construction contractors on construction risk identification (Hlaing, Singh, Tiong, & Ehrlich, 2008)

(5) Major construction risk factors considered by general contractors in Qatar (Abdulaziz & Theodore, 2015)

Table 4.1 shown the results of 32 risk factors proposed by the journal papers

Table 4.1 Risk checklist from the previous studies

No.	Risk factors	Previous studies				
		Ahmed 1999	Zou 2007	Thuyet 2007	Hlaing 2008	Abdulaziz 2015
1	Availability of funds	x	x	x	x	x
2	Cash flow management	-	x	x	x	x
3	Delays in contract payment	x	x	x	x	x
4	Material price fluctuations	x	x	x	x	x
5	Labor price fluctuations	x	x	x	x	-
6	Interest rate changes	-	-	x	-	-
7	Exchange rate changes	-	-	x	x	-
8	Market fluctuations	-	-	x	x	x
9	Quality of design	x	x	x	x	x
10	Design changes	x	x	x	x	x
11	Suitability and quality of materials and equipment	x	x	x	x	x
12	Availability and supply of materials, equipment, workmanship	x	x	x	x	x
13	Productivity of labor and equipment	x	x	x	x	x
14	New technology	-	x	x	x	x
15	Inadequate site investigation	x	x	x	x	x
16	Knowledge and experience of contractor	x	x	x	x	x
17	Safety	x	x	x	x	x
18	Labor strikes	x	x	x	x	x
19	Quality of sampling and testing control	x	x	x	x	x
20	Third party delays	x	x	x	x	x
21	Action led to environmental pollution	x	x	x	x	-
22	Changes in work scope	x	x	x	x	-
23	Delay in possesssion of site	x	x	x	x	x
24	Delays in negotiation of change order	x	x	x	x	x
25	Ambiguities in contract documents	-	x	x	x	-
26	Changes in legislations, policies, and regulations	x	x	x	x	x
27	Problem of approvals and licences	x	x	x	x	x
28	Dispute with residents around site	-	-	x	x	x
29	Corruption and bribery	-	x	x	-	-
30	Adverse weather conditions	-	x	x	x	x
31	Unforeseen site conditions	x	x	x	x	x
32	Force majeure	x	-	x	x	x

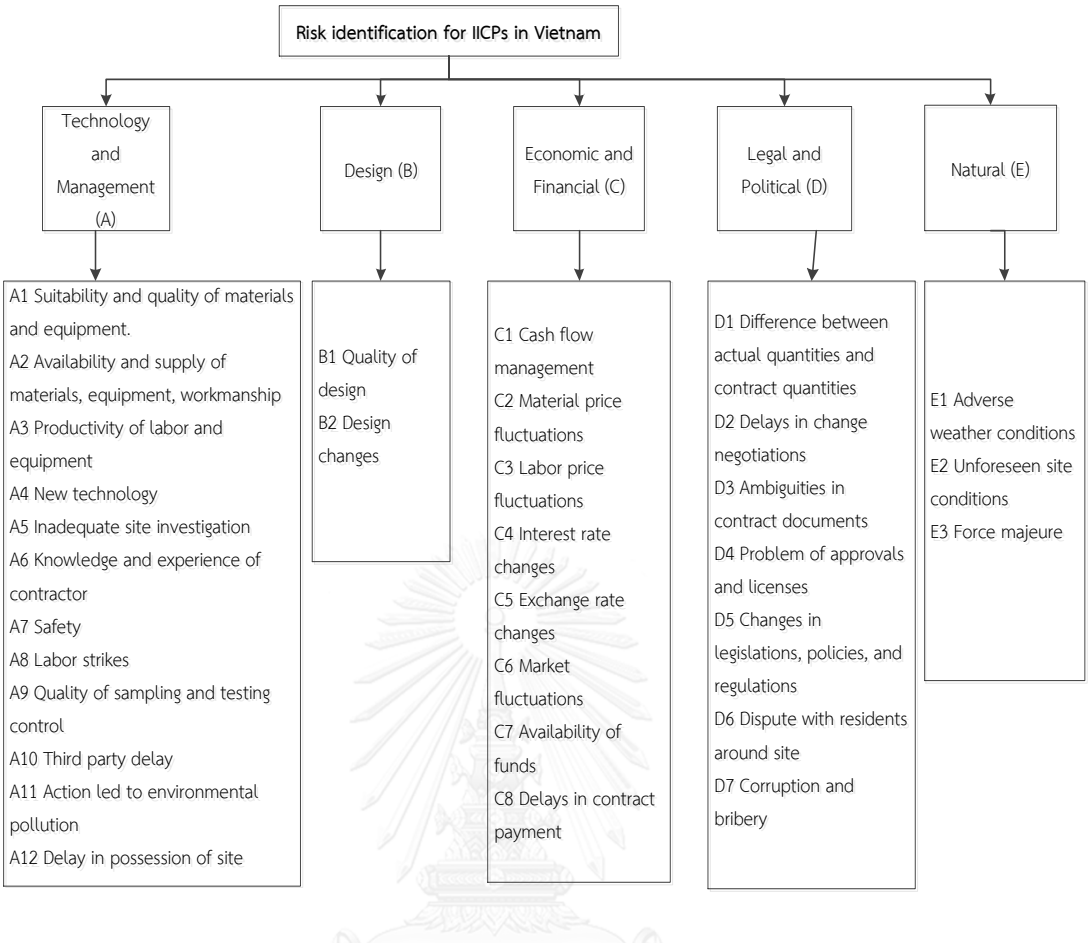

Figure 4.1 Proposed hierarchical risk breakdown structure (HRBS) for the construction contract of IICPs in Vietnam

Each previous study used different terms to name the risks. To facilitate further analysis, this study has renamed the risk factors for consistency. Furthermore, this study has also divided the 32 risk factors into five risk categories, consisting of the technology and management, design, economic and financial, legal and contractual, and natural risk categories.

The results are shown in Figure 3.1. There are 12 risk factors in the technology and management, 2 in the design, 8 in the economic and financial, 7 in the legal and contractual, and 3 in the natural category. The definition of each risk factor is given in Chapter 4.

4.2 Risk identification for IICP in Vietnam

4.2.1 Qualification of respondents

To conduct the risk verification process, this research vetted the experts of the pilot group by three criteria:

(1) The respondent was or is working in at least one IICP in Vietnam

(2) The respondent has at least three years of experience in construction projects.

(3) The respondent is a person, such as a senior engineer, site manager, project owner, department manager and in an upper position, entitled to make decisions in implementing the work process. The backgrounds of the respondents in the risk identification process are presented in Table 4.2.

The in-depth interviews were conducted with five respondents who suited the criteria for participating in this study. There are four experts working in construction firms and one in a project management consultancy company. The average experience of the experts is ranged from five to ten years. At the end of the interviews, the experts were asked to recommend other experts who also suited the criteria.

4.2.2 Characteristics of the IICP in Vietnam

The respondents stated their preference for an IICP ranging from one hundred billion Vietnamese Dong to two hundred billion Vietnamese Dong. For small projects of contract values less than 50 billion Vietnamese Dong, the contractors said that the contractor's profit was too low to pay for head office overhead costs, because the majority of contractors carrying out such project were the large or middle-sized Vietnamese construction firms. Therefore, the contractors often did not want to receive contracts of low value, except for special cases.

The respondents said that the owners tended to choose lump sum contracts for IICPs in order to transfer construction risks to the contractors, who are considered to be more familiar with the Vietnamese construction market. The owners would select

Table 4.2 Background of the respondents in risk identification and risk allocation processes

No.	Position	Experience	Number of IICPs	Company	Type of project
1	Vice Site Manager	5-10 years	> 2	Contractor	Residential, Industrial
2	Project Consultant	5-10 years	> 2	Consultant	Residential, Commercial, Industrial
3	Site Manager	5-10 years	> 2	Contractor	Hospital, Industrial
4	Tender Manager	10-20 years	> 2	Contractor	Residential, Commercial, Official Building, Industrial
5	Vice Technical Manager	5-10 years	> 2	Contractor	Industrial, Residential, Residental

large contractors with sufficient financial capability, knowledge and experience to pursue projects.

The construction market in the southern part of Vietnam has many strong foreign contractors, such as Obayashi Vietnam, Fujita Engineering and Kajima, Sumitomo, who often competed with local contractors in the tendering process, because the foreign owners realized that the risks of working with a local contractor is higher than with a foreign contractor. However, after winning, the foreign contractor often assigned the majority of the work packages to a local subcontractor. For example, Japanese owners usually prioritized Japan construction firms who had representative offices in Vietnam to carry out their projects. The Japanese contractors often divided the project into many work packages, and subcontracted the packages to Vietnamese contractors at lower prices.

To increase a project's income in international construction projects, a Vietnamese contractor needed to develop a risk management system in order to compete with the foreign contractors.

In the in-depth interviews, 29 risk factors were approved by more than 50% of the experts and were entered onto the list of risk factors for IICPs in Vietnam. The results are shown in Table 4.3.

Three risk factors that were not approved to be on the list were delays in possession of the site, disputes with residents around the site, and corruption and bribery

(1) Delay in possession of the site: Under contract provisions, the project owner gives the contractor a legal license to enter the site on the project's commencement day. The respondents said that the contractors were entitled to an extension of time for the project's completion and to compensation for the owner's delay in transferring a part or the whole of project site to the contractor.

The respondents said that the foreign investors always looked at legal information carefully before deciding to invest in the Vietnamese market. The majority of the project owners were from Korea, Singapore, the British Virgin Islands, Hong Kong, Japan and Taiwan. The owners had two options: hiring a small industrial building from a Vietnamese employer or renting land in an industrial zone in order to build their plants.

According to the respondents, most IICPs did not incur much of this type of risk due to the availability of land, and the benefits conferred by the Vietnamese Government for opening investments.

(2) The disputes with residents around the site: This risk is due to residents being negatively affected by the construction works, and the resulting noise and dust. It is the contractor who often consumes the time to solve the problem and bears the costs of compensating the residents.

There are two popular payment methods when renting land in an industrial zone in Vietnam. The renter can pay annually or at once for the whole of the rental period, which usually should not exceed 50 years, except for projects requiring large capital investments, or being constructed in areas having difficult social and economic conditions. In such cases, the investors may receive an extension of the rental duration. However, the total time cannot exceed 70 years.

Table 4.3 Risk checklist from the preliminary expert group

No.	Risk factors	Preliminary group				
		1st expert	2nd expert	3rd expert	4th expert	5th expert
1	Suitability and quality of materials and equipment	x	x	x	x	x
2	Availability and supply of materials, equipment, workmanship	x	x	x	x	x
3	Productivity of labor and equipment	x	x	x	x	x
4	New technology	x	-	x	-	x
5	Inadequate site investigation	x	x	x	x	x
6	Knowledge and experience of contractor	x	-	x	x	-
7	Safety	x	x	x	x	x
8	Labor strikes	x	x	x	x	x
9	Quality of sampling and testing control	x	-	x	x	x
10	Third party delay	x	x	x	x	x
11	Action led to environmental pollution	x	x	x	x	x
12	Quality of design	x	x	x	x	x
13	Design changes	x	x	x	x	x
14	Cash flow management	-	x	-	x	x
15	Material price fluctuations	x	x	x	x	x
16	Labor price fluctuations	x	x	x	x	x
17	Interest rate changes	x	x	x	x	x
18	Exchange rate changes	x	x	x	x	x
19	Market fluctuations	x	x	x	x	x
20	Availability of funds	-	x	x	-	x
21	Delays in contract payment	-	x	x	-	x
22	Changes in work scope	x	x	x	x	x
23	Delays in change negotiations	x	x	x	x	x
24	Ambiguities in contract documents	-	x	x	x	x
25	Problem of approvals and licenses	-	x	x	-	x
26	Changes in legislations, policies, and regulations	-	x	x	-	x
27	Adverse weather conditions	x	x	x	x	x
28	Unforeseen site conditions	x	x	x	x	x
29	Force majeure	x	x	x	x	x

The respondents said that the number of IICPs in Vietnam is increasing. However, most manufacturing plants are built far away from the residential areas.

Therefore, disputes with residents around the site was not approved by the pilot expert group for this study.

(3) Corruption and bribery

This risk is about the exploitation of individuals or organization in order to receive benefits. The respondents said that this type of risk was not identified for the IICPs in Vietnam, because the private construction firms always educate their staff about anti-graft behavior in order to eradicate corruption within the construction industry. Furthermore, corruption and bribery management are conducted under the rigorous monitoring of the construction management consultant, the owner's representative and the authorities.

4.3 Risk classification

To facilitate further analysis, this research grouped the twenty-nine risk factors into five risk categories. The definition of each risk category is shown in Table 4.4.

The technology and management risk category included risks about technical failures and failures of the management progress. This category has 11 risk factors which are suitability and quality of materials/ equipment (A1), availability and supply of materials/equipment/workmanship (A2), productivity of labor and equipment (A3), new technology (A4), inadequate site investigation (A5), knowledge and experience of the contractor (A6), safety (A7), labor strikes (A8), quality of sampling and testing controls (A9), third party delays (A10), and actions causing environmental pollution (A11).

The design risk category (B) is related to the construction designs, the shop drawings, and the technical specifications. There are two risk factors: quality of design (B1) and design changes (B2).

The economic and financial risk category (C) includes eight risk factors: cash flow management (C1), material price fluctuations (C2), labor price fluctuations (C3),

interest rate changes (C4), exchange rate changes (C5), market fluctuations (C6), availability of funds (C7), and delays in contract payments (C8).

The legal and contract risk category (D) includes five risk factors: changes in scope of work (D1), delays in change negotiations (D2), ambiguities in contract documents (D3), the problem of approvals and licenses (D4), and changes in legislations, policies and regulations (D5).

The natural risk category (E) includes three risk factors: adverse weather conditions (E1), unforeseen site conditions (E2), and force majeure (E3).

4.4 Definition of risk factor for IICPs in Vietnam

To facilitate the process of allocating risk to the contract parties and choosing risk-responsive strategies, this study identified the characteristics of each risk factor below.

4.4.1 Technology and management risk category

A1 Suitability and quality of materials, equipment and labor

This risk is about the suitability and quality of materials and equipment used in project works. The respondents said that the contractor is responsible for the quality of the materials and equipment under the contract provisions. The contractor will conduct the testing and the sampling on-site under the monitoring of the supervising consultants and the owner's representative. During the construction boom, suppliers did not have sufficient quantities of the appropriate materials in accordance with the specifications. The project had to cope with unsuitable alternative materials. Therefore, the contractor often prepared a contingency plan in this situation, for example, the contractor bought the materials from other suppliers.

The contractor is responsible for the suitability and quality of the equipment, as well as the safety of labor and equipment on the site. The respondents said that Vietnamese contractors always maintained a source of equipment to apply in their projects. Risks occurred when the number of projects a contractor was carrying out

proved to be too many for the amount of equipment and human resources available. In these cases, the contractor rented the equipment from the supplier or the subcontractor who was responsible for the failure of equipment.

A2 Availability and supply of materials, equipment and labor

The respondents said that during the implementation process, the contractor usually met the difficulties regarding the source of the construction materials in the construction boom, for example, the scarcity of sand used for construction. In other cases, a project had to use special materials that could only be imported.

According to the respondents, risks occurred when the contractors were faced with limitations in the transportation process, or with a lack of the time to place orders with the suppliers, resulting in unavailability of materials and equipment. The risks can be caused by the failures of the subcontractors or suppliers, resulting in the contractors having to wait long for the materials or the labor to arrive.

For the availability of labor, Vietnamese contractors can cope with a shortage of skilled workers, since Vietnam has an abundant supply of young laborers. The main cause of this problem was the shifting of the construction labor from the construction section to another section. Furthermore, young laborers often did not choose construction works while the elder skilled labors who has experience retired or were preparing to retire lead to the lack of the skilled labor in the construction industry in Vietnam.

A3 Productivity of labor and equipment

The productivity of labor and equipment is an important issue with Vietnamese contractors in any construction project. There are many factors, such as poor technology, unsuitability of work assignments, salary policy, bonus policy, the behavior of the leadership, and the work environment, that impact the productivity of work. This study focused on two main causes, which were considered by the interviewees. First, the level of the application of modern technologies to execute the works by Vietnamese contractors in IICP is still limited, because of the limitations in their

Table 4.4 Categories of risk factors for IICPs in Vietnam

Risk category	Code	Risk factors
Technology & Management (A)	A1	Suitability and quality of materials and equipment
	A2	Availability and supply of materials, equipment, workmanship
	A3	Productivity of labor and equipment
	A4	New technology
	A5	Inadequate site investigation
	A6	Knowledge and experience of contractor
	A7	Safety
	A8	Labor strikes
	A9	Quality of sampling and testing control
	A10	Third party delay
	A11	Action led to environmental pollution
Design (B)	B1	Quality of design
	B2	Design changes
Economic & Financial (C)	C1	Cash flow management
	C2	Material price fluctuations
	C3	Labor price fluctuations
	C4	Interest rate changes
	C5	Exchange rate changes
	C6	Market fluctuations
	C7	Availability of funds
	C8	Delays in contract payment
Legal & Political (D)	D1	Difference between actual quantities and contract quantities
	D2	Delays in change negotiations
	D3	Ambiguities in contract documents
	D4	Problem of approvals and licenses
	D5	Changes in legislations, policies, and regulations
Natural (E)	E1	Adverse weather conditions
	E2	Unforeseen site conditions
	E3	Force majeure

financial capacity. For example, precast materials are popular in many Southeast Asian countries, such as Singapore, Malaysia and Thailand. However, the application of these materials is still very limited in the Vietnamese construction market.

The respondents agreed that the application of modern technologies not only increased the productivity of work, but also saved time and costs for IICPs in Vietnam. However, financial capability and appropriate resources are two factors considered by the contractor when making decisions.

The respondents also said that most Vietnamese construction workers were immigrants 18 to 40 years old from the Western and Central provinces. The workers are often gathered into a group under the management of a foreman. Most workers come from agricultural areas, and so, they lack skill in construction work. This is the cause of the low productivity of labor, which negatively impacts project time and costs.

A4 New technology

Employing applicable new technology is a strategy that often brings many benefits, such as saving time and reducing costs, as well as accidents, to the contractor and the owner during the construction phase. Vietnamese contractors are gradually applying more model technology in the construction phase. In some cases, an applicable new technique does not bring the expected results for the contractor. The new technique may be unsuitable for the project and the laborers may not be able to work with that technology. The respondents said that a contractor may lack the experience in using a new technology that the contractor had previously not used. The frustration of new technology often affects a project's budget. Therefore, a contractor needs to gather enough information and predict the difficulties that may arise before applying a new technology.

A5 Inadequate site investigation

Site investigation is an important task for collecting data and information on a site. It is especially serious when the actual site conditions are different from what is stated in an initial site investigation report provided by the owner to the contractor who will then submit a bid price for a project. There are many additional causes of

inadequate site investigation procedures. This study focuses on three main reasons for inadequate site investigations. First, the percentage of cost for a site investigation is limited in the construction projects. Therefore, the site information which was provided in the invitation to bid of the project owner is insufficient. For example, Ashton and Gidado found that only 0.004% of a contract sum is often allocated to a site investigation process (Gidado, 2001). Clayton recommended that for an adequate site investigation, the average percentage of cost should be at least 1.1% of the contract sum (Clayton, 1982). Second, a contractor may have limited time to study the site investigation information. Finally, there could be lack of experience and manpower for site investigation work.

The respondents said that for a large project, a Vietnamese contractor usually uses an experienced subcontractor, such as a consulting structural and ground engineering organizations, for site investigation work. However, for a small and medium-sized projects, checking the site information was often executed by the site and project managers.

In the case of inadequate site investigation, the contractor needs to conduct re-visits, which leads to the duplication of work. In order to reduce the risks associated with uncertain ground conditions, the contractor needs to improve the site investigation process by preplanning site investigative work in a logical sequence, develop a computer program that is capable of meeting designer requirements and maintaining a flexible approach to designing the investigation. An adequate site investigation will bring appropriate results to the project in the last stages. For example, Alhalaby and Whyte's research concluded that "90% of risks to a project originate from unforeseen ground conditions, which could often have been avoid by adequate and full site investigation" (Alhalaby, 1994).

A6 Knowledge and experience of the contractor

The respondents said that the knowledge and experience of the Contractor was an important factor affecting the success of a project. In Vietnam, the owner often required the contractor to submit a profile of the contractor's experience with past construction projects, but such profiles did not necessarily reflect the contractor's

capability for the current project. According to the respondents, a lack of experience only occurs when a contractor works with a new foreign owner who requires higher work standards than the contractor had ever previously executed.

The respondents said that a lack of knowledge and experience in the international construction environment often led to disputes during the implementation process. Such disputes could affect the brand image of a company. For example, the respondents said that when a foreign owner cannot solve a dispute with a local contractor, the owner often decides to terminate the contract or expel the contractor from the site. The foreign owner does not care about compensation issues due to Vietnamese legal proceedings being very complicated and taking a long time to resolve disputes. A local contractor will create a bad relationship with the foreign owner. To avoid this problem, the Vietnamese contractor needs to prepare more information, and acquire more knowledge of and experience in the international construction environment in order to reduce any unnecessary risks.

A7 Safety

Construction safety is a priority problem in any construction industry. There are many factors, including the leakage of electrical power, falling from heights, toxic fumes, and the transportation of dangerous and heavy equipment that could lead to accidents onsite For IICPs in Vietnam, most accident are related to the electrical system used daily onsite. The respondents said that only some large contractors could fully supply protective materials for the workers when working near an electrical power source. According to the respondents, electrical equipment was often used in many construction projects. However, there was also a lack of regular maintenance of the equipment. Therefore, to ensure safety onsite, a contractor needs to innovate a safety system for the workers and the equipment. For dangerous works, the contractor should use specially trained laborers. It is important that all workers really understand the danger of electrical power lines.

Another reason is due to the negligence of the workers. Despite safety regulations that may be issued by the contractor, many workers may not take sufficient

measures to protect themselves when working with electrical power or climbing up to a height. To deal with construction accidents, many Vietnamese contractors purchase personal injury insurance for their workers, who can receive compensation from an insurance company or a tool manufacturer in the case of injury due to defective tools or accidents while driving company trucks.

A8 Labor strikes

Labor strikes are an important risk that often leads to delays in a construction project. There can be many different reasons for labor strikes. For the IICP, the strikes often occur among workers in the same team, between two worker teams on the same project, or between the contractor and the laborers.

Vietnamese contractors often divide a project into many work packages and assigned each package to the labor team. The leader of a team is responsible for managing the team and for the division of labor. When the work is finished, the team often receives payment according to amount of the work accomplished as specified in the contract documents. For strikes among laborers in the same team, the respondents said that such strikes occur when the team leader has not clearly allocated the scope of work for each laborer, or was not fair in the wage adjustment for each laborer.

The strikes between the contractor and the laborers happen when the contractor has delayed a contract payment. When strikes happen between two labor teams, the causes often arise from interpersonal conflicts. The respondents said that it was important for a contractor to understand the causes of labor strikes, so that they can save time and money when solving labor disputes.

A9 Quality of sampling and testing controls

This risk concerns the construction quality control. For IICPs in Vietnam, quality control involves sampling and testing controls during the works. Normally, the construction project often sets up a quality management system and puts in place effective measures to monitor compliance with the quality requirements by the owner and consultant. A sampling/testing process for materials or a work package is

conducted under the inspection of three parties, including a laboratory selected by the consultant or the contractor, the contractor's representative and the consultant's representative. Failure in sampling/testing usually arises due to the subjective attitudes of the parties or the negligence of the staff.

A10 Third party delays

The third party is an agent in a construction project, and may be the consultant, the subcontractor, the supplier, etc. Under the FIDIC 1999 Red Book and the Vietnamese construction standard forms, the owner is responsible for the risk of the engineer who with the owner's approval. The contractor is responsible for the subcontractors, except for a nominated one. The third party delay in this study is a delay that is not the fault or negligence of either the owner or the contractor, but caused by the local authorities. For IICPs in Vietnam, there are some risks caused by third party behavior.

A11 Actions causing environmental pollution

This risk is about environmental pollution caused by the results of construction work, such as dust, smell, silt and oil, which are common construction site pollutants that may affect the health and lives of the surrounding residents. In some developed countries, this risk is the main reason for construction delay, because the contractor must face issues from the residents and the local authorities, who may shut down the project. However, in Vietnam, most contractors have given two reasons why environmental pollution is not considered as a main problem caused by construction. First, the contractor is able to control only some of the activities that cause pollution, but not all, because the contractor's finances are limited, and curbing more pollution would require more money. Second, as a respondent said, local Vietnamese authorities are less stringent about environmental standards than are other countries. The contractor would rather forge a good relationship with the local authorities in order to allow the project to continue smoothly instead of spending a large amount money on protecting the environment. Doing so would raise the project costs, which the contractor would not be able to control during the construction phase.

4.4.2 Design risk category

B1 Quality of design

In construction projects, most design errors are the responsibility of the architect/engineering company that commonly carries out the overall or main part of the design. However, the contractor is the party that faces the consequences of design problems during the construction phase.

There are many causes, such as the lack of experience of the contract parties, different site conditions, and defective plans and specifications, affecting the quality of design in construction projects. For IICPs in Vietnam, this study focuses on two main reasons. First, the risk comes from the failure of the owner and the architect/engineer. For example, the contractor suffers a project delay due to a failure, ambiguity or mistake in the designs, drawings or specifications provided by the owner. Normally, the contractor must spend time to wait for the repair process. Second, the risk comes from the failure of the contractor. The engineer responsible for the shop drawings onsite may be young and recent graduates who lack experience, which may lead to errors and omissions in the drawings. Moreover, a design may be overly complex or difficult to implement. Fixing a project with a poor design will incur cost overruns and construction delays.

B2 Design changes

This risk is about design changes that can occur in many situations, such as the owner's changing of orders, different site conditions, and failures or mistakes in key details that lead to changes in design. For IICPs in Vietnam, the respondents stated that there were many causes of changes in designs during the construction phase, consisting of the incompatibility between design and actual site conditions, late or inaccurate drawings, additional work, unclear requirements of the owner, inappropriate or lack of experience for the feasibility study, and unforeseen conditions or mandatory changes, especially for errors or missing details due to the contractor's personnel. The contractor is responsible for accommodating the changes made by the owner, but he has the right to claim more compensation and project time when there are

unreasonable or too many changes. According to the respondents, the design changes are often simply mistakes or omissions that do not affect the structure facilities and the project income. Therefore, the contractors often require their staffs to fix the errors to be corrected with the consultant's instruction. Normally, there are no cost adjustments or time extensions for such changes.

In practical situations, the owner often changes the design during the construction phase, and tries shift the responsibility for doing so onto the contractor. The respondents said that any changes that will create unexpected expenses and time will need to be settle by both parties during the pre-contract phase. In addition, both contract parties need to see overall picture of the construction project in order to respond to any risks.

4.4.3 Economic and financial risk category

C1 Cash flow management

This risk is about the capacity of cash flow management. There are many reasons that lead to a lack of money for construction projects. First, a delay of the contract payment by the owner would affect the contractor's cash flow. Second, a subcontractor may not complete a work on time or may complete a work that does not mean the standards specified by the contract. Therefore, the contractor may not pay the subcontractor until a sub-standard work is brought up to standard. In this case, the contractor often bears a part of the expenses. Moreover, at the same time, the contractor may need to pay the material supplier in order to prepare for any following works. Third, the contractor may lack experience in cash flow management, especially in payment allocations to the subcontractors and the suppliers. Finally, the contractor may have issues about the management of investment capital and have insufficient funds to run any current projects.

Cash flow management is an important factor affecting the success of a project. Failures in cash flow management are not frequently mentioned and may occur between any contract parties. For IICPs in Vietnam, the respondents considered the

financial problems of contractor to be a more serious matter than those of the owner. According to the respondents, the contractors could fail in financial management due to inappropriate cash flow management, submitting very low bids due to competition, and inadequate financing capability.

A contractor will face financial problems during the project lifecycle. Normally, the time to receive the income of one project A and the time to pay for another project are not balanced. This means that a project tends to be inspected first, which delays income, while expenses have to be paid on time. The time required for a project time may overrun the estimated time, resulting in a delay.

C2 Material price fluctuations

This risk is about the fluctuation of material prices in the construction market in Vietnam. There are many factors affecting the prices of construction material. However, the respondents said that the lack of material sources and the changes in oil prices are two strong factors impacting the transport costs. Increases in material prices impact the operating costs of IICPs in Vietnam, especial during the peak season. Normally, in lump sum contracts, the contractor always calculates contingency allowances for increases in material prices. Therefore, if the costs of materials increase by less than five percent, the contractor is responsible for the consequences of this risk. However, for increases more than five percent, the contractor would re-negotiate with the project owner.

C3 Labor price fluctuations

Besides materials, labor is also a major factor affecting cost overruns in the construction industry. This risk is about the fluctuations in labor prices in the Vietnamese construction market. When the materials are readied, but there is no labor to carry out the work, a project can experience a delay. In Vietnam, there are two type of laborers in construction projects: skilled and unskilled. According to the respondents, the shortage of skill laborers with the experience, knowledge and ability to carry out the work is a significant problem for the Vietnamese contractor, because in this case, the labor rate increases, when compared with the initial prices, so a

contractor may not have enough laborers to run the project. For example, in the peak construction season, when the labor demand is increasing, a contractor may not be able to hire skilled laborers, because they prefer not to work for lower wages. To solve this problem, the contractor may have to employ unskilled workers, which could lead to problems in the quality of work and meeting project deadlines.

C4 Interest rate changes

This risk is about interest rate changes that can affect long-term construction projects. Most parties in construction projects borrow money from banks or financial institutions when the demand of capital is high, so the interest rates increase, because of a limited availability of funds. When interest rates are lower, this is an opportunity for the contractor develop his business, because the contractor can borrow money at a cheaper rate to finance construction. According to the respondents, the increasing of interest rates affect the housing market more than the industrial market in Vietnam. The respondents said that the interest rate changes mostly affect the short-term deposits of construction companies. To solve this problem, a contractor often collects information about the interest rates of many banks before making the decision to save money. The respondents also said that most Vietnamese contractors do not conduct any sensitivity analysis of interest rates, but usually compare interest rates among banks in order to choose the most beneficial one for their company, because the contractor said that the interest rate is not a significant impact on a project's income.

C5 Exchange rate changes

This risk is about exchange rates that affect the parties who find financial support from other countries. The respondents said that most construction materials are produced in the country, except for special materials, such as electrical and mechanical equipment that the contractor often imports from foreign countries. According to the respondents, the risk related to exchange rate changes can occur when the contractor conducts international purchase transactions. The contractor usually does not analyze the sensitivity of foreign currency, because the contractors

mainly performs purchase transactions and provide services in Vietnamese Dong for construction projects.

C6 Market fluctuations

This risk is about the impact of market fluctuations on construction costs. When demand for construction is high, the contractors must face labor shortages, the lack of materials, and supply and capacity constraints, which result in rising tender levels. However, drops in market demand are the main factor that affect the profit margins of the contractor, because the amount of the contractor's work will be cut, leading to risks about cash flow management.

C7 Availability of project funds

This risk is about the availability of funds for the parties in construction projects. The respondents said that the main point of this risk is the financial difficulties of the owners in IICPs. An owner without enough capital for contract payments during the construction phase can cause a delay of the whole project.

The foreign owner usually cooperates with the contractor who has good financial capability, because a project's value typically fluctuates between one hundred billion and two hundred billion Vietnamese Dong. During the construction phase, the owner can face some financial problem arising from subjective factors, such as failure in financial management, and improper cost planning, or from objective factors, such as a global financial crisis, and effects of banks.

C8 Delays in contract payment

There are many factors that affect contract payments. For example, the owner will delay the payment to the contractor when the contractor has not completed the payment procedures on time. During the construction phase, unclear contract conditions can also lead to delays in contract payments. For example, when the contractor has finished his work, he submits a payment claim to the project owner. However, the consultant exploited the site clear failure in the checking process, then the consultant refuses the payment request of the contractor. The contractor argues

that this is failure of the consultant, due to unclear contract provisions, leading to project delays in order to solve this problem.

The contract payments can be affected by some subjective factors of the owner, such as owner interference, slow decision-making, and inadequate fund management. According to the respondents, delays in payment is a normal problem in construction projects, and affect the cash flows that fund the projects, especially for those contractors who are not financially strong. This study found two common reasons for the delays of IICPs in Vietnam, which are the ambiguity in the contractor's responsibility and slow decision-making by the project owner. The respondents said that the contractor should consider the possibility of delays in payments, because these would strongly affect the contractor's financial capability. The owner should also consider this issue in order to minimize impacts on the project schedule.

4.4.4 Legal and political risk category

D1 Changes in scope of work

This risk is about the differences between actual and contract quantities. The main cause of the problem is the failure to estimate costs correctly. According to the respondents, the lack of experience of the contractor is a main factor leading to inaccurate quantity estimates or wrong measurements for the contract drawings. The respondents stated that conflicts can arise if the contract provisions are unclear on this issue. The owner is not bound to pay the contractor for any omissions from the bills of quantities when the contractor lacks experience in performing. Moreover, there are some factors, such as calculation mistakes, different site conditions, and omissions in the design, that affect quantity estimates. Normally, the contractor is responsible for the re-measurements for work quantities, and for a part of the consequences of this risk.

D2 Delays in negotiations for changes

This risk is about the delays in negotiations about changes in the construction project, which can occur in the total project lifecycle, especially during the

construction phase. The respondents said that the reasons for changes can come from the owner's financial difficulties, an owner who is obstinate, and from changes in the project schedule, scope of work, or specifications. The reasons for changes may also come from the contractor: the contractor's financial difficulties, unfamiliarity with local conditions, fast-track construction, contractor's lack of judgment and experience, shortage of skilled manpower, contractor's lack of required data, lack of contractor's involvement in design, design complexity, substitution of materials or procedures, unavailability of equipment, and contractor's desired profitability.

There are also some external causes, such as changes in weather conditions, economic conditions, government regulations and unforeseen problem that are not directly related to the owner and contractor. It is certain that delays in change negotiation orders will affect both cost and time in a construction project. Construction contracts require the contractor to follow changes in work and notify the owner within a specific period of time of the occurrence of the risk, and the contractor can seek more payment and extension time when there are unreasonable or too many changes. However, when the changes arise, most of the time, the owner tries to exploit weaknesses in the contractor and in the contract in order to avoid being responsible for the delays.

For IICPs in Vietnam, the delay in change negotiations come from two agents. First, for the change order of the project owner, for example, during the construction period, the owner wants to change a part of the design and requires the contractor to carry out the additional work, which causes the contractor to stray from the contract schedule. Second, the change negotiations can come from the contractor, because of the errors during the construction phase, for example, the contractor makes mistakes in cost estimates, which are beyond the contractor's control. Then, the contractor must spend time to re-negotiate with the project owner. According to the respondents, the change negotiations will affect both parties, who should see the overall picture of the project, especially each part relating to each party in order to reduce unexpected expenses and the time needed for the project.

D3 Ambiguities in contract documents

This risk relates to the ambiguities in contract documents, which depend on how well the project is prepared. For IICPs in Vietnam, the parties always see the importance in drafting the contract document clearly, but ambiguities can still be present and can come from three main reasons. First, the errors from the lack of experience of the contractor's staff. Normally, the parties are not aware of problems until the risks occur. The second reason is mistakes in document preparation. In international construction projects, English is a very important language for communication among the parties but not everybody who is responsible for the contract draft have sufficiently good English skills. Therefore, the parties usually avoid or are afraid of communication with each other to collect information related to unclear issues. In addition, time limitation for preparing the document can cause the omissions of issues in the contract that affect every party's rights and duties. According to the respondents, in the contract preparation stage, speaking and writing skills are the most highly required. The impact of language barriers can lead to ambiguities in contract documents. Finally, the respondents said that when the parties are unclear about something during pre-contract stage, they tend to use common words to describe this problem, while the reader may understand the paper in another way. It is very difficult to be aware of the problems until they arise during the construction phase. The ambiguity can create conflict between the owner and the contractor.

D4 Problem of approvals and licenses

This risk is focused on the problem of approvals and licenses from the authorities. During the construction phase, the contractor needs to face the delays from the local authorities, which will affect the cost and schedule of the construction project. For IICPs in Vietnam, the respondents stated that the owner usually does not face the problem of approvals and licenses, because the consultant will carry out this role with the money given by the project owner. However, in the case that the local contractor has a good relationship with the local authorities, the contractor can help the owner by incurring only smaller expenses. The long times taken for project approvals in Vietnam can be interpreted as an abuse by the staff of the local authorities, and are a waste of project resources, leading to time extensions and cost

overruns. Moreover, the problems with approvals and licenses affect foreign direct investment not only in the construction market, but also in other markets.

D5 Changes in legislation, policies and regulations

The main point of this risk is the changes in legislation, policies, regulations and laws by the government that limit the investments of foreign owners. In Vietnam, the limitations in the proportions of ownership by foreigners differs depending on the field, such as in the construction sector, foreigners cannot own more than 49% of the total investment. In the banking sector, foreigners cannot own more than 30% of the total investment. When there are changes in the government policies that may affect the IICPs, the owner often bears the consequences of risk, according to the contract conditions. However, in the case that the contract is well prepared to support unexpected changes, the owner can share a part of this risk with the contractor. For example, when the government promulgates policies to change the salary levels of laborers, which affects project costs, the contract is clearly the responsibility of the contractor. Therefore, the project does not have a conflict during the construction phase. The changes in legislation, policies and regulations will affect to the attractiveness of investments to foreigners participating in the Vietnamese construction market.

4.4.5 Natural risk category

E1 Adverse weather conditions

This risk relates to adverse weather conditions, which are a cause of delays in construction projects. Southern Vietnam has only sunny and rainy seasons, but the weather conditions in the Central Vietnamese provinces are more adverse. According to the respondents, adverse weather conditions affect the productivity of a project, for example, in the sunny season, the productivity of labor is lower than in the rainy seasons. Also, prolonged heavy rain leads to temporary work stoppage. In some industrial zones, poor drainage systems also affect site access while it is raining. According to the respondents, when the owner is too strict about the completion date,

the contractor should collect daily weather information to support claims for extensions of time for completion.

E2 Unforeseen site conditions

This risk is about losses due to unforeseen site conditions. For IICPs in Vietnam, the respondent said that it is difficult to prove which site condition was considered unpredictable. For example, a weak ground base could lead to a collapsed fence of a nearby plant, or the water supply, drainage systems, and electrical cable systems in an industrial zone. The consequences of unforeseen site conditions is often suffered by the contractor as losses for the compensation and repairs in order to deal with project delays.

E3 Force majeure

This risk is about force majeure resulting of human and natural causes. For IICPs in Vietnam, the definition of force majeure is an event, such as an earthquake, a hurricane, a tsunami, a volcanic eruption, a war, or an epidemic, that cannot be avoided or anticipated in a contract. The respondents said that in Vietnam, most of the natural disasters are due to floods and tsunamis. However, these only affect a limited number of areas. Moreover, the owner often buys insurance for such cases of force majeure. Therefore, the parties tend not to focus much on force majeure for most construction projects, which is why when force majeure does occur, the construction project is more affected than it should have been.

CHAPTER 5 RISK ALLOCATION FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM.

This chapter describes the risk allocation process for both contract parties for IICPs in Vietnam. At the beginning, the FIDIC Red Book 1999, the Vietnamese Standard Form of the Ministries Building, and a practical sample contract were used to identify the responsibilities of the contractor and owner under contract provisions in order to clarify the ambiguity in contract documents. This study conducted in-depth interviews with three respondents who were and are participating in the IICP. According to the results of this chapter, there are 25 risk factors that are allocated as the contractor's responsibilities, and 4 risk factors as the owner's. The processes of responding to twenty-five risks factors belonging to the contractor's responsibility are described in the next chapter.

5.1 Definitions of samples

5.1.1 Characteristics of the reference documents

According to risk identification in Chapter 4, this chapter used three reference documents, including the Federation International Des Ingenieurs-Conseils (FIDIC) Red Book 1999, Vietnam's Standard Form. For Construction Contracts (VSFCC), and a practical construction contract of the Southern Steel Factory to examine the responsibilities of the Vietnamese contractors and the foreign owner with 29 risk factors in the IICP.

The 1999 Red Book is recommended for building or engineering works designed by the Employer or by his representative, the Engineer. In this contract, the contractor liability is construction of the construction project according to the design provided by the Employer (FIDIC, 1999). However, the designs of the IICP are often very complex and include many types of design, such as the construction, mechanical, and electrical design. Therefore, the contractor needs to be careful with failures resulting from designs.

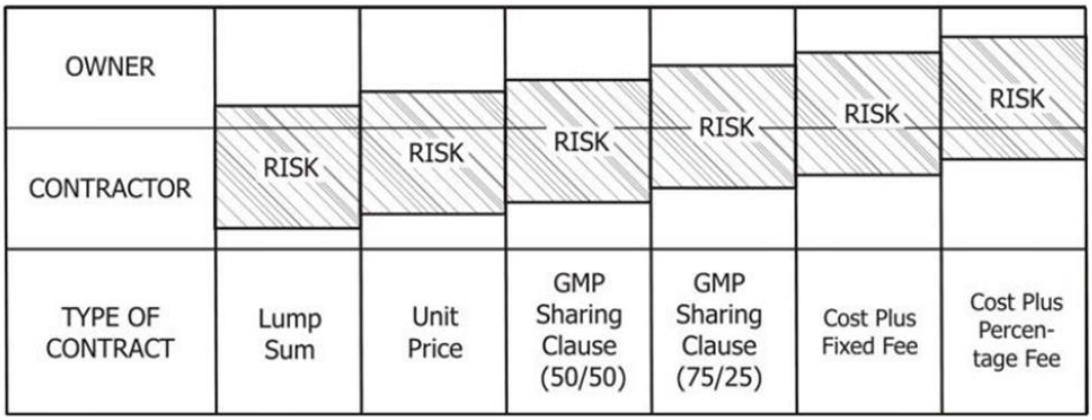

Figure 5.1 Degree of risk for the owner and the contractor in construction contract types (Debella, 2004)

The VSFCC is a contract format to be drafted in accordance with the Vietnamese Construction Law No. 16/2003/QH11 (FIDIC, 1999) and the Decree No. 16/2005/NĐ-CP (Vietnam, 2003). Construction companies often consider the VSFCC as a standard contract form to base their sample forms for their company. The respondents said that Vietnamese construction companies also used the FIDIC as a second reference document to draft contract forms for international construction projects. Therefore, this study chose two reference documents to analyze risk allocation for IICPs in Vietnam. This study also used a practical construction contract by the Southern Steel Factory Project in order to compare the differences in risk allocations mentioned in the three reference documents, of which a summary is shown in Table 5.1.

5.1.2 Characteristics for choosing the practical sample project

The different types of contracts will affect the degree of risk for the contractor and the owner in a construction project, as shown in Figure 5.1. The interviewees said that there were two types of construction contracts that were often chosen by the foreign owners for IICPs in Vietnam consisting of lump sum contract and unit price

Table 5.1 The summary of risk allocation for the technology and management category from FIDIC 1999 Red Book, the VSFCC and the SSFCC

Code	Risk factors	FIDIC 1999 Red Book		Vietnam's Standard Form of Construction Contract		Southern Steel Factory Construction Contract	
		Clause	Title	Clause	Title	Clause	Title
Technology and Management							
A1	Suitability and quality of materials and equipment	4.1	Contractor's general obligations	2	Quality and technical requirements	11.2 11.4	Contractor's responsibilities Contractor's manpower & equipment
A2	Availability and supply of materials, equipment, workmanship	4.16	Transport of goods		Not mentionable	11.2 11.9	Contractor's responsibilities Not applicable
A3	Productivity of labor and equipment	6.1	Records of Contractor's personnel & equipment	14	Rights and Responsibilities of Contractor	11.2	Contractor's Responsibilities
A4	New technology	13.2	Value engineering		Not mentionable	11.1	Contractor's rights
A5	Inadequate site investigation	4.1	Site data		Not mentionable	11.7	Site conditions
A6	Knowledge and experience of contractor	17.2	Contractor's care of the works	14	Rights and Responsibilities of Contractor	6.6	Contractor's responsibility for errors
A7	Safety	4.8	Safety procedures	9	Insurance	15.1	Labor safety
A8	Labor strikes	6.11	Disorderly conduct		Not mentionable	16.2	Security on site
A9	Quality of sampling and testing control	9.4	Failure to pass tests on completion		Not mentionable	6.3	Inspection of completed works
A10	Third party delay	8.5	Delays caused by Authorities		Not mentionable		Not mentionable
A11	Action led to environmental pollution	4.18	Protection of the Enviroment		Not mentionable	15.2	Environmental protection

Table 5.2 The summary of risk allocation for the economic and financial category, the design category from FIDIC 1999 Red Book, the VSFCC and the

Code	Risk factors	FIDIC 1999 Red Book		Vietnam's Standard Form of Construction Contract		Southern Steel Factory Construction Contract	
		Clause	Title	Clause	Title	Clause	Title
Economic and Financial							
C1	Cash flow management	4.2	Performance secuity	8	Performance secuity	4.1	Contract performance security
C2	Material price fluctuations	13.8	Adjustments for changes in cost	6	The contract price		Not mentionable
C3	Labor price fluctuations	13.8	Adjustments for changes in cost		Not mentionable		Not mentionable
C4	Interest rate changes		Not mentionable		Not mentionable		Not mentionable
C5	Exchange rate changes	13.4	Payment in applicable currencies	7.4	Currency payment	8.6	Currency and payment procedure
C6	Market fluctuations		Not mentionable		Not mentionable		Not mentionable
C7	Availability of funds	2.4	Employer's financial arrangements		Not mentionable		Not mentionable
C8	Delays in contract payment	14.8	Delayed payment		Not mentionable	8.4	Payment time
Design							
B1	Quality of design	11.2	Cost of Remedying Defects		Not mentionable		Not mentionable
B2	Design changes	8.4	Extension of time for completic		Not mentionable		Not mentionable

Table 5.3 The summary of risk allocation for the legal and political category, the design category from FIDIC 1999 Red Book, the VSFCC and the SSFCC

Code	Risk factors	FIDIC 1999 Red Book		Vietnam's Standard Form of		Southern Steel Factory Construction	
		Clause	Title	Clause	Title	Clause	Title
Legal and political							
D1	Changes in work scope	8.4 & 13.1	Extension of time for completion, Right to vary	6.3 a	Adjustments for the contract price	9	Contract price adjustment
D2	Delays in change negotiations	20.1	Contractor's claims		Not mentionable		Not mentionable
D3	Ambiguities in contract document	1.5	Priority of documents		Not mentionable		Not mentionable
D4	Problem of approvals and licences	2.2	Permits, Licences or Approvals		Not mentionable		Not mentionable
D5	Changes in legislations, policies, and regulations	13.7	Adjustments for changes in legislation	6.3b	Adjustments for changes in		Not mentionable
Natural							
E1	Adverse weather conditions	8.4	Extension of time for		Not mentionable		Not mentionable
E2	Unforeseen site conditions	4.12	Unforeseeable physical conditions		Not mentionable	11.7	Site conditions
E3	Force majeure	19.4	Consequences of Force	11	Force majeure	20.6	The consequences of Force

contracts. According to the research by Debella, the contractor will bear the highest degree of risk in lump sum contracts. Therefore, this study focused on analyzing risk allocation in lump sum contracts between Vietnamese contractors and foreign owners using the construction contract of the Southern Steel Factory as a practical sample contract for IICPs in Vietnam. Details of the sample project are shown in Table 5.2.

The foreign owner prefers lump sum contracts because they limit the owner's responsibility during the construction process and transfer the responsibility for cost overruns and delay times during the project lifecycle to the contractor. The contractor agrees to a lump sum contract because they are more profitable than other contract forms, and help the contractor to reduce the flexibility of the owner making any changes during the construction phase.

The main contractor of the Southern Steel Factory Project (SSFP) is Uy Nam Investment Construction Company, which is a member of the Coteccons Group, and was the largest Vietnamese contractor in the South Vietnam. This company offers various construction services in many project types, including industrial projects,

Table 5.4 The characteristics of sample construction contract

Information	**The characteristic of sample**
Project name	Southern Steel Factory
Owner	Southern Steel Sheet CO., LTD
Contractor	Uy Nam Investment Construction J.S.C
Consultant	Chan Phuong Engineering J.S.C
Duration	5/2013 - 1/2014
Contrac price	270 billion VNĐ - 12.8 million USD
Payment	Lump sum
Delivery system	Design - Bid - Build
Note: 1USD = 21,000 VNĐ (Vietnam Dong)	

residential buildings, commercial buildings, infrastructure projects and irrigation projects. The contract price of the SSFP was USD12.8 million. The project was finished in nine months.

5.2 Risk allocation options for IICPs in Vietnam

In-depth interviews were used to gather the risk allocation options of five respondents who participated in the process of allocating risk. Four respondents came from Vietnamese construction companies, and one came from a project management consultancy company. All respondents had from 5 to 10 years of experience in the construction industry, as shown in Table 4.2. The results were used to identify the risk factors belonging to the contractor's responsibility for IICPs in Vietnam.

Table 5.3 summarizes the results of allocating 29 risk factors for the IICP in this study. To clarify the responsibility of both contract parties, the in-depth interviews were conducted with the five respondents about the characteristics of each risk factor mentioned in Chapter 4, and risk allocations in the construction contract clauses from the three reference contract formats.

5.2.1 Technology and management risks

A1 Suitability and quality of materials and equipment

Sub-clause 11.4 of the FIDIC 1999 Red Book stipulates that the contractor shall provide the materials testing results, and the product of work completion to the employer and the engineer. The testing results should be performed by laboratories with the prescribed standards. Therefore, the suitability and quality of materials and equipment is the responsibility of the contractor in the implementation process. Under Clause 2 of the VSFCC, the contractor must deliver materials and equipment in accordance with the specifications. Under Sub-clause 11.4 of the SSFCC, the contractor is responsible for guaranteeing the quality of the materials and equipment for executing the work.

According to the respondents, the contractor often searches for materials of suitable quality in accordance with the contract's standards. Normally, the specifications will be provided by the suppliers at the pre-contract phase. After the materials have passed the sampling or the testing process, they will be stored at the construction site. The respondents said that any violation is due to inconsistency and mistakes in the quality of the construction materials when comparing with the specifications, and is the contractor's responsibility, because he was being paid for doing the work and for his competency.

According to the respondents, the contractor often transfers the risks of the suitability and quality of materials and equipment to the suppliers or the subcontractors by dividing the project work into many smaller work packages, which are then assigned by the contractor to the subcontractors. However, the contractor is still the liable agent for any failure relating to these problems according to the construction contract.

A2 Availability and supply of materials, equipment and workmanship

The shortages of materials, equipment or workmanship is a current problem of Vietnamese contractors in construction projects, affecting project time and costs. Under Sub-clause 4.16 of the FIDIC 1999 Red Book, the contractor is responsible for supplying the sufficient quantity of materials, equipment and workmanship to execute the works in accordance with the contract, except in some special cases, the responsibility for the supply of materials and equipment belongs to the owner. Sub-clause 11.9 of the SSFCC is about transportation of materials and equipment being not applicable. The VSFCC also does not mention this problem. The respondents explained that most of materials, equipment and workmanship were delivered to the site by the sub-contractors or the suppliers. Therefore, the main contractor often rejects the risks related to the transportation of materials, because the responsibility belongs to the party who directly carries out the work.

Table 5.5 Risk allocation options for IICPs in Vietnam

Code	Risk factors	Who resposible					
		SSFCC	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5
A1	Suitability and quality of materials and equipment	C	C	C	C	C	C
A2	Availability and supply of materials, equipment, workmanship	C	C	C	C	C	C
A3	Productivity of labor and equipment	C	C	C	C	C	C
A4	New technology	C	C	C	C	C	C
A5	Inadequate site investigation	C	C	C	C	C	C
A6	Knowledge and experience of contractor	C	C	C	C	C	C
A7	Safety	C	C	C	C	C	C
A8	Labor strikes	C	C	C	C	C	C
A9	Quality of sampling and testing control	C	C	C	C	C	C
A10	Third party delay	N	C	C	C	C	C
A11	Action led to environmental pollution	C	C	C	C	C	C
B1	Quality of design	N	C	C	C	C	C
B2	Design changes	N	C	C	C	C	C
C1	Cash flow management	IN	C	C	C	C	C
C2	Material price fluctuations	N	S	S	S	S	S
C3	Labor price fluctuations	N	S	S	S	S	S
C4	Interest rate changes	N	C	C	C	C	C
C5	Exchange rate changes	IN	S	S	S	S	S
C6	Market fluctuations	N	S	S	S	S	S
C7	Availability of funds	N	O	O	O	O	O
C8	Delays in contract payment	O	O	O	O	O	O

Note: C: Contractor; O: Owner; S: Shared between Contractor and Owner, Ex: Expert, IN: Stipuated in contract without specifying allocation, N: Not stipuated in contract

Table 5.5 (continuation) Risk allocation options for IICPs in Vietnam

Code	Risk factors	Who resposible					
		SSFCC	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5
D1	Changes in work scope	O	S	S	S	S	S
D2	Delays in change negotiations	N	S	S	S	S	S
D3	Ambiguities in contract document	N	S	S	S	S	S
D4	Problem of approvals and licences	N	S	S	S	S	S
D5	Changes in legislations, policies, and regulations	N	O	O	O	O	O
E1	Adverse weather conditions	N	C	S	S	S	C
E2	Unforeseen site conditions	IN	S	S	S	S	S
E3	Force majeure	IN	O	O	O	O	O
Note: C: Contractor; O: Owner; S: Shared between Contractor and Owner, Ex: Expert, IN: Stipuated in contract without specifying allocation, N: Not stipuated in contract							

According to the respondents, a poor infrastructure system is the main reason for delays in transportation. The contractor should be responsible for the availability of materials, equipment and workmanship in order to keep to the schedule of the project.

A3 Productivity of labor and equipment

Sub-clause 4.16 of the FIDIC 1999 Red Book states that the contractor is responsible for all the equipment of both the contractor and the employer onsite. Moreover, the contractor's personnel must be appropriately qualified, skilled and experienced in their respective trades or occupations. However, the main reason for low productivity is the lack of skilled labor. Under Sub-clause 11.2 of the SSFCC, the contractor shall supply the labor and equipment in sufficient quantities as specified by the contract. In addition, the contractor is required to supply suitable persons for the work. Based on the definitions of productivity of labor and equipment risk given in Chapter 4, all respondents agreed that the contractor is responsible for the problem.

A4 New technology method

Under Sub-clause 13.2 of the FIDIC 1999 Red Book, the contractor can make a proposal incorporating value engineering at any time to get an extension the time for the completion of works, to improve efficiency, and increase the benefits of the project. The contractor will receive 50% of the profit for his proposal in this case. The VSFCC does not mention anything about this problem. However, the SSFCC states that the contractor is entitled to change the construction method after obtaining approval from the owner in order to accelerate the working schedule, or if the current construction method is not appropriate for the site conditions. The contractor can propose to use other construction method to execute to the works. According to the respondents, the contractor often receives the full profit for the results of the contractor's proposal in the practical projects. Moreover, the contractor is also responsible for the losses that occur due to the consequences of new technology.

A5 Inadequate site investigation

Under Sub-clause 4.10 of the FIDIC 1999 Red Book, the owner is required to supply the site data to the contractor for preparing the bid document at the tendering stage. The site data often includes all relevant information of the sub-surface and hydrological conditions on the site. The contractor is responsible for checking and verifying the site data provided by the owner before submitting the tender offer. The respondents said that the time for checking the site was a limitation, so it is very difficult to demonstrate the latent risks to the owner. This is one of the main reasons leading to disputes between the contractor and the owner of a construction project. The respondents said that the owner always finds a way to transfer the responsibility of an inadequate site investigation to the contractor without a pre-contract commitment. Although the architect/engineering firm is responsible for the site investigation, the contractor is very much affected by the consequences of an inadequate site investigation. Therefore, the contractor should identify clearly the degrees of losses that each party would bear in the case of any risk occurring during the implementation process.

A6 Knowledge and experience of the contractor

Under Sub-clause 17.2 of the FIDIC 1999 Red Book, Clause 14 of the VSFCC and Sub-clause 6.6 of the SSFCC state that the contractor is responsible for the losses and damages caused by the contractor's personnel before and after the owner has issued a Take-Over Certificate. However, the knowledge and experience risk of the contractor is only mentioned in the pre-qualifications of the bidders. The SSFCC states that the contractor's manpower must be well qualified, skilled and experienced in the type of work. The owner can request the contractor to replace any personnel onsite if the personnel is badly qualified, displays the wrong attitude, acts recklessly, or actively poses a threat to safety, health or the environment. According to the respondents, the contractor must bear the risks related to the contractor's competence. However, the project owner needs to establish pre-qualifications for choosing the contractor in order to avoid bid collusion for projects.

A7 Safety

Under Sub-clause 4.8 of the FIDIC 1999 Red Book, the contractor's responsibility is comply with all safety regulations onsite. Moreover, the contractor is responsible for physical protection onsite. The SSFCC also mentions that the contractor is responsible for training, guiding, and informing personnel on labor safety regulations in order to avoid dangers to the people and equipment onsite. With special works, the worker is required to submit a certificate of safety training. The respondents said that safety regulations and warnings were located at the most visual locations on construction sites in order to alert the engineers, the laborers and third parties. The contractor also issues the safety measures onsite and for the surrounding buildings.

A8 Labor strikes

Under Clause 6.11 of the FIDIC 1999 Red Book, the contractor is liable for preventing any unlawful, riotous or disorderly conduct among the contractor's personnel in order to protect people and property onsite and nearby. Labor strike problems were frequent during construction projects in Vietnam. However, the degree of losses is insignificant. This study cannot find a clause in the VSFCC or the SSFCC

mentioning the contractor's responsibility for the risk related to labor strikes. The respondents said that the most common cause of labor strikes was related to payment problems and the contractors usually bear the consequences of this risk.

A9 Quality of sampling and testing controls

Under Clause 9.4 of the FIDIC 1999 Red Book, the contractor is liable for providing the results of materials testing to the owner's representative. In this situation, the engineer will explore the failure of the testing process, and the contractor will require the contractor to execute re-testing. The SSFCC states that the results of testing should be performed by professional laboratories with the prescribed standards. The owner's representative has the right to inspect and check any testing tools before being covered by the contractor. Normally, there are three members who attend a material testing: the consultant's representative, the contractor's personnel, and the laboratory staff. In order to avoid a project delay due to the sampling and testing controls, the contractor needs to clearly notify the other parties of the testing plan. According to the respondents, the quality of sampling and testing controls is the contractor's responsibility.

A10 Third-party delays

Under Sub-clause 8.5 of the FIDIC 1999 Red Book, the contractors can receive an extension of time for completion in the case that a delay was caused by a third party. However, the VSFCC and the SSFCC do not mention this problem. The respondents said that third-party delays are a common problem in many construction projects in Vietnam. A delay of one to three days is often considered an insignificant risk by the contractor, who will accept responsibility. However, a longer delay will lead the contractor to make a claim to the owner for an extension of time to complete the project.

A11 Actions causing environmental pollution

Under Sub-clause 4.18 of the FIDIC 1999 Red Book, the contractor is responsible for environment protection that complies with Vietnam construction law. The VSFCC does not mention who is responsible for environmental pollution. However, under

Sub-clause 15.2 of the SSFCC, the contractor is responsible for taking measures for environmental protection for onsite and the surrounding environment. The clause also states that the owner and the Environmental Department have the right to suspend the work in the case of the contractor violating Vietnamese environmental regulations. The contractor is also responsible for the compensation of any losses or damages resulting from the contractor's actions during the construction phase.

5.2.2 Design risks

B1 Quality of design

Under Sub-clause 17.3 of the FIDIC 1999 Red Book, the owner is responsible for any design by the owner's personnel or the architect/engineering company. Under Sub-clause 4.1c of the FIDIC 1999 Red Book, the contractor is responsible for the construction methods and the designs executed by the contractor. The SSFCC does not mention the quality of design. According to the respondents in the pilot test, any design errors or omissions identified in Chapter 4 should be borne by whoever carries out this work. This means that the owner shall bear the consequences of any design errors executed by the owner's personnel or representative. The contractor shall bear the consequences of design errors from his work.

B2 Design changes

Under Sub-clause 13.1 of the FIDIC 1999 Red Book, the owner has the right to make changes to the level, positions and/or dimensions of any part of the works prior to issuing the Take-Over Certification. The contractor will receive an extension of time for the project's completion. Following the risk identification in Chapter 4, when a change in design is proposed by the contractor, he is responsible for the re-design of the part of this work, and shall receive fifty percent of the profit from the results. The VSFCC and the SSFCC do not mention the responsibility and allocation of the profit of design changes proposed by the contractor. The respondents said that there were two main reasons leading to design changes consisting of the contractor professional in design process and the limitations of the design preparation time. The respondents

said that the contractor was unwilling to make the design changes of the owner frequently and the design changes due to any ambiguities or mistakes in the initial designs of the architect/engineer.

5.2.3 Economic and financial risks

C1 Cash flow management

The FIDIC 1999 Red Book, the VSFCC and the SSFCC do not mention the responsibility of cash flow management in construction projects. According to the respondents, the owner is responsible for the project fund management and the contractor is responsible for the cash flow management in implementing the works. Vietnamese contractors acknowledge that foreign partners have professional systems to manage the cash flow for their companies and projects. Therefore, the contractor always tries to learn about cash flow management system from not only foreign contractors, but also foreign owners in the cooperation process in order to avoid or reduce the occurrence of risk during the project lifecycle.

C2 Material price fluctuations

Under Sub-clause 13.8 of the FIDIC 1999 Red Book, the contractor may adjust the material prices to the current market costs under the formulae prescribed in this sub-clause. Under Clause 6 of the VSFCC, the contractor may adjust the prices of special materials, such as electricity, water and steel, in the case of changes in government policies following Decree No. 75/2008/ ND-CP of the Vietnamese Government. The SSFCC does not mention the responsibility for the material price fluctuations in the implementing process. The respondents said that foreign contractors prefer lump sum contract to other contract forms, because the consequences of material price fluctuations usually are the contractor's responsibility. However, for general IICPs, which often have contract prices ranging from 4.8 million to 9.5 million USD, the project is often completed in a short term of approximately 9 to 18 months. The respondents said that the material price fluctuations are negligible in this period. Therefore, the contractor is responsible for rises or falls in the costs of

the materials in lump sum contracts. The respondents also said that in the case that the material prices increase by more than 5 percent compared with the contract value, the contractor will re-negotiate the contract value with the owner.

C3 Labor price fluctuations

Similarly to material price fluctuations, under Sub-clause 13.8 of the FIDIC 1999 Red Book, the contractor can adjust the labor costs to the current market costs by the formulae prescribed in this sub-clause. Under Clause 6 of the VSFCC, the contractor can adjust the labor costs in the bid submission in the case of the changes in the basic wage rates for the employees, following the Decree No. 75/2008/ND-CP of the Vietnamese Government. The respondents realized that the differences in the labor costs of Ho Chi Minh City and other provinces are negligible. Normally, the wage rate placed in the range of 10 USD to 12 USD per workday. Moreover, the IICPs are often finished in the short term so the impacts of labor price fluctuations are insignificant. The contractor is responsible for rises or falls in the cost of labor in lump sum contracts. The respondents said that in the case that the labor costs increase more than 5 percent compared with the contract value, the contractor will re-negotiation the work prices.

C4 Interest rate changes

The FIDIC 1999 Red Book, the VSFCC and the SSFCC do not mention interest rate changes. The respondents said that all of the contract parties are affected by interest rate changes if they borrow money from the banks to do business. The interest rate is the rate of return on capital. When the interest rate is low, the return on capital is low, therefore the cost of capital is low. During periods of low interest rates, it is more feasible to use capital for advanced purchasing, since the cost of capital is low. Both the contractor and the owner are responsible for the consequences of interest rate changes.

C5 Exchange rate changes

Under Sub-clause 13.4 of the FIDIC 1999 Red Book, the owner will paid to the contractor in the currency which approved in the construction contract. If the contract

stipulates payment in more than one currency, the owner shall pay the amounts payable in all applicable currencies. Sub-clause 7.4 of the VSFCC also states that the contract payment can be made in Vietnamese Dong or foreign currencies. Sub-clause 8.6 of the SSFCC states the contract value is to be paid in Vietnamese Dong. The respondents said that most Vietnamese construction contracts used the Vietnamese Dong as a unique currency for the payment of the contract price. The contractor and the owner may bear the impacts of exchange rate changes in the case that the project has purchased materials and equipment from abroad. For example, the owner bears the losses for the increasing exchange rate of the USD when importing construction equipment from overseas. The respondents said that most of the construction materials, such as cement, concrete and steel, were bought from the local suppliers. The contractor often has the equipment for the electrical, mechanical and plumbing systems imported from overseas. In lump sum contracts, the contractor is responsible for the consequences of the exchange rate changes.

C6 Market fluctuations

The FIDIC 1999 Red Book, the VSFCC and the SSFCC do not mention the impacts of market fluctuations. However, the oscillation of international markets often impact the demands of developing industrial facilities in Vietnam. The Vietnamese contractor is often impacted more by market fluctuations than is the foreign owner. It is difficult to predict economic market changes when the contractor does not use any analytical technique for his business. For example, the Vietnamese contractor could not properly evaluate the impact of the ASEAN Economic Community (AEC) in 2015 due to the fact that local contractors often do not use any tools to predict and measure the sensitivity of the market. From the contractor's viewpoint, the contractor is responsible for the consequences of market fluctuations.

C7 Availability of funds

Under Sub-clause 2.4 of the FIDIC 1999 Red Book, the owner is responsible for the submission of financial arrangements within 28 days after receiving a request from the contractor. The availability of funds are not mentioned in the VSFCC and the

SSFCC. The respondents said that the contractors are hired for project, but do not have the financial capability to control the risks related to project funds. Therefore, the owner is liable for this problem.

C8 Delays in contract payment

Sub-clause 14.8 of the FIDIC 1999 Red Book, the contractor was entitled to receive compensation during the period of delayed payment. Sub-clause 8.4 of the SSFCC states when the contractor does not receive any payment for more than 15 days after the payment deadline as stated in contract provisions, the owner is responsible for compensating the contractor for the time delay according to the debt interest rate of the bank. The VSFCC does not mention the responsibility of the owner for delays in contract payments. According to the respondents, the contractor usually takes long for the payment procedures. For example, when the contractor claims the work payment, he needs to prepare for many payment procedures, including the payment claim, table of quantity values implemented as per contract, the table of variation quantity values as per contract, the quality document of the implemented works, and the financial invoices. If there any invoices are incomplete or contain errors, the contractor must rectify and resubmit the invoices to the owner, thereby taking a long time for the approvals. The delayed payments affect the cash flow management of the contractor, for example the contractor may be unable to pay the suppliers and the subcontractors, leading to the whole project to be delayed. For IICPs in Vietnam, the respondents agreed that delays in contract payments are the responsibility of the owner.

5.2.4 Legal and political risks

D1 Changes in scope of work

According to Sub-clause 13.1 of the FIDIC 1999 Red Book, the owner shall be entitled to changes in the quantities of any item of work included in the contract. Sub-clause 6.3a of the VSFCC and Clause 9 of the SSFCC also state that the contract value can be adjusted according to the actual quantities of the works. There are two main

causes leading to the changes in scope of work: errors in the cost estimated process, and the contractor's failure in performing the process. According to the respondents, the contractor is responsible for any losses from changes in the scope of work due to contractor failures, which were identified in Chapter 4. When the causes of the changes are due to the owner, the contractor is entitled to receive payment plus suitable profit and an extension of time for the completion of the work.

D2 Delays in change negotiations

In the Vietnamese construction industry, the contract parties rarely bring their disputes to court, because the litigation often takes a long time to be resolved. The VSFCC and the SSFCC do not mention the delays in the change negotiations of the construction projects. According to the respondents, the contractor often bears the impact of delays in change negotiations. The contractor can claim an extension of time for project completion in the case that time is needed to perform the works. Therefore, the delays in the change negotiations of the contract parties is the responsibility of the contractor.

D3 Ambiguities in contract documents

According to Sub-clause 1.5 of the FIDIC 1999 Red Book, the engineer is responsible for clarifying any ambiguities in contract documents. The VSFCC and the SSFCC do not mention who is responsible for the ambiguities in contract documents. According to the respondents, there are two main clauses in contracts that create ambiguity: the competence of the contractor in checking the contract, and the carelessness of the contract administration. The contractor should check the contract provisions carefully before signing the contract in order to avoid the contract disputes during the construction phase.

D4 Problem of approvals and license

Under Sub-clause 2.2 of the FIDIC 1999 Red Book, the owner is liable for assisting the contractor in obtaining the necessary permits, licenses or approvals, following the laws of the country. The VSFCC and the SSFCC only state that the contractor is responsible for compliance with regulations in accordance with

Vietnamese Construction Law. According to the respondents, the Vietnamese contractors have the advantages in family with the local cultures and the legal procedures. Therefore, the contractor not only obtain well the permit, license and approval procedures which were required by Vietnam construction law for the contractor's responsibility in project. They also assisted the owner to obtain the legal procedures belong to the owner's responsibility which were also required by Vietnamese construction law for international construction projects.

D5 Changes in legislations, policies and regulations

Under Sub-clause 13.7 of the FIDIC 1999 Red Book, the contractor is entitled to receive an adjustment for increases or decreases in the project costs resulting from changes in the government legislations, policies and regulations. Clause 6.3b of the VSFCC also mentions this problem. However, this research could not find the responsibility for this issue in the SSFCC. According to the respondents, the owner is responsible for the changes in legislations, policies and regulations if these changes are beyond the contractor's capacity in the construction projects. Moreover, by the contractor's relationship, he is often supported by the foreign owners in the information of changes in regulations in order to limit the consequences of the risks. For example, when the contractor receives the adjustment about Vietnam regulations which may affect a project that is coming soon, the contractors notify the owners to make contingency plans for this issue in the future.

5.2.5 Natural risks

E1 Adverse weather conditions

Under Sub-clause 8.4 of the FIDIC 1999 Red Book, the contractor is entitled to an extension of time for completion when a project is delayed by adverse weather conditions. The VSFCC and the SSFCC do not mention this problem in the contract clause. According to the respondents, it is difficult to identify which weather conditions can be considered as adverse for a construction project in Vietnam. Heavy rains, storms, forest fires and floods are common adverse weather conditions in Vietnam.

The respondents said that the contractor is often responsible for the consequences of these risks, and should consider these issues before signing a contract.

E2 Unforeseen site conditions

Under Sub-clause 4.12 of the FIDIC 1999 Red Book, the contractor is entitled to receive an extension of time for project completion and an additional payment due to adverse physical conditions, including natural and unforeseen conditions due to man-made activities that occur during the construction stage. The VSFCC and the SSFCC do not mention this problem in the contract provisions. According to the respondents, the contractor often bears the consequences of the minor risks, and will place a claim with the owner in the case of major risks to the project time and cost. The respondent said that it is difficult to prove that a site condition was unforeseen. Therefore, this is a situation that can lead to a dispute between the contractor and the project owner during the construction phase.

E3 Force majeure

Under Sub-clause 20.1 of the SSFCC, force majeure is an event, such as an earthquake, a hurricane, a flood, a tsunami, a volcanic eruption, a war, or an epidemic, that cannot be avoided or anticipated when signing a contract. The contractor shall be entitled a time extension for the project completion due such delays and shall be compensated by any costs incurred by force majeure. However, under Clause 11 of the VSFCC and Sub-clause 19.4 of the FIDIC 1999 Red Book, the contractor is entitled only to a time extension for force majeure, as mentioned in Sub-clause 20.1 of the SSFCC. According to the respondents, the consequences of risks by force majeure is the owner's responsibility in the case that the insurance company does not accept responsibility for the compensation of any losses.

CHAPTER 6 RISK-RESPONSIVE STRATEGIES BY LOCAL CONTRACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM.

After identified and allocated 29 risk factors in IICPs to both contract parties. This chapter continued to set up a list of risk-responsive strategies for IICPs in Vietnam. The source of risk-responsive strategies was be collected from books and papers, and be used for the questionnaire design when got at least one approval from the group expert A.

6.1 The sample size

6.1.1 Parameters for choosing the participants

In this research, the Delphi technique was used to gather the data. The in-depth interview with each respondent was conducted on two grounds to reduce the dispersion and enhance the reliability of the results. Before conducting the survey process, the study proposed three parameters to select the participants for the responding process, for which the details are presented in Table 6.1. The participants were required to have more than 5 experience years on site, joined in at least one IICP in Vietnam, and a position from senior site engineer to upper level.

In the first round of the Delphi process, the respondents were required to answer a questionnaire survey based on their opinions and experiences of the risk-responsive strategies used in their practical projects. After collecting and analyzing the results, the researchers conducted a second round with in-depth interviews to find the explanations for their given during the first round.

6.1.2 Characteristics of the respondents

At the beginning, this study only found three persons who had the suitable profiles with the qualifications given in Table 6.1. In order to increase the number of

Table 6.1 Qualifying parameters of the respondents

Parameter	Name	Description
1	Experience	More than 5 years on the construction site
2	Job position	The top or middle staffs were or are working in Vietnam Construction firms such as senior site engineer, site manager, project manager and senior
3	Number of the IICP participated	Experience at least one project

participants, the researcher asked the interviewees to recommend other suitable candidates.

Twenty-four invitations were sent by telephone and email to the candidates. Six invitations received no response, and three invitees declined to participate with the reason that they were working far from Ho Chi Minh City. Therefore, this study only collected information from fifteen respondents. The details of the participation process are presented in Table 6.2. Seven participants were working at the headquarters of construction firms, and another eight were working at a construction site in Ho Chi Minh City and neighboring provinces.

In Vietnam, industrial facilities are built by two types of construction firms: those firms that make many types of construction, including commercial buildings, schools, and hospitals in addition to industrial facilities, and those firms that make only industrial facilities.

The strength of the study is that all respondents are participating in the role of department manager or project manager in at least one IICP with a foreign owner. To save time for the participants during the in-depth interviews, the research objectives and questionnaire information were sent to each respondent by email. After receiving feedback from the respondents during the first round Delphi, the researcher continued to conduct the in-depth interviews.

Table 6.2 Participation of the respondents

Code	Number of invited	Number of agreed to participate	Number of completed round one	Number of completed round two
Office employees (OM)	11	7	7	7
Site employees (SM)	13	8	8	8
Total	24	15	15	15

All interviews were conducted in Ho Chi Minh City. Each interview took an average of approximately from 30 to 60 minutes. Moreover, Table 6.3 details the characteristics of the fifteen respondents, all of whom were working in Vietnamese construction firms, were positioned at the middle and top levels and had been involved in projects with more than five years of experience in the construction industry.

6.2 Objectives of the risk-responsive strategies

In construction projects, the risks may be threats or the opportunities for the parties during the implementation process. The purpose of this chapter is identify the methods used to decrease the consequences of the negative risks and to increase the benefits of the positive risks. For example, the application of new technology often brought many benefits, such as saving time, reducing expenses, and enhancing the quality of work, for the contractor. However, the contractor was able to meet the threats when they did not have good human resources to operate the modern technology. The process is depicted in Figure 6.1.

In the cases where the risk was a low threats and hard to control, the contractor will choose the strategies to move the risk to the position where it was easy to control. Similarly, when the risk was a high threat and hard to control, the contractor will

choose the strategies to make move the risk to the position where it a low threat and easy to control. When the threat was high were easy to control, the contractor would find a way to mitigate the impact of the threat.

Table 6.3 The characteristics of the respondents

No.	Code	Current position	Experience	Number of the IICP	Types of project have participated	Company	Party
1	SM1	Vice-Site manager	5-10 years	1	Residential, industry	Private	Contractor
2	OM1	Project manager	> 10 years	> 2	Residential, school, industry	Private	Contractor
3	SM2	Site manager	5-10 years	> 2	Residential, commercial, industry	Private	Contractor
4	SM3	Site manager	5-10 years	> 2	Office, commercial, industry	Private	Contractor
5	SM4	Vice site manager	5-10 years	1	Residential, industry	Private	Contractor
6	SM5	Site manager	5-10 years	2	Residential, commercial, industry	Private	Contractor
7	SM6	Vice site manager	< 5 years	> 2	Residential, industry	Private	Contractor
8	OM2	Tender manager	> 10 years	> 2	Residential, commercial, industrial	Private	Contractor
9	OM3	Vice-Technical manager	> 10 years	> 2	Residential, office, hotel, commercial, industrial	Private	Contractor
10	OM4	Assisstant to the general manager	5-10 years	1	Commercial, hospital, industrial	Public	Contractor
11	SM7	Site manager	5-10 years	> 2	Office, hospital, industrial	Private	Contractor
12	OM5	Project manager	> 10 years	> 2	Residential, office, industrial	Private	Contractor
13	OM6	Tender manager	> 10 years	> 2	Industrial	Private	Contractor
14	SM8	Site manager	> 10 years	1	Residential, commercial, industrial	Private	Contractor
15	OM7	Technical manager	> 10 years	> 2	Industrial	Private	Contractor

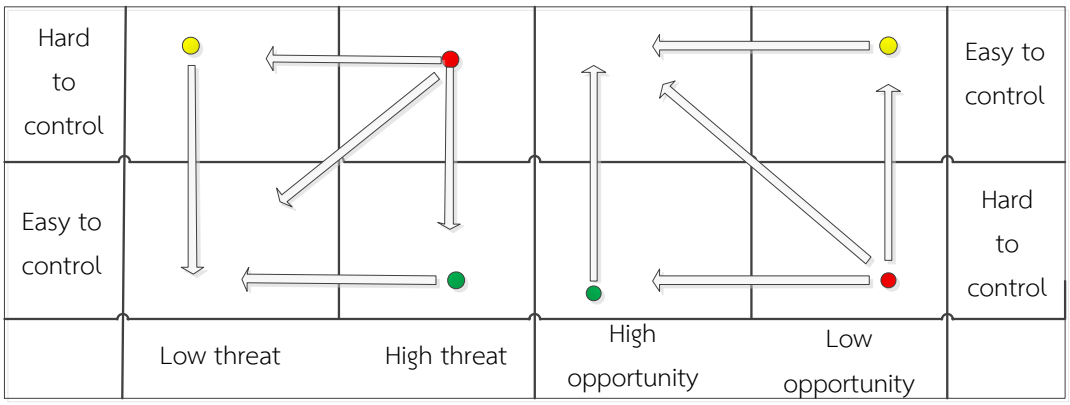

Figure 6.1 The objectives of risk-responsive strategies

In the cases where the risks were low opportunities and/or hard to control, the contractor will choose the strategies to increase the profit and to explore ways to control these opportunities more easily.

6.3 Development of alternative risk-responsive strategies

From the literature reviews, this study explored two simple approach to managing risks: to do something or to do nothing (Martin Loosemore, 2006).

6.3.1 Do nothing (DN)

When the risk is beyond the scope of the respondent's control or the respondent is never responsible for the consequences of the risks in the last and current projects, the respondent may decide to do nothing with this risk factor. For example, the respondents said that the contractor was not responsible for the consequences of the risk if the risk was about the availability of funds, which was beyond the capacity of the contractor's control. According to the respondents, the owner should be responsible for the consequences of risk. Another example is when the respondent ignored exchange rate changes, because the contractors had said that the company was responsible for monitoring the exchange rate changes when implementing the projects.

It is important for the reader to understand that the Vietnamese contractors consider the existence of risk before deciding on a DN strategy for the risk, which does not mean that the contractor forgot or did not know of the likelihood of the risks in the project.

6.3.2 Do something

If a risk is an opportunity, the contractor should select the approach to maximize its potential benefits. However, for a threat, the contractor should select the approach to minimize the consequences of the threat. In the construction industry, there are four basic strategies to respond a risk: absorbing, reducing the impact and likelihood of, transferring and avoiding the risk.

To facilitate for the respondents in the selection process of risk-responsive strategies, this study developed a list of risk-responsive strategies, which were gathered from three books and two journal papers:

- Risk response techniques employed currently for major projects (Baker et al., 1999)
- Analysis of risk-response measures for tunneling projects (Likhitruangsilp, 2012)
- Managing risk in construction projects (Smith, 1999)
- Risk management and construction (Flanagan & Norman, 1993)
- Risk analysis and management for projects (Institution of Civil Engineers, 2005)

The risk-responsive strategy checklist was verified by three experts in construction projects. The checklist is described below.

(1) Risk avoidance

Risk avoidance is a method to avoid unexpected threats during the project lifecycle. However, this is not always possible. For example, it is difficult for the

contractor to avoid a risk mentioned in the contract conditions. According to the respondents, the contractor often avoided those risks for which they knew they did not have capability to control and manage. Some approaches of avoidance are presented below.

The contractor can avoid risks by not tendering for projects which may be highly risk (Engineers, 2005). For example, the respondents said that the contractor usually avoided bidding on projects where the contractor noticed that the project owner was meeting the financial problem.

The contractor can also avoid risk by tendering with a high bid price (Baker et al., 1999). For example, the contractors said that they would submit a bid price with a higher contingency allowance to new customers with whom they had never previously worked.

In another way, the contractor can avoid the risk by pre-contract negotiations with a clause to exclude the contractor from responsibility should the risk occur (Flanagan & Norman, 1993).

This study focused on the alternative risk-responsive strategies of Vietnamese contractors during the construction phase. The contractors were not entitled to rescind the risks implied in the contract provisions. Therefore, risk avoidance was not selected to enter into the risk-responsive strategy checklist of the questionnaire.

(2) Risk reduction

According to the opinions of the three experts, there are ten risk-responsive strategies to enter into the list of risk-responsive strategy for this study. These strategies are risk reduction by (1) contingency allowances, (2) work adjustment, (3) contingency plans, (4) bonus and/or penalty policies, (5) employee education, (6) physical protection, (7) workforce adjustments, (8) improvements in labor relationship policies, (9) acquisition of additional information, (10) past relationships, (11) limitations of working overtime, (12) good relationship with the government, (13) setting system predicting and assessing the potential risks, (14) re-checking contract documents more

than once, and (15) notifying designers and owners to visit the site regularly in order to reduce design changes.

1) Contingency allowances

The contractor will calculate the percentage of additional cost sin the bid submission in order to respond to future risks. The respondents said that the money often helped the contractor to avoid or reduce losses when the risk occurred. For example, the contractor used the contingency allowance to reduce the loss from material price fluctuations.

2) Work adjustments

For work adjustment strategy, the contractor can re-arrange the project works to mitigate the consequences of the risk. For example, the re-arrangement of the machine position was the facilitation for the transportation process of workers and equipment on the site.

3) Contingency plans

When making a risky decision, the contractor needs to prepare to face the risk's occurring in the future. For example, the contractor predicted that the project could cope with the unavailability of materials in the next three months, because of a scarcity of construction sand. Then, the contractor with other suppliers to guarantee the quantity of materials to be delivered on time.

4) Bonus and/or penalty policies

The contractor uses the bonus policy to enhance the productivity of work. For example, the contractor proposed a bonus to team workers who could complete their work fifteen days prior to the contract schedule's deadline. Moreover, the team worker needed to comply with the specified quality of work.

5) Workforce adjustment

The contractor can mitigate the impact of risk by adjusting the workforce. For example, when the productivity of work is the low, the contactor can adjust the position for labor to improve the work effectively.

6) Employee education

Employee education is a method to reduce or avoid risks that may occur during the work. For example, the contractor should organize safety training for the workers in order to avoid or reduce construction accidents on site.

7) Acquisition of additional information

Acquisition of additional information is a method that can help the contractor to predict risk. For example, using information from the Hydrometeorological Prediction Center (HPC), the contractor can predict if there will be an extension of the rainy season that year. Then, the contractor could notify the owner for a time extension to completion. The contractor can reduce a project delay because of the adverse weather conditions.

8) Physical protection

Physical protection is an efficient method to mitigate risk, especially risks related to the property of the parties at the construction site. For example, the contractor furnished a safety system to protect the personnel from accidents and property from theft.

9) Past relationships

The selection of a partner with whom a contractor has previously worked on a previous project is a risk-responsive strategy to reduce the risks for Vietnamese construction firms. For example, in order to ensure the quality of work and meeting the project schedule, the contractor gives priority to previous subcontractors for their familiarity with the contractor's work style.

10) Good relationship with government

A good relationship with local authorities is a popular strategy to solve risks related to the legislation documents of a construction project, especially for a foreign owner in international construction projects. The respondents said that a project procedure can be approved smoothly when the contractor has a good relationship with the local authorities. Moreover, the local authorities can support the contractor

and the owner to resolve other risks, such as labor disputes and site assessments that may occur during the implementation process of the project.

(3) Risk transfer

There are two popular methods for transferring the risk in IICPs: transfer by subcontracting and by using an insurance company.

The contractor can transfer the risk to other parties such as the supplier or subcontractor by the subcontract provisions. The contractor knows that he will have the opportunity to obtain more benefits from the project owner with a lump sum contract format. Similarly to the subcontract, the contractor understood that he will spend the high risk premium when shifting the risk to the subcontractors by a lump sum contract. Moreover, the contractors may lose the benefits when the risk is a potential opportunity. For example, the contractor assigned the foundation work to the subcontractor who was considered to be experienced enough to carry out the work.

Insurance is a strategy to transfer the risk to an insurance company, and is often applied to significant risks that have a major impact on a project's time and cost. There are many types and levels of insurance for a construction project. The contractor is responsible for the obtaining of insurances according to the owner requirements and the law of the country. For example, the contractor was required to obtain the insurance for total contractor's workers and third party insurance in accordance with the contract provisions. Normally, insurance is expensive, so the contractor should calculate carefully prior to making the decision.

(4) Risk retention

In some case, the contractor must cope with the risks by using the income of the project, because the contingency allowance is not enough to cover the consequences of the risk. The respondent said that the contractor used a part of the project income to spend for the loss in the case that the contingency allowance was not enough to handle the increases in material prices.

CHAPTER 7RESULTS AND DISCUSSION OF RISK RESPONSE FINDINGS

This chapter summarizes and discusses the risk-responsive strategies chosen by the fifteen respondents for each risk factor for the IICPs in Vietnam. The questionnaire surveys and in-depth interviews using the principle of Delphi method were used to collect and justify alternative risk-responsive strategies by the respondents for this study. This chapter also identifies the major criteria considered by the respondents for the making of decisions.

7.1 Results

7.1.1 Technology and management category

A1 Suitability and quality of materials and equipment

As shown in Table 7.1, risk transfer by subcontracting and risk reduction by cooperating with past relationships are two popular methods that the respondents

Table 7.1 Risk-responsive strategies by Vietnamese Contractors for suitability and quality of materials and equipment

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	9	●		●			●		●	●	●	●		●	●	
Insurance	5	●	●		●			●							●	
Contingency allowance	2		●												●	
Work adjustment	0															
Contingency plan	3			●		●									●	
Bonus/Penalty policy	2							●		●						
Workforce adjustment	0															
Employee education	1											●				
Addition information acquisition	3		●	●												●
Physical protection	2		●									●				
Past relationship	11	●	●	●	●			●			●	●	●	●	●	●
Good relationship with government	0															
Retention	4			●			●		●				●			

chose to respond the risks related to the suitability and quality of materials and equipment. Nobody ignored or underestimated this risk because the consequences impact the project time and cost. Other risk-responsive strategies selected by many respondents include risk transfer by insurance companies, contingency allowances, contingency plans, bonus/penalty policies, acquisition of additional information, and physical protection.

The owner always tries to transfer the risk to the contractor. The contractor also finds a way to shift the risk to the subcontractors. The Cost & Contract Management Department (CCMD) of Vietnamese construction firms is responsible for the negotiations for material prices with the suppliers/subcontractors both before and after the tendering. The CCMD often monitors the cash flow of a project during the construction phase in order to optimize the profitability of the company. The respondent said that the CCMD usually creates a network of subcontractors and suppliers in order to save time to find the source of materials and to ensure the stability of material prices in the peak season. For construction projects at new locations, the Quantity Surveyor of the project often contracts with the supplier who was recommended by the CCMD of the company.

For construction equipment, the contractor often hires from the subcontractors. The respondents said that Vietnamese contractors only bought insurance for the critical construction of equipment, such as tower cranes and excavators. Therefore, the insurance company is responsible for the losses in the case that the risk occurred in accordance with the insurance contract provisions.

In the case that the owner proposed new construction materials or equipment applications, the contractor will calculate the amount of money needed to prevent the risks when performing the works. For example, the project used a large amount of money to decorate the walls. The contractor was worried about accidents during the process of erecting the glass. Therefore, he gave a higher percent of contingency allowances in the bid submission to respond to this sort of risk.

The respondents said that the suppliers are responsible for the quality of materials according to the specifications. For example, when materials and equipment are stored in a warehouse onsite, to mitigate any losses in storage, the penalty policies are released to the engineer who is responsible for ensuring the quality of materials and equipment in storage until the time for their use.

According to the VSFCC and the Vietnamese Construction Law, the contractor is responsible for obtaining the insurance for the contractor's equipment onsite. The respondent said that the contractor also requires the subcontractors to obtain in order insurance for their equipment to execute the works.

The contractor often does not have a contingency plan for risk in the pre-contract stage, the respondents said that the contingency plan is only mentioned when the project nearly copes with the risk during the implementing process. For example, the contractor discovered the lack of Cup-Lock Scaffolds during the construction stage, so he used Flanged Scaffolds as an alternative.

The respondent said that any failures due to unsuitable equipment could be the fault of the operator. In this case, the contractor needs to training staff before assigning the jobs to them. For example, when the contractor assigns excavator work to a good driver who carefully uses and frequently maintains the equipment, the contractor not only avoids accidents during the construction process but also increases the effectiveness of the work and extends the lifetime of the equipment. For the quality of materials, the contractor needs to educate the worker on how to preserve the materials in order to ensure the quality until the time for their use. For example, workers are not allowed to stack more than ten cement bags on top of each other, or put more than seven paint bins on a pallet so that the pallet will not overload. The respondent said that the duty of the contractor is to ensure that all persons who operate and use the construction equipment and materials are trained for health, safety and risk issues.

A2 Availability and supply of materials, equipment and workmanship

Table 7.2 Risk-responsive strategies by Vietnamese Contractors for availability and supply of materials, equipment and workmanship

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	9	●		●				●	●	●		●		●	●	●
Insurance	0															
Contingency allowance	0															
Work adjustment	3				●			●		●						
Contingency plan	7			●		●	●		●		●	●	●			
Bonus/Penalty policy	3		●						●			●				
Workforce adjustment	3		●		●				●							
Employee education	1		●													
Addition information acquisition	5		●	●				●		●						●
Physical protection	0															
Past relationship	9	●		●		●	●		●		●	●	●		●	
Good relationship with government	0															
Retention	3	●	●	●												

Table 7.2 shows that risk transfer by subcontracting, risk reduction by cooperation with past relationships and preparation for the contingency plans are three popular risk-responsive strategies that the respondents have chosen to respond to the risks related to the availability and supply of materials, equipment and workmanship. Nobody underestimated this risk because the consequences of the risk will impact project time and costs. Work adjustments, bonus/penalty policies, workforce adjustments, acquisition of additional information and risk retention are risk-responsive strategies that were also selected by many respondents in this study.

The respondents said that unavailability of materials will lead to project delays. At the peak of the construction season, the supply of materials is usually lower than the market demand, leading to a shortage of materials for the construction projects.

However, cooperation with past suppliers will guarantee available materials for the contractor at this time. In Vietnam, the supplies are often transported from the factory to the site or the contractor's warehouse. Therefore, the supplier will bear any risks for the transportation of materials. In the case that the contractor adjusted the schedule of work, and the past supplier could not supply the materials following the contractor's requirement. The contractor will contact other suppliers to make sure that the materials arrive in order to perform the works. In this case, the contractor will bear the differences between the prices of material of the new supplier.

The respondents said that the subcontractor is always well equipped to execute his work, except for very heavy equipment. For the contractor's equipment, he hires a logistic company to transfer equipment among the sites, or the contractor transports the equipment from the contractor's warehouse to the construction site. The contractor will bear any losses for the unavailability of equipment due to the failure of the contractor's transportation.

The lack of skilled labor is responsible for the contractor under the construction contract. In the case that the project does not have enough labor to perform the work, the contractor usually adjusts the construction method. For example, the contractor increases working hours to reduce the project delay because of the lack of workmanship. To facilitate the management process, the project managers usually select the worker teams who have worked with the contractor in previous projects. Moreover, the respondents said that the contractor often contracts with high prestige universities in order to recruit excellent human resources for his business in the present and the future. Moreover, the contractor will transfer the consequences of risk to the subcontractor in the case that the cause of the unavailability of workmanship belongs to the subcontractor under the subcontract provisions.

For projects that are far from Ho Chi Minh City, the contractors are often faced with the lack of experienced engineers. To solve the problem, the site manager often requires the assistance from the company by recruiting additional resources according to the project contract time. In addition, according to the respondents, the age of the Vietnamese site engineers usually ranges from 22 to 35 years old. This is an advantage

for the construction companies to develop good management resources for the company in the future. Therefore, employee education is considered to be an effective strategy to avoid losses from the unavailability of workmanship.

The study explored the choice of risk-responsive strategies for the availability of construction materials and equipment that the site manager considers for the fluctuations of the market and the limitations in the transportation process.

A3 Productivity of labor and equipment

As shown in Table 7.3, workforce adjustments, employee education and subcontracting are three popular risk-responsive strategies that were chosen to cope with the risks of the productivity of labor and equipment. Nobody underestimated this risk because the consequences impact the project time and the project cost. Work adjustments, bonus/penalty policies, acquisition of additional information and past relationships were also chosen by many respondents to cope with this risk.

The respondents said that in the case that work allocations for labor were not effective, the contractor will conduct a workforce adjustment in order to improve the productivity of work. For example, a brick mason cannot work effectively in a plasterer's job. It is difficult for the site engineer to arrange an appropriate job position for construction labor at the beginning stage, especially for self-employed workers who have not incorporated. Normally, the contractor often allocates the job to the self-employed worker based on the worker's request. Some respondents said that the contractor can reduce the risk by adding information from the foremen of the labor groups.

For the productivity of equipment, the respondent said that low productivity can be due to the skill of the operators. According to the respondents, the contractor uses equipment for many projects. However, he does not spend money for maintenance services, except when deterioration and breakdown of the equipment

Table 7.3 Risk-responsive strategies by Vietnamese Contractors for productivity of labor and equipment

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	6	●		●					●	●		●	●			
Insurance	0															
Contingency allowance	1						●									
Work adjustment	2		●									●				
Contingency plan	0															
Bonus/Penalty policy	4		●					●	●		●					
Workforce adjustment	12	●		●	●	●			●	●	●	●	●	●	●	●
Employee education	8		●	●		●		●		●			●	●	●	
Addition information acquisition	3						●			●					●	
Physical protection	0															
Past relationship	2			●						●						
Good relationship with government	0															
Retention	0															

occur. The maintenance service fees are very expensive. A good operator is often effective when using equipment and also extends its life.

The respondents said that the contractors often chose to cooperate with the last worker team with whom they have worked together in many previous projects. This helps the contractor to make cost estimates more precisely. The contractor also mitigates the risks related to labor errors while performing the works by cooperation with old subcontractors. The contractor said that they only hired new worker teams when the old team was unavailable.

The respondents said that a bonus policy was often used to increasing the productivity of work in special cases. For example, the contractor proposed to the subcontractor that the subcontractor could receive more than one hundred million Vietnamese Dong if the work is finished a week earlier than the deadline stated in the contract. Moreover, the labor team will receive a penalty if they do not complete the work on time.

Employee education is a risk-responsive strategy that Vietnamese construction companies use to develop good human resources for future projects. The respondent said that construction companies often organize trainings for potential engineers. Moreover, the site manager often adjusts the work positions that have low productivity.

Most of the respondents agreed that the application of modern technologies was an effective strategy to improve the productivity of work for Vietnamese construction projects. For example, the application of the Luffing Tower Crane 114 tons and the Host 90 meters per minute helped the contractor work more effectively in a narrow work space.

A respondent said that the construction laborers of the central Vietnamese provinces usually have lower productivity than those of the southern provinces. Therefore, when receiving projects in the central provinces, the contractor often includes more contingency allowances in his bid proposal in order to pay for overtime work.

A4 New technology

Table 7.4 shows that acquisition of additional information and risk retention are two popular choices of the respondents to respond to risks related to new technology. Nobody underestimates this risk because the consequences of the risk will impact project time and costs. Contingency allowances, work adjustments, contingency plans, workforce adjustments, employee education and physical protection are also methods chosen by some respondents to cope with the risk.

The respondents said that there are two main reasons why the contractor decides on the application of new technology in their projects. First, the new technology is required by the owner or the consultant. Second, the contractor realized that the new technology can shorten the project time and save project costs. To avoid risks that may occur in performing process, the contractor referred to technical information from many sources, such as the suppliers, on the internet or the

Table 7.4 Risk-responsive strategies by Vietnamese Contractors for new technology

Risk-Responsive strategies	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	1			●												
Insurance	1									●						
Contingency allowance	2									●		●				
Work adjustment	2	●														●
Contingency plan	5		●	●		●			●						●	
Bonus/Penalty policy	0															
Workforce adjustment	4							●	●			●		●		
Employee education	5		●	●						●	●					●
Addition information acquisition	10	●	●	●			●	●	●		●	●	●		●	
Physical protection	2		●					●								
Past relationship	1			●												
Good relationship with government	0															
Retention	6			●	●		●		●			●	●			

experience of other contractors who have applied that technology. For example, the application of the monolithic method in concrete pouring process helped the contractor achieve the floor of the high rise building in six days, and also helped the contractor enhance the sanitation and safety in the construction phase.

The respondents said that they usually cope with the lack of the appropriate resources to apply new technologies. In the case that the new technology did not bring the economic efficiency, the contractor may still apply them to solve the difficulty of the lack of labor in the peak season. The application of new technologies also helps the contractor ensure the consistency in the quality of work.

Some contractors choose to include a contingency allowance in their bid proposal in order to reduce losses from the consequences of risks in the future. Moreover, the contractor will make at least one contingency plan in the absence of applicable new technology.

According to the respondents, the application of modern technology often gave strength to the bidder in the tendering process. Moreover, a contractor decided to transfer the risk to the insurance companies. For special work packages, the contractors often hired an experience subcontractor to carry out the works. The contractor often gave priory to subcontractors from previous projects.

A5 Inadequate site investigation

In Table 7.5, we can see that acquisition of additional information is the most popular risk-responsive method chosen to cope with the risk related to inadequate site investigation. Nobody underestimated this risk because the consequences of the risk impact the project time and costs.

Contingency allowances, work adjustments, risk retention, risk transfer by subcontracting, contingency plans, risk transfer by insurance, cooperation with past relationships and creating a good relationship with the government were also chosen by many respondents to respond to inadequate site investigation.

Before submitting a bid to the owner, the contractor has the right to a site visit. However, the respondents said that most Vietnamese contractor do not have enough of a professional workforce and the adequate equipment to handle a site investigation. Therefore, they often hire a subcontractor to carry out this work. After the subcontractor collects and analyzes the data from a survey, the results are sent to the contractor. Normally, the costs and time for a site visit are limited. So, having inadequate information is inevitable. It is difficult for the contractor to make a decision for a bid submission with inadequate information. For example, according to the results of a site investigation, the contractor drilled ten wells to lower the underground water level. In the construction process, the contractor could not continue the work because he realized that the underground water level was higher than given by the data survey. Then, the contractor bore the cost to drill an additional ten wells as well as the idle time during the project delay for the risk.

Table 7.5 Risk-responsive strategies by Vietnamese Contractors for inadequate site investigation

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	4	●			●				●							●
Insurance	2							●					●			
Contingency allowance	5	●	●			●	●						●			
Work adjustment	5	●	●	●									●	●		
Contingency plan	4	●		●				●					●			
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	7	●		●					●			●	●		●	●
Physical protection	0															
Past relationship	2			●							●					
Good relationship with government	2								●	●						
Retention	5		●	●			●			●		●				

The respondents said that the contractor primarily used the site investigation information of the owner to perform the work. In some cases, the contractor could get more site information from the local authorities, which could help the contractor avoid the risk during the implementation process.

The respondents said that the cooperation with the local authorities not only helped the contractor receive the information of the site conditions at this location, but also created favorable opportunities to conduct the works smoothly with the support of the local authorities.

The contractor said that for projects located far away from the construction company, the site investigation was very difficult. Therefore, the contractor usually submits a higher contingency allowance than in other projects.

The contractor said that the site investigation company was responsible for inadequate site information. The contractor usually selected to cooperate with past partners who have good experience in site investigation in order to avoid the loss from

the subcontractor failure. However, the contractor said that the losses from inadequate site investigations were often very large and beyond the capacity of the site investigation company. Therefore, the losses of the contractor were unavoidable in this case. The contractor usually re-negotiated with the owner for the consequences of inadequate site investigation.

The respondents said that the failure for site investigation was often discovered in the construction phase. To reduce the impact of risk, the contractor often adjusted the construction method, for example, the contractor switched from pile foundation method to the band foundation method in order to cope with the weakness of the ground soil. Moreover, insurance was the method used to help the contractor reduce the financial burden in the case that the risk occurred.

A6 Knowledge and experience of the contractor

Table 7.6 shows that the workforce adjustment is the most popular risk-responsive strategy that the respondents chose to cope with the risks related to the knowledge and experience of contractor. Nobody underestimated this risk because the respondents said that the consequences of the risk impact the project time and costs. The other risk-responsive methods include risk transfer by subcontracting, risk transfer by insurance, contingency allowances, contingency plans, bonus/ penalty policies, employee education, acquisition of additional information, cooperation with past relationships and risk retention were also selected by many respondents in this study.

The respondents said that people are the most important asset of the company and determine the success of a project. Most the construction failures are due to the knowledge and experience of the personnel, especially the recently graduated engineers. To limit the risk, the construction company often organizes training courses for potential engineers in order to create a strong management team for the company in the future.

The respondents suggest assistance from the company for any part of work for which the site manager does not have the experience to perform. Then, the company

Table 7.6 Risk-responsive strategies by Vietnamese Contractors for knowledge and experience of the contractor

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	5		●	●					●		●		●			
Insurance	2	●								●						
Contingency allowance	5		●	●		●	●	●								
Work adjustment	0															
Contingency plan	4			●	●				●				●			
Bonus/Penalty policy	2			●											●	
Workforce adjustment	10		●	●		●		●	●	●		●		●	●	●
Employee education	5		●	●										●	●	●
Addition information acquisition	2		●	●												
Physical protection	0															
Past relationship	4			●	●						●		●			
Good relationship with government	0															
Retention	3			●					●				●			

will conduct workforce adjustments to carry out this work. In some cases, the contractor recruited an experienced person to run the job. The respondents usually gave priority to the past partner who has demonstrated their capacity in previous projects. For example, the owner required the contractor to construct the firefighting system in accordance with American Society for Testing and Materials which the contractor has never previously implemented. The contractor solved this problem by finding an expert with experience in this system to take on this job.

The respondents said that with the projects that had high risks, the contractor usually requests a higher percentage for the contingency allowance in order to prevent the impact of the risk in the case that the contractor does not properly estimate the complexity of the project.

The respondents said that in the case of the company's discovering the lack of management capability of their staff, the contractor often added an assistant of replaced the manager of the project.

In Vietnam, the project management team are from 30 to 40 years old. The respondent said that the loss due to contractor failure was unavoidable. In this case, the company often reduced the project income to help the project solve the problem related to the knowledge and experience of contractor, including before and after the project was finished.

The large construction companies is rarely faced with knowledge and experience of contractor in the implementing process. They often recruit good candidates from reputable universities. The potential engineers are educated to become good sources of management for the companies in the future.

A7 Safety

According to Table 7.7, employee education, bonus and/or penalty policies, insurance and workforce adjustments are four popular risk-responsive strategies chosen by ten, eight, six, and six respondents respectively to respond the safety risks in strategies selected by many respondents in this study include risk transfer by subcontracting, contingency allowances, physical protection, cooperation with past partners, the construction of a good relationship with the government, and risk retention.

The respondents said that safety is the first priority of any IICP in Vietnam. The construction company often applies the safety system OHSAS 18001:2007 for their projects. According to the contract provisions, the contractor is not only responsible for ensuring the safety of the construction equipment, but also the personnel, onsite. The contractor also has the duty to establish safety regulations on the construction site. Moreover, safety patrols took place daily and safety meetings were also conducted weekly.

The respondents said that the contractor often organized safety checks for equipment and safety training for the laborers before entering the site. For some special works, the contractor required the worker to obtain a safety certificate,

Table 7.7 Risk-responsive strategies by Vietnamese Contractors for safety

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	4			●					●	●		●				
Insurance	6		●	●				●			●	●			●	
Contingency allowance	2								●						●	
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	8		●	●	●	●	●		●				●			●
Workforce adjustment	6		●	●				●	●					●		●
Employee education	10	●	●	●			●		●	●	●	●	●		●	
Addition information acquisition	0															
Physical protection	4			●		●			●				●			
Past relationship	3			●				●	●							
Good relationship with government	3	●		●								●				
Retention	3			●			●		●							

especially the safety certificate of Vietnam's Labor, Invalid and Social Affair Ministry, which was usually issued by reputable construction companies, and competent institutions.

The respondents said that the safety regulation often contained a penalty for the people who violated the safety provisions. Moreover, the contractor also gives a month or quarterly bonus to any worker team that does not have any safety violations in order to encourage the laborers to implement the safety regulations of the project.

The respondent said that the contractor has the duty to buy Personal Accident Insurance 24/24 for all workers who were working on the construction site in accordance with the Vietnam Labor Code. The insurance company will compensate the damages in the case of death, permanent disablement, and temporary disablement or compensate the medical expenses of Particular Insured Persons. The contractor also required the subcontractor to obtain Personal Accident Insurance for all workers before performing the works.

According to the construction contract, the contractor had the right to reject or adjust the work when he realized that it could be insecure for their staff. The respondent said that the contractor will be lay off any worker that committed safety violations more than three times. For owners, such as Japanese owner, who require high standards of work safety, the Vietnamese contractor often increased the percentage of the contingency allowance in the bid submission to deal with the risks.

The respondents said that in current projects, the safety manager tends to receive a higher salary than does the project manager. For example, the owner of the Toyota factory project paid the safety manager three thousand dollars per month, while the project manager was paid only two thousand dollars per month. This shows that safety is receiving more and more attention for construction projects in Vietnam.

Safety is the priority of attention in construction projects in Vietnam. The large contractors have strong financial resources as a basic condition to equip their construction projects with safety systems.

A8 Labor strikes

Looking at Table 7.8, we can see that employee education, workforce adjustments, and contingency plans are three popular risk-responsive strategies chosen by eleven, nine, and seven of the respondents, respectively, to cope with labor strikes in a construction project. Nobody underestimated this risk because the consequences of the risk will impact the project time and costs. Other risk-responsive strategies included creating good relationships with government, risk retention, physical protection, cooperation with past relationships, and risk transfers by subcontracting were also chosen by many respondents in this study.

According to the contract provisions, the contractor is responsible for the general protection security on the construction site. The respondents said that the contractor often released the penalty to limit the labor strikes during the implementation process. Moreover, the contractor always organized training for the laborers and the subcontractor in order to educate the employee behavior onsite.

Table 7.8 Risk-responsive strategies by Vietnamese Contractors for labor strikes

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	2								●	●						
Insurance	0															
Contingency allowance	0															
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	7	●	●			●			●		●		●			
Workforce adjustment	9	●	●	●	●				●			●		●	●	●
Employee education	11	●	●	●		●	●	●		●	●	●	●		●	
Addition information acquisition	0															
Physical protection	3			●						●		●				
Past relationship	2			●									●			
Good relationship with government	4	●		●	●							●				
Retention	4						●		●	●						

The respondents said that labor strikes sometimes happen between two worker teams. To solve the problem, the contractor often adjusted the workforce of both teams. For example, the contractor separated the leaders out of each team. Then, the contractor arranged the new work for them. In the case that the laborers repeat the violations, the contractor will expel them from the construction site.

The contractors said that labor strikes were a common problem in any construction project and often led to delays in performing the work and project delays due to the intervention of the local authorities. The contractor usually tried to create good relationships with the local authorities, who solved the labor strike problem quickly. Moreover, this relationship also helps the contractor limit the delays caused by the authorities.

The contractor also said that the subcontractor was responsible for the loss of the contractor's and the owner's assets in the case that the cause of the loss was due to the behavior of the subcontractor's laborers. Therefore, to avoid losses from labor strikes, the contractor gives priority to cooperate with old partners who had the ability

to manage their human resources well. The respondents often suggested the assistance of the company if the consequences of labor strikes were beyond the capacity of the project.

A9 Quality of sampling and testing controls

Looking Table 7.9, we can see that workforce adjustments and employee education are two popular risk-responsive strategies that were chosen by eleven and seven of the respondents, respectively. Nobody underestimated this risk factor because the respondents thought that the consequences of the risk impact project time and costs. The other risk-responsive strategies that were also selected by many respondents include risk retention, risk transfer by subcontracting, risk reduction by work adjustments, risk reduction through penalty policies, risk reduction by acquisition of additional information, and risk reduction by cooperating with past partners.

The respondents said that the quality of sampling and testing controls were the responsibility of the contractor. The consultants re responsible for establishing the quality of testing control instructions. The contractor must comply with all of the sampling and testing instructions under the supervision of the consultant's representative. The contractor said that reprimands were often used for small errors made by the engineer in the testing process. In the case that the failure is due to the carelessness of the engineer, the contractor will replace the engineer.

The respondents said that the failures in testing controls will affect the general quality of a project. Therefore, to guarantee the accuracy of testing, normally, there are three parties who monitor the testing of the materials: the contractor's representative, the consultant's representative and the representative of the laboratory. The respondents said that the laboratory is also responsible for the results of the testing/ sampling under the testing contract. The contractors usually give priority to a past partner in order to save time and to ensure the quality of work. For a new

Table 7.9 Risk-responsive strategies by Vietnamese contractors for quality of sampling and testing controls

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	2				●							●				
Insurance	0															
Contingency allowance	0															
Work adjustment	3	●							●					●		
Contingency plan	0															
Bonus/Penalty policy	3										●		●		●	
Workforce adjustment	11	●	●	●		●	●	●	●			●	●	●		●
Employee education	7	●	●					●		●	●		●		●	
Addition information acquisition	2			●		●										
Physical protection	1									●						
Past relationship	2			●								●				
Good relationship with government	0															
Retention	4		●	●					●				●			

construction method or new materials, the contractor found out that more technical information is required to avoid failure during testing control.

The respondents said failures due to the equipment is usually very difficult to observe, so the contractor could require the laboratory to check the testing equipment before conducting the sampling and/or testing the work. The contractor also said that the project will require the assistance of the company in the case that the consequences of the risk are beyond the management capability of the site.

A respondent said that incorrect results can be due deterioration of the testing equipment. For example, the deflection of the slump tool led to mistakes in the results of concrete testing. Therefore, the contractor needed to protect the equipment carefully in order to ensure the accuracy of the results.

A10 Third party delay

Table 7.10 shows that all of the fifteen respondents said that the contractor's having a good relationship with the government is the best approach to reduce the delays from third party activities. Nobody underestimated this risk factor because the consequences of the risk impact the project schedule. The other risk-responsive methods selected by some respondents were risk retention, risk reduction by cooperation with past relationships, and risk reduction by employee education in this study.

In a construction project, there are many agents, such as the subcontractors, the suppliers, the insurance companies and the authorities, known as third parties. According to the construction contract, the contractor is responsible for delays caused by the contractor's subcontractors and suppliers. In Vietnam, delays by the local authorities affects both contract parties in a project. For example, the project was delayed, because of the unexpected checking of the authorities due to the legal checking, environmental checking, security checking, etc. To limit third party delays, the respondents said that the contractor and owner need to develop good relationships with the local authorities, which will help them facilitate the implementation of the works.

The respondents said that the contractors often develop relationships with the local authorities with the assistance of past relationships. For example, when the contractor received the project at the new industrial zone, he initially connected with the industrial management board with the assistance of the project owner, consultant or local subcontractor. The contractor realized that the work processes were conducted more smoothly when the contractor kept a good relationship with the authorities. The respondents said that the costs to respond are often borne by the Vietnamese construction firms, because the costs were insignificant.

The respondents also said that the company usually assigned the responsibility for solving third party delays to the site managers and the project managers. Moreover, the contractor also required the engineers and the workers to comply with all of regulations of the industrial management in the construction activities, such as the noise from the pile driving or the dust from the transportation of the soil, in order to

Table 7.10 Risk-responsive strategies for third party delay by Vietnamese contractors

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	0															
Insurance	0															
Contingency allowance	0															
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	3						●	●	●							
Addition information acquisition	1		●													
Physical protection	0															
Past relationship	3		●					●	●							
Good relationship with government	15	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Retention	4	●		●			●		●							

limit the risks. Moreover, employee education in the beginning stage was a good method to restrict harassment by the local authorities.

A respondent said that the acquisition of additional information was about the legislation and the regulations of industrial management boards that helped the contractor avoid project delays due to third parties.

The public contractors are often faced with fewer third-party delay problems than are the private contractors, because they usually have good relationships with the governmental authorities.

A11 Actions causing environmental pollution

Table 7.11 shows that risk reduction by employee education, good relationship with the government and risk reduction by bonus and penalty policies are three most popular methods that were chosen by nine, six, and six of the respondents, respectively, to respond to actions causing environmental pollution on the

construction site. Nobody underestimated this risk, because the consequences impact the project time and project costs. The other risk-responsive methods also selected by some respondents include risk retention, risk transfer by subcontracting, risk transfer by insurance, risk reduction by acquisition of additional information, and cooperation with past partners.

The contractor is responsible for environmental protection on the construction site and the surrounding areas under the contract provisions. The respondents said that there were two main causes of environmental pollution: human behavior and the deterioration of equipment.

The respondents said that all workers were educated to prevent actions causing environmental pollution, for example, nobody was allowed bring food and drink bottles onsite. Moreover, the contractor requires the laborers to collect all of the rubbish around the work area and dispose of it at the right location at the end of the workday.

The respondents said that penalties were applied to acts violating the environmental protection of the workers. Moreover, bonuses were awarded to the worker teams that strictly implemented the environmental regulations of the contractor. For example, a warning would be given to any littering done the first time, and financially penalized the second time. Repeated violations will result in the violators being expelled from the construction site. For special industrial zones, the contractors often look for additional information to inform the engineers and workers about actions that cause environmental pollution.

The respondents said that the subcontractor was responsible for the actions of their laborers. The contractor usually cooperated with the past partners who have worked in previous projects, because the contractors realize that these past partners often comply well with the environmental regulations of the contractor, so that the contractor does not have to spend much time instructing the workers of the subcontractor.

Table 7.11 Risk-responsive strategies by Vietnamese Contractors for the actions causing environmental pollution

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	4			●					●	●		●				
Insurance	2					●		●								
Contingency allowance	0															
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	6			●					●		●	●	●			●
Workforce adjustment	1								●							
Employee education	9		●	●			●		●		●		●	●	●	●
Addition information acquisition	3			●	●					●						
Physical protection	0															
Past relationship	3			●								●	●			
Good relationship with government	6		●	●			●	●		●			●			
Retention	3	●					●		●							

The respondents said that the transportation of materials was one main action causing environmental pollution. Pollution is also caused by the operations of machines, for example, the leaking of oil can happen during the operation of a tower crane. Normally, the contractor will buy insurance for the machines and the equipment on the construction site. However, the insurance company only has the duty for the cause of a fire or an explosion of the equipment. Therefore, the contractor usually requests the staff to check the equipment carefully both before and after performing the work.

The respondents said that in some cases that the costs for the environmental protection measures in accordance with the Environmental Law of Government was very high. However, the Vietnamese contractor always tries to comply with the regulations of the Environmental Department in order to avoid any project delays due to the intervention of the authorities. In some cases, the contractor coped with the risks by the project income to ensure the credibility of the customer. Moreover, the

development of good relationships with the government was an effective strategy to avoid and mitigate the financial losses from actions causing environmental pollution during the construction phase. One respondent said that the contractor often evicted violators from the site in the case of major violations, or if the violation was repeated more than three times.

7.1.2 Design category

B1 Quality of design

Looking at Table 7.12, we can see that risk retention was the most popular risk-responsive strategy to cope with the quality of design. The other risk-responsive strategies include risk transfer by subcontracting, contingency allowances, work adjustments, contingency plans, bonus and penalty policies, workforce adjustments, employee education, acquisition of additional information, and cooperation with past relationships were also chosen by some respondents to respond to risks related to quality of design in this study. Nobody underestimated this risk factor, because the consequences of the risk may impact the project time and costs.

Table 7.12 Risk-responsive strategies by Vietnamese Contractors for quality of design

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	5				●		●		●	●		●				
Insurance	0															
Contingency allowance	4		●	●		●		●								
Work adjustment	5			●				●	●	●						●
Contingency plan	2			●					●							
Bonus/Penalty policy	2									●		●				
Workforce adjustment	2								●			●				
Employee education	3										●	●	●			
Addition information acquisition	3			●							●		●			
Physical protection	0															
Past relationship	3		●	●					●							
Good relationship with government	0															
Retention	11	●	●	●		●	●		●			●	●	●	●	●

The respondents said that the contractor's drawings are approved by three parties, which are the contractor, the consultant and the owner's representative. Therefore, in the case that there happens to be errors in the shop drawings, these errors were often small flaws fixed by the contractor himself.

When the contractor discovered any errors in the design of owner, he often required the consultant to re-check the drawings and fixed these errors. Then, the consultant will return the design to the contractor. In the case that the errors do come from the owner's design, the contractor notifies the consultant in order to solve this matter. The contractor always tries to complete the design as soon as possible in order to avoid a delay of the whole project.

The respondents said that the engineers carrying out the design and shop drawings on the construction site usually included senior and recently graduated engineers. Therefore, errors and omissions in the design were unavoidable in implementing the work. The senior engineers are responsible for instructing new staff members to work more effectively.

The respondents said that the reprimand penalty was often applied for the initial violation. If the violator repeated the violations, the contractor replaced the workforce to carry out the work.

The respondents said that the contractor usually assigned special work, such as the design of cold storage, electrical, water supply and sewerage systems, to the subcontractor, who was responsible, because the contractor did not have the capacity to carry out these works. The contractor gave priority to the old subcontractors who had worked together with the contractor in previous projects. The contractors said that cooperation with old partners helped to assure the quality of work and saved the time for the subcontractor who was familiar with the work environment.

For the drawing of the construction methods, the respondents said that the pre-bid time was limited, so the bidder must approve the construction method before the bid submission. In some case, errors were unavoidable, because the limitation of time led to the bidder not having collected the appropriate information. In the case

that the contractor copes with these ambiguous issues, he tries to gather more information to clarify the matter, which helps the contractor avoid losses in the future.

Moreover, the contingency allowances helped the contractors reduce the costs in order to solve the consequences of the risk. In the case that the contractor realized that the initial construction method was not possible to implement, the contractor will prepare contingency plans for the work. The acquisition of additional information helped the contractor to select a suitable construction method for the project. In the case that the risk was beyond the capacity of the project's financial capability, the site manager will require the assistance of the construction company.

B2 Design changes

Looking at Table 7.13, we can see that risk retention was the most popular strategy chosen by the respondents to cope with the design change risk. The other risk-responsive strategies also chosen by many respondents include risk reduction by contingency allowances, risk reduction by contingency plans, risk reduction by bonus/penalty policies, risk transfer by subcontracting, acquisition of additional information and using past relationships. Nobody decided doing nothing with the design changes because the respondents said that the consequences of risk may affect the project schedule.

The respondents said that the contractor often accepted the work adjustments to follow the changes of the owner in the case that the change insignificantly affected the company's profit. For example, the owner suggested that the contractor move the door position one centimeter to the left according to the initial design. The site manager said that he agreed with this change in the case that the change was given to him at least a week prior following the work schedule. The respondents said that design changes were unavoidable issues in any construction project. Therefore, an experienced contractor always made a percentage of the contingency allowance to prevent the risk from occurring. The contractor also said that in the case that the design changes were required after the contractor was ready with the materials, equipment

Table 7.13 Risk-responsive strategies by Vietnamese contractors for design changes

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	2								●	●						
Insurance	0															
Contingency allowance	5		●	●	●	●		●								
Work adjustment	0															
Contingency plan	5			●					●	●			●			●
Bonus/Penalty policy	5		●	●				●	●				●			
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	3	●	●					●								
Physical protection	0															
Past relationship	2		●	●												
Good relationship with government	0															
Retention	10	●		●	●	●	●		●		●	●		●	●	●

and the workforce to perform the work. The owner was not only responsible for the cost of the extra work volume, but also the additional indirect costs, such as the costs for the ideal time of the labor and the equipment.

The respondents said that the contractors was responsible for shop drawing based on the owner's design. After the shop drawings was finished, the vice-site contractor often required the engineer to repair or redesign according to the level of manager was responsible for checking the drawings before sending them to the consultant. For the minor errors, the errors. For example, the length of column steel was 5.8 meters according to the design. However, the carelessness of the worker in cutting process made the steel tree to be only 5.7 meters. To solve this problem, the contractor added one more steel tree.

For the cause of design changes due to the capacity of the contractor's personnel, the respondents said that a reprimand was applied for the first violation. However, the contractor will adjust the workforce in the case that the violator repeats the mistakes many times.

For the drawings of the construction method, the respondents said that the contractor often suggested changes in case that the design was unsuitable for the practical site conditions. Moreover, the contractor always had contingency plans for such cases.

The contractor also required the subcontractor to be responsible for his designs. The contractor often gave priory to old partners who had worked with the contractor in previous projects, because cooperation with past relationships helps the contractor limit the risks, ensure the quality of work, and save time for the subcontractor familiar with the contractor's work style. In the case that the contractor detects errors in the subcontractor's design, the contractor will solve the problem based on the level of the errors. For example, when the design error of the subcontractor is contained in Code 1, the contractor will approve the drawing. If the design error is contained in Code 2, the contractor will notify the subcontractor for correction. If the design error is contained in Codes 3, 4 or 5, the contractor will return the design and request the design to be fixed. If the design error of the subcontractor is contained in Codes 6 or 7, the contractor will require the subcontractor to redo the drawings.

7.1.3 Economic and financial category

C1 Cash flow management

Table 7.14 shows that risk transfer by subcontracting was the most popular strategy chosen by the respondents for cash flow management problems. Other risk-responsive strategies also chosen by many respondents include risk reduction by contingency allowances, risk retention, contingency plans, employee education and cooperation with past relationships. Two respondents said that they often managed the cash flow of the project very tightly, and have never been faced with cash flow management risk. Therefore, they decided to do nothing about the risk.

The respondents said that the main cause affecting the contractor's cash flow was delays in contract payments. The contractors were often paid following the

Table 7.14 Risk-responsive strategies by Vietnamese Contractors for cash flow management

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	2						●		●							
Subcontracting	9	●		●	●	●		●		●	●	●	●	●		
Insurance	0															
Contingency allowance	5			●				●			●				●	●
Work adjustment	0															
Contingency plan	3			●								●	●			
Bonus/Penalty policy	0															
Workforce adjustment	1		●													
Employee education	3	●	●							●						
Addition information acquisition	0															
Physical protection	0															
Past relationship	3			●								●	●			
Good relationship with government	0															
Retention	5	●	●	●									●	●		

milestones of the execution quantities. After finishing the work, the contractor submitted the payment claims to the consultant. During the waiting period, the payment claim was approved and the payment was made by the owner. The contractor needed to solve to two issues included the subcontract payment and the expenses for running the of current works. To solve these problem, the contractors often transferred the risk to the subcontractor, who only received payment for his work when the contractor received the payment from the project owner.

The contractors gage priority to their old partners who had cooperated with the contractors in previous projects, because they usually accepted the contractor's proposal for the extension of the payment time until the contractor received the money from the project owner.

The respondents said that the site manager was responsible for monitoring and managing the cash flow of the project. Normally, the money of the project was transferred from the construction company to the project account in the case that the

cash flow management was beyond the project control and led to the dispute between the contractor and the subcontractors or suppliers. The site manager often required assistance from the company. The company will use the contingency allowance to solve the problem for the project at that time. In the case that the company realizes that the site manager did not have the capacity to control the project's finances, the company often provided an additional workforce to solve this problem, or the company replaced the current workforce with an appropriate workforce for the project.

The respondents said that the site managers played an important role in the success of a project. The site manager is responsible for establishing the financial statement of the project. To enhance the management capacity of the site manager, the construction companies usually organized training sessions for potential staff members, especially those at the management level. Therefore, the site manager always has a strategy to solve cash flow failures during the work process. For example, the site manager realized that the cost for the work A was more than fifty million Vietnamese Dong compared to the initial contract value. To balance the project's finances for the implementation process of the work B, the site manager tried to save expenses to offset the losses due to the performing process of the work A.

C2 Material price fluctuations

As shown in Table 7.15, risk transfer by subcontracting was the most popular risk-responsive strategy selected by eight respondents in this study. Nobody underestimated the material price fluctuations, because the consequences of the risk may impact the project costs. The other risk-responsive strategies selected by many respondents include contingency allowances, risk reduction by work adjustments, risk reduction by contingency plan, risk reduction by acquisition of additional information, and risk retention.

The respondent said that the IICPs often had contract values of around 100 billion to 200 billion Vietnamese Dong. The projects were often completed in about 9

Table 7.15 Risk-responsive strategies by Vietnamese Contractors for material price fluctuations

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	8			●	●	●					●	●		●	●	●
Insurance	0															
Contingency allowance	7	●	●	●			●		●		●		●			
Work adjustment	2							●					●			
Contingency plan	2			●								●				
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	4		●	●				●				●				
Physical protection	0															
Past relationship	6	●	●	●				●		●		●				
Good relationship with government	0															
Retention	2			●										●		

to 16 months. Therefore, the material price fluctuations were insignificant. Moreover, the contractor always made the percentage of the contingency allowances in the bid submission to hedge for the increasing of the material prices. Therefore, the contractor could retain the risk.

Other respondents said that the contractors will bear the responsibility for material price changes in the circumstance of the price increasing by less than 5 percent of the contract price. In the case that the material prices increases by up to 5 percent, the contractor often conducts a re-negotiation the contract value with the project owner.

The contractor often required the supplier to hold the materials until they were ready to be used. Moreover, to avoid an escalation of the material prices when the prices of raw material increased, or during the peak construction season, the contractor often bought the materials early and stocked them in a warehouse for later use.

The respondents said that the contractors often discounted the prices when they purchased more than one time and purchased a higher volume of materials. Therefore, the contractors give priority to cooperate with the old suppliers. For example, according to the supplier contract, the paint company accepted to keep the same material prices for the contractor for up to a year after the signing of the contract.

The respondents said that the information for adjusting material prices from the suppliers helped the contractor to prepare the contingency plans to cope with the risks in the future. For example, the contractor adjusted the work schedule by accelerating the completion time of the project when he received the plan for the material price adjustments of the supplier in the next three months. In practical situations, the respondents said that the contractors will adjust the types of materials and the volumes of the materials to mitigate the losses in the case that the prices of the initial material are so high. For lump sum contracts, the contractor could receive a windfall in case the material price decreases.

The contractor also manages the risk related to the material price fluctuations by closely monitoring the market information, the business plans and the inventories of the company. Then, the contractor decides the time of purchase. The respondents said that most Vietnamese contractors do not use any tools to predict the material price fluctuations.

C3 Labor price fluctuations

Looking at Table 7.16, we realized that risk transfer by subcontracting and contingency allowances were the two most popular risk-responsive strategies chosen by ten and nine respondents, respectively, for the labor price fluctuations. Other risk-responsive strategies selected by many respondents include contingency plans, risk reduction by cooperation with past relationships and risk retention in order to cope

with labor price fluctuations. Nobody underestimated this risk factor, because the consequences of the risk may affect the project costs.

The respondents said that there are two types of laborers in the construction projects consisting of the laborers who are paid according to the workday and according to the volume of work. The workday laborers were only paid the base rate for overtime work on Sundays or public holidays. The contractors did not calculate extra wages for overtime work for the workday laborers.

The respondents said that the contractor always calculated the percentage of the contingency allowances in the bid price in order to prevent the labor prices from increasing during the performing process of the works. The contractors accepted the loss in the circumstances of the labor price increasing by less than 5 percent compared with the contract price. In the case that the labor price increased by up to 5 percent, the contractor often re-negotiated the contract value with the project owner. For the project with a schedule of less than a year, the owner usually did not accept the contractor's claim about the labor price fluctuations.

Table 7.16 Risk-responsive strategies by Vietnamese contractors for labor price fluctuations

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	10	●		●	●	●		●		●	●	●	●	●		
Insurance	0															
Contingency allowance	9	●	●	●			●	●	●		●				●	●
Work adjustment	0															
Contingency plan	4	●		●								●	●			
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	0															
Physical protection	0															
Past relationship	4		●	●								●	●			
Good relationship with government	0															
Retention	4		●	●									●	●		

The respondents said that the contractor often divided the total project into many work packages. Then, the contractor assigned these work packages to the subcontractors who were responsible for increasing the labor prices in their work packages. Moreover, the contractor often gave priority to the old partners with whom they had worked in previous projects, because the contractor knew that the subcontractor had enough financial capacity to cope with the increasing of labor prices, and the contractor could avoid wasting time with a subcontractor who was familiar with the contractor's work style.

The respondent said that the contractor usually predicted the labor price fluctuations based on the experience and the information of the subcontractor. The Vietnamese construction companies do not use any the technical to calculate the variations in labor prices.

At the peak of the construction season, when the labor prices increase, the contractor often adjusts the construction method by using modern equipment to reduce the manpower. The respondents said that the contractor often did not have contingency plans at the pre-contract phase. The contingency plan was often prepared when the contractor was about to face risks in the foreseeable future.

C4 Interest rate changes

Table 7.17 shows there are ten respondents who chose risk retention strategies for interest rate changes. Seven respondents selected risk reduction by contingency allowances. Other strategies chosen by many respondents include risk reduction by contingency plans, risk reduction by acquisition of additional information, and cooperation with past relationships to cope with interest rate changes. One respondent selected the "do nothing" strategy.

The respondent said that the interest rate changes often affected the short-term deposits of the contractor. Therefore, the contractor usually selected the bank with the best interest rate to save money, which brought more profit for the company.

Table 7.17 Risk-responsive strategies by Vietnamese Contractors for interest rate changes

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	1						●									
Subcontracting	0															
Insurance	0															
Contingency allowance	7	●	●	●						●			●		●	●
Work adjustment	0															
Contingency plan	3		●	●				●								
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	3	●		●								●				
Physical protection	0															
Past relationship	2		●	●												
Good relationship with government	0															
Retention	10	●	●	●	●	●			●		●		●	●		●

Moreover, the construction company always gave priority to the old banks to guarantee the safety of the contractor's money.

The respondent said that the construction company did not use any tool for sensitivity analysis of the interest rate, because the impact of interest rate changes were insignificant to the contractor's finances. Therefore, the contractor accepted the consequences of the risk in the construction phase.

The respondents said that the contractor also calculated the amount of contingency allowances in order to prevent the risk in the future. Although, the contractor did not analyze the sensitivity of the interest rate, they always based on the market information to predict the changes in the interest rate.

A respondent said that the consequences of interest rate changes did not fall within the project's control. His company often took very good care with this issue. Therefore, the respondent selected the "do nothing" strategy for the interest rate changes.

C5 Exchange rate changes

Table 7.18 shows that nine respondents chose risk retention to respond to exchange rate changes. Other risk-responsive strategies were chosen by many respondents include risk transfer by subcontracting, contingency allowances, work adjustments and risk reduction by acquisition of additional information. There are two respondents who selected the "do nothing" strategy with the exchange rate changes. The respondents said that responding to exchange rate changes always belonged to the duty of the board of directors. The respondents have never stayed in the role as the deciders for the risk. Therefore, they chose the "do nothing" strategy in this case.

The respondents said that the construction company often accepted the effects of the exchange rate changes on their business activities, because the contractor did not use any tools to analyze the sensitivity of the exchange rate and most of the purchasing activities and the construction services of the company were carried out in Vietnamese Dong.

Table 7.18 Risk-responsive strategies by Vietnamese Contractors for exchange rate changes

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	2						●		●							
Subcontracting	0															
Insurance	0															
Contingency allowance	5		●	●								●	●			●
Work adjustment	2	●						●								
Contingency plan	0															
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	3	●		●								●				
Physical protection	0															
Past relationship	1		●													
Good relationship with government	0															
Retention	10	●	●	●	●	●				●	●			●	●	●

The contractors said that most of construction materials were bought from local suppliers. The contractor only use foreign currency to purchase the electrical devices and mechanical equipment from China, Taiwan, Japan and the European countries. Therefore, the contractors only considered the exchange rate changes when the IICP had the technology part much higher than the construction structure part.

The respondents said that the contractor could adjust the purchasing time in order to avoid the escalation in the price of goods. For example, when the contractor received a notice for the equipment price adjustments in the next three months from the foreign suppliers, the contractor arranged to buy the equipment early and stocked it in the warehouse for later use.

Some respondents said that the contractor also calculated the percentage of contingency allowances to be approximately 0.5 to 1 percent of the contract price in order to respond to future risks.

A respondent said that the contractors can avoid risk by cooperating with old suppliers who agreed to expand the contract payment time. Therefore, he proposed past relationships as an effective strategy to cope with exchange rate changes.

C6 Market fluctuations

Table 7.19 shows that risk retention and “do nothing” are two popular strategies chosen by the respondents to respond the risk relate to market fluctuations. Other risk-responsive strategies also chosen by some respondents include contingency plan, workforce adjustment and acquisition of additional information.

The respondents said that the responsibility for the consequences of market fluctuations belonged to the construction company. The site manager did not have enough capacity to control the risk. Moreover, the respondents have never been in the role as deciders of the response strategy for risks. Therefore, most of the respondents chose the “do nothing” strategy for market fluctuations.

Table 7.19 Risk-responsive strategies by Vietnamese Contractors for market fluctuations

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	6		●	●			●		●			●			●	
Subcontracting	0															
Insurance	0															
Contingency allowance	0															
Work adjustment	0															
Contingency plan	2									●			●			
Bonus/Penalty policy	0															
Workforce adjustment	2	●											●			
Employee education	0															
Addition information acquisition	2				●			●								
Physical protection	0															
Past relationship	0															
Good relationship with government	0															
Retention	6					●				●	●		●	●		●

The respondents said that market changes often affected the contractor's debts. However, the construction company frequently monitored the client's debts according to the contract payments, and the contractor always maintained a sufficient amount of money to apply in the company's business activities. Therefore, market fluctuations significantly affected the contractor's business.

The respondents said that the contractor can be faced with a lack of capital due to the time of the maturity of loans from the banks being different from the times of the contract payments from the client. Therefore, the acquisition of additional information was an effective strategy to help the contractor limit the project delay when the risk occurred.

The respondents said that the project owner often bears the loss of the market fluctuations more than does the contractor. For example, the market fluctuations led to changes in land rent rates, or decreasing the number of tenants who hired industrial facilities. The contractor could trivially affect the market fluctuations, such as the

changes in electrical and water rates, and the in management fees from the boards of industrial zones, during the implementation of the construction projects. However, the cost to respond to the risk was insignificant, so the contractor often accepted the consequences of the risk.

The respondents said that the contractor can adjust the workforce to reduce the consequences of risk. For example, in the economic crisis of 2008, many construction companies applied the employee reduction strategy to mitigate the operation costs of the company. Moreover, the company also conducted restructuring management and the re-allocation of the investment capital of the company.

7.1.4 Legal and political risks

D1 Changes in the scope of the work

Table 7.20 shows that nine respondents choose risk retention for changes in the scope of work. Other risk-responsive strategies selected by some respondents include risk transfer by subcontracting, contingency allowances, risk reduction by work adjustments, risk reduction by workforce adjustments, acquisition of additional information, and cooperation with the past relationships. Nobody underestimated the risk because the respondents said that changes in the scope of the work often happened during the project lifecycle.

The respondents said that the contractor was responsible for the changes in the scope of work resulting from the contractor's failure, especially in lump sum contracts. When the contractor realized that there was a difference between the actual and the contract quantities, he often sought the source of the issue. The information, especially the bidding prices of other bidders, could be gathered from the site engineer, the consultant or the subcontractor.

The respondents said that the normal cause of changes in the scope of the work are miscalculations in the bid submission of the contractor. The respondents said that the contractor accepted the extra costs for the changes in the scope of work when the cost to respond was under 5 percent of the contract value. In the case that

Table 7.20 Risk-responsive strategies by Vietnamese Contractors for changes in work scope

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	4			●					●		●	●				
Insurance	0															
Contingency allowance	5	●			●						●	●			●	
Work adjustment	4			●		●			●				●			
Contingency plan	0															
Bonus/Penalty policy	0															
Workforce adjustment	3						●		●	●						
Employee education	0															
Addition information acquisition	3			●				●					●			
Physical protection	0															
Past relationship	0															
Good relationship with government	0															
Retention	9	●	●	●	●				●	●		●		●		●

the cost was higher than 5 percent of the contract value, the contractor usually re-negotiates the contract value with the owner. For a unit price contract, the contractor will adjust the unit price when the actual quantity is less than 20 percent of the quantity estimated by the owner.

The respondents said that the contractor often had a limited time for preparing the bid documents, and the cost estimates were often performed by both skilled engineers and recently graduated engineers. Therefore, miscalculations were unavoidable in the bid preparation. However, to avoid the losses from cost estimations, the contractor always put in a contingency allowance in the range of 5 to 10 percent for the changes in the scope of the work that the contractors could not predict during the tendering process. The respondents said that the contingency allowances usually helped the contractor to mitigate the losses in case the risk occurred.

The respondents said that the contractor also adjusted the work to reduce the losses from the consequences of the risk. For example, the contractor discovered the

miscalculation for the time to complete work item A. Then, he tried to shorten the time to perform the work item B from 30 days down to 25 days to compensate for the 5 days due to the miscalculation for the work A. The contractor also realized that he had saved 30 percent of the cost by executing the work A to use for the work B.

The respondents said that the contractor's error leading to changes in the scope of the work during the implementing process is often small. The contractor will immediately rectify any mistakes that are discovered. In the case that the changes in the scope of the work are beyond the capacity of the project's control, the site manager usually requires assistance from the construction company. For example, the contractor discovered mistakes in the calculations of the heights of the technological floor in a factory project. The loss was estimated to be around 1.5 billion Vietnamese Dong, then the site manager notified the company, which coped with the loss by using the project's income and the contractor finances. In this case, the project's losses were unavoidable.

The respondents said that the subcontractor was responsible for the changes in the scope of the work that are due to the contractor's failure. The subcontractor usually bears the compensation for the changes. However, the contractor often bears the delay in the project for this problem. To limit the consequences of the risk, the contractor always requires their staff and the subcontractors to be careful when implementing the work.

D2 Delays in change negotiations

Table 7.21 shows that risk retention is the most popular risk-responsive strategy chosen by eight respondents for the delays in change negotiations. Nobody underestimated the risk because it often occurred during the construction phase. Other risk-responsive strategies selected by some respondents included risk reduction by work adjustments, risk reduction by contingency plans, risk reduction by acquisition of additional information and risk reduction by past relationships.

Table 7.21 Risk-responsive strategies by Vietnamese Contractors for delays in change negotiations

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	0															
Insurance	0															
Contingency allowance	0															
Work adjustment	5					●		●		●				●		●
Contingency plan	4			●				●				●	●			
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	4	●	●	●							●					
Physical protection	0															
Past relationship	0															
Good relationship with government	0															
Retention	8	●	●	●	●		●		●					●	●	

The respondents said that the delays in change negotiations directly impacted the project time, as well as indirectly impacted the project costs. In the waiting period for the results of the change negotiations, the contractor often adjusted the work in order to avoid wasting the workforce. The contractor said that it was very difficult to calculate the losses due to the change negotiations, because they were ambiguous.

The contractor often did not stop the work to wait for the final result, and always had a contingency plan for this circumstance. The respondents said that the contractors often spent a long time for the results of the change negotiations, especially in an IICP in which the contractor often had to cope with communication barriers with foreign people. The contractor often claimed a time extension for the completion of project when the project was delayed for a long time due to this problem.

The respondents said that in the case that the contractor required the changes, he needed to gather all of the information as soon as possible in order to answer the

questions of the owner's representative and consultant. For example, when the contractor needed to change the type of footing, firstly, he notified the consultant and the owner's representative about the reason for the change. Then, the contractor presented the solutions to this problem. Finally, the contractor waited for the results from the project owner. The contractors said that careful preparation often helped the contractor to mitigate the time delay due to the negotiation meetings.

D3 Ambiguities in contract documents

Table 7.22 shows that risk retention is the most popular risk-responsive strategy chosen by eight respondents for ambiguities in contract documents. Other risk-responsive strategies chosen by some respondents included risk reduction by employee education, risk reduction by acquisition of additional information and risk reduction by past relationships. Two respondents selected the "do nothing" strategy, because the respondent realized that the practical construction contract provisions were very clear about the rights and duties of each contract party, the volume of the contract payment, and the project schedule. Therefore, they did not choose responsive strategies to solve the ambiguities in contract documents.

The respondents said that there were two main reasons that lead to ambiguity in contract documents. First is the language barriers of the manager who is responsible for implementing the work under the contract provisions. Second, the carelessness of the contractor's personnel in checking the contract. For example, the specifications of the pile driving work in the construction project contained 50 interpretation files. During the working process, the carelessness of the contractor in the review specifications led to failure in the implementation process. According to risk identification in Chapter 4, both parties, especially the contractor who will carry out most of the risk in implementing the works, are responsible for checking the contract before signing it.

The respondents said that when the contractor signed the contract, the contractor was forced to bear the losses that may be due to ambiguities in contract documents. In another example, the site manager allowed the worker to use the

Table 7.22 Risk-responsive strategies by Vietnamese Contractors for ambiguities in contract documents

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	2	●												●		
Subcontracting	0															
Insurance	0															
Contingency allowance	0															
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	3		●								●		●			
Addition information acquisition	2			●				●								
Physical protection	0															
Past relationship	4		●		●			●		●						
Good relationship with government	0															
Retention	8		●	●		●	●		●			●			●	●

remainder of the marble to pave the factory floor after the project was finished. For the final payment, the owner required the contractor to compensate for the losses related to the contractor's responsibility for this issue. The loss of the company was unavoidable in this circumstance.

In the large construction companies in Vietnam, the legal department is responsible for the contract management, including the construction contracts and the purchase contracts. The respondents said that most legal officers did not have experience of construction sites. Moreover, the language barrier was also an issue in the drafting and checking of the documents for the project. Therefore, the contractor may cope with the ambiguities in contract documents during the construction stage by the reviewing and checking being carried out by a third party, such as a lawyer, who is considered an expert in contract management. The contractor usually gave priority to the old partners with whom they had worked together in the previous projects.

The respondent said that in the case that the contractor discovered ambiguities in the contract document while performing the work, he tried to find the source of the problem in order to clarify the ambiguities. The information was often provided by the consultant or the project owner. Then, the contractor will set up a meeting with the owner's representatives to re-negotiate the contract provisions. However, the meeting often takes a long time, leading to project delays. Therefore, the contractor always requires that the contractor's staff be careful about the contract monitoring and checking process.

D4 Problem of approvals and licenses

Table 7.23 shows all of respondents selected a good relationship with government as the most popular risk-responsive strategy to solve the problem of approvals and licenses in this study. Six respondents chose risk retention to respond to this risk.

According to Chapter 5, the contractor is responsible for compliance with the legal documents in accordance with Vietnam's legislation system. The respondents said that the contractor must obtain many license documents required to run the project according to Vietnamese Construction Law. Therefore, the contractor always tries to create and keep a good relationship with the local authorities in order to facilitate the obtaining of the legislative documents for projects. The respondent said that this is an advantage Vietnamese contractors have for winning in the bidding process.

The respondents said that the cost of responding to this the problem of approvals and licenses is usually insignificant. Moreover, Vietnamese contractors often have good relationships with the authority from previous projects. Therefore, the contractor selected the retention strategy for this risk.

The respondents said that the foreign owner often requested the assistance of the contractor to obtain the legal documentation, which was the responsibility of owner, according to Vietnamese construction law. The problem of approvals and

Table 7.23 Risk-responsive strategies by Vietnamese Contractors for problem of approvals and licenses

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	0															
Insurance	0															
Contingency allowance	1														●	
Work adjustment	0															
Contingency plan	0															
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	0															
Physical protection	0															
Past relationship	0															
Good relationship with government	15	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Retention	6	●	●	●					●				●			●

licenses for a project was often executed smoothly when the contractor carried out the whole legislation problem.

A respondent said that the regulation fee of each industrial zone was different based on government regulations. In the case that the contractor realized high expenses for the approvals and licenses procedures, he often added more contingency allowances in the bid submission to prevent the risk occurring. The foreign owner and the Vietnamese contractor often hired a local service company who had he legal status in this field in order to handle the legal procedures issues.

7.1.5 Natural risks

E1 Adverse weather conditions

Table 7.24 shows that risk retention is the most popular risk-responsive strategy selected by ten respondents to respond the adverse weather conditions. Other risk-

Table 7.24 Risk-responsive strategies by Vietnamese Contractors for adverse weather conditions

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	0															
Insurance	0															
Contingency allowance	6		●	●						●		●	●		●	
Work adjustment	5		●	●				●	●				●			
Contingency plan	5	●			●		●		●		●					
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	4		●				●		●			●				
Physical protection	2			●					●							
Past relationship	1			●												
Good relationship with government	0															
Retention	10		●	●		●			●	●		●	●	●	●	●

responsive strategies chosen by some respondents included contingency allowances, risk reduction by work adjustments, contingency plans, and risk reduction by acquisition of additional information. Nobody underestimated the weather problems, because the consequences of adverse weather conditions usually led to losses for the contractor in the construction phase leads to flooding on site, which submerges the surface foundation under the construction.

The respondent said that typhoons, heavy rains, burning sun and floods are considered to be adverse weather conditions in Vietnam. The contractor often bears the losses due to this problem. For example, project delays because of heavy rain.

The respondents said that except for unforeseen weather events, such as earthquakes, hurricanes, heavy floods and tsunamis, which are considered as force majeure in construction contracts, the contractor often used the project's finances to respond to the risk. To avoid project loss, the contractor always calculated the contingency allowance to be around 0.5 to 1 percent of the contract value.

The respondent said that the contingency plans often were not prepared in the pre-contract stage. The contractor proposed the contingency plan to the consultant when he realized that the risk may occur in the near future. For example, the contractor proposed the consultant establish a water drainage system in this area. Moreover, the contractors also adjusted the work in order to mitigate the idle time of the workforce.

The respondents said that the contractor often claimed to extend the time for the completion from the project owner, because of the project being delayed by the consequences of adverse weather conditions. Acquisition of additional information was an effective risk-responsive strategy to negotiate with the owner in order to extend the time for the project's completion. For example, in 2009, the project was delayed by three months, because the heavy rains lasted longer than in previous years. After collecting the information from the Astronomical Observatory about the weather, the contractor submitted the claim for an extension of time for completion to the project owner. The respondents also said that in the case that the owner did not accept the requirement of the contractor, the claim would be rejected. The contractor usually coped with the delay by increasing the overtime work in order to balance with the time of the delay, because of the unusual weather conditions.

The respondents also said that the contractor often kept a journal of the construction site in order to make the claim for the extension of the time for the completion at the end phase of the project, especially for the project executed in the central Vietnamese provinces where the weather conditions are extreme.

A respondent often gave priority to the old subcontractor who had accepted to share the losses due to the consequences of adverse weather conditions with the contractor in previous projects. Moreover, the respondent said that the cooperation with the last partner helped the contractor to restrict the disputes when the risk occurred. For project locations far from Ho Chi Minh City, the contractor often hired a local subcontractor who was familiar with the local weather conditions in order to carry out the work, since the local subcontractor helped the contractor predict adverse weather conditions and propose risk-responsive strategies based on experience.

E2 Unforeseen site condition

Table 7.25 shows that risk retention is the most popular risk-responsive strategy selected by thirteen respondents. Other risk-responsive strategy selected by some respondents include risk transfer by subcontracting, contingency allowances, contingency plans and risk reduction by past relationships. Nobody selected the "do nothing" strategy, because the respondents know that the consequences of risk may lead to losses in the project income.

The respondents said that the ruins of war, including unexploded shells, and bombs, are unforeseen site conditions that the contractor may encounter while performing the works. In practical construction projects, the budget paid for the site investigation is limited, and the contractor does not have enough time for data collection prior to the bid submission. Therefore, the contractor usually copes with the risk by contingency allowances. In the case that the risk premium is beyond the capacity of the project's control, the site manager often requires the assistance of the construction company.

Table 7.25 Risk-responsive strategies by Vietnamese Contractors for unforeseen site conditions

Risk-Responsive methods	Frequence	Respondents														
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Do nothing	0															
Subcontracting	2	●							●							
Insurance	0															
Contingency allowance	5		●	●						●		●			●	
Work adjustment	0															
Contingency plan	4	●		●				●			●					
Bonus/Penalty policy	0															
Workforce adjustment	0															
Employee education	0															
Addition information acquisition	0															
Physical protection	0															
Past relationship	2	●		●												
Good relationship with government	1			●												
Retention	13	●	●	●	●	●	●		●	●		●	●	●	●	●

The respondents said that Construction All Risks Insurance often covered risks from unexploded shells or bombs. Moreover, the contractor is responsible for the water and electrical systems, as well as the underground cables of the industrial zones. For example, the pipe water of an industrial zone was broken during construction. The contractor paid the total cost of repairing the pipe and the compensation to the plants that were operating in this industrial zone and were affected by this problem.

The respondents also said that the contractor usually selected an experienced subcontractor to carry out the work packages. The contractor gave priority to old partners with whom he had worked on the previous projects in order to ensure the quality of work and to save time for the subcontractor who was familiar with the contractor's work style.

A respondent said that good relationships with the local authorities brought advantages for the contractor during the collection of site information, with which the contractor could predict the risks related to the site conditions more precisely before the project's commencement.

7.2 Discussion

Through the two-round Delphi process, the summary result of alternative risk-responsive strategies by Vietnamese contractors for the IICP risks are shown in Table 7.26. This study also identified some criteria which the contractor often considers before choosing risk-responsive strategies for each risk factor through the in-depth interviews.

For the statistical results of alternative risk-responsive strategies for each risk factor in the technology and management risk category, the concentration of results is low, because the respondents usually met these risks while performing the work. Thus, the number of risk-responsive strategies employed to respond to the risk were very diverse. Risk reduction by workforce adjustment and risk reduction by employee education are two popular strategies considered as favorable selections to respond to risk factors from human resource activities. Risk transfer by subcontracting is a favorable

selection to respond to risks from the materials and equipment failure. The criteria for choosing risk-responsive strategies by the respondents for each risk factor are different, as explained below.

Table 7.26 The summary of alternative risk-responsive strategies by Vietnamese Contractors in the IICPs

Risk factors			Alternative risk-responsive strategies by Vietnamese contractors in IICPs													
			Without knowledge	Risk transfer		Risk reduction										Risk retention
			Risk not worried	Subcontracting	Construction insurance	Contingency allowance	Work adjustment	Contingency plan	Bonus policy and/or penalty policy	Workforce adjustment	Employee education	Addition information acquisition	Physical protection	Past relationships	Good relationship with government	Risk response by Contractor capability
Technology & Management	A1	Suitability and quality of materials and equipment	0	9	5	2	0	3	2	0	1	3	2	11	0	4
	A2	Availability and supply of materials, equipment, workmanship	0	9	0	0	3	7	3	3	1	5	0	9	9	3
	A3	Productivity of labor and equipment	0	6	0	1	2	0	4	12	8	3	0	2	0	0
	A4	New technology	0	1	1	2	2	5	0	4	5	10	2	1	0	6
	A5	Inadequate site investigation	0	4	2	5	5	4	0	0	0	7	0	2	2	5
	A6	Knowledge and experience of contractor	0	5	2	5	0	4	2	10	5	2	0	4	0	3
	A7	Safety	0	4	6	2	0	0	8	6	10	0	4	3	3	3
	A8	Labor strikes	0	2	0	0	0	0	7	9	11	0	3	2	4	4
	A9	Quality of sampling and testing control	0	2	0	0	3	0	3	11	7	2	1	2	0	4
	A10	Third party delay	0	0	0	0	0	0	0	0	3	1	0	3	15	4
	A11	Action led to environmental pollution	0	4	2	0	0	0	6	1	9	3	0	3	6	3
Design	B1	Quality of design	0	5	0	4	5	2	2	2	3	3	0	3	0	11
	B2	Design changes	0	2	0	5	0	5	5	0	0	3	0	2	0	10

When choosing risk-responsive strategies for A1, suitability and quality of materials and equipment, the contractor considers contract provisions concerning the contractor's responsibility for risks, the cost to execute a response strategy, and the time to execute a response strategy fully.

When choosing risk-responsive strategies for A2, availability of materials, equipment and workmanship, the contractors consider the costs associated with a response strategy, the contractor's policy in the construction boom, the project's location to add a risk premium, and the knowledge and experience of the contractors.

When choosing risk-responsive strategies for A3, productivity of labor and equipment, the respondents consider the costs and time to execute a response strategy fully, the contractor's policy for improving the work productivity, for example, the application of new technology in construction methods, and the knowledge and experience of the contractor in responding to risks.

When choosing risk-responsive strategies for A4, new technology, the respondents consider the costs associated with a response strategy, the appropriateness of resources, the owner's policy, and familiarity with the new technology of the contractors.

When choosing risk-responsive strategies for A5, inadequate site investigation, the respondents consider the costs associated with a response strategy, the project's location, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for A6, knowledge and experience of the contractor, the respondents consider the complexity of the project, the costs to execute a response strategy, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for A7, safety, the respondents consider the costs associated with a response strategy, the contractor's financial situation, the safety policy of the company, the owner's policy, and the contract provisions concerning the risks.

Table 7.26 (continuation) The summary of alternative risk-responsive strategies by Vietnamese Contractors in the IICPs

Risk factors			Alternative risk-responsive strategies by Vietnamese contractors in IICPs													
			Without knowledge	Risk transfer		Risk reduction										Risk retention
			Risk not worried	Subcontracting	Construction insurance	Contingency allowance	Work adjustment	Contingency plan	Bonus policy and/or penalty policy	Workforce adjustment	Employee education	Addition information acquisition	Physical protection	Past relationships	Good relationship with government	Risk response by Contractor capability
Economic & Financial	C1	Cash flow management	2	9	0	5	0	3	0	1	3	0	0	3	0	5
	C2	Material price fluctuations	0	8	0	7	2	2	0	0	0	4	0	6	0	2
	C3	Labor price fluctuations	0	10	0	9	0	4	0	0	0	0	0	4	0	4
	C4	Interest rate changes	1	0	0	7	0	3	0	0	0	3	0	2	0	10
	C5	Exchange rate changes	2	0	0	5	2	0	0	0	0	3	0	1	0	10
	C6	Market fluctuations	6	0	0	0	0	2	0	2	0	2	0	0	0	6
Legal & Contract	D1	Difference between actual quantities and contract quantities	0	4	0	5	4	0	0	3	0	3	0	0	0	9
	D2	Delays in change negotiations	0	0	0	0	5	4	0	0	0	4	0	0	0	8
	D3	Ambiguities in contract documents	2	0	0	0	0	0	0	0	3	2	0	4	0	8
	D4	Problem of approvals and licenses	0	0	0	1	0	0	0	0	0	0	0	0	15	6
Natural	E1	Adverse weather conditions	0	0	0	6	5	5	0	0	0	4	2	1	0	10
	E2	Unforeseen site conditions	0	2	0	5	0	4	0	0	0	0	0	2	1	13

When choosing risk-responsive strategies for A8, labor strikes, the respondents consider the contractor's regulations concerning the risks.

When choosing risk-responsive strategies for A9, quality of sampling and testing controls, the respondents consider the contract provisions concerning the risks, and the knowledge and behavior of the contractor's staff.

When choosing risk-responsive strategies for A10, third party delay, the respondents consider the associated expenditures, the contractor's policy, and the knowledge and experience of the legal specialist.

When choosing risk-responsive strategies for A11, actions causing environmental pollution, the respondents considered the associated expenditures, the contractor's financial situation, the owner's policy, and the perceptiveness of the contractor for the environmental issues in contract provisions and Vietnamese construction law.

For risk factors within the design risk category, the majority of respondents chose risk retention strategy for them, because the respondents judged the impacts of design risks as being insignificant. Le-Hoai found that design changes frequently occur in Vietnam large construction projects, and are one of the major factors for project delays and cost overruns (Le-Hoai, Lee, & Lee, 2008). The statistical results of alternative risk-responsive strategies adopted by the fifteen respondents for each risk factor in the design risk category were quite diverse. The respondents considered some criteria for choosing risk-responsive strategies to each design risk.

When choosing risk-responsive strategies for B1, quality of design, the respondents consider the knowledge and experience of the designers, the owner's policy, and the costs associated with a response strategy.

When choosing risk-responsive strategies for B2, design changes, the respondents consider the owner's policy, the contract's policy, the contract provisions concerning risks, and the knowledge and experience of the contractor.

Chan et al. found that adding a skilled designer at the tender stage, establishing a system to control and evaluate variations for the design offices, and preparing an effective contingency plan are good solutions to reduce the losses from time and costs for design risks arising later (Chan & Kumaraswamy, 1996).

For risk factors in the economic and financial risk category, risk retention strategy was the favorable alternative for interest rate changes, exchange rate changes, and market fluctuations, because the respondents judged the impact of the risks as insignificant to their projects, and their company managed this issue very well. The statistical results of alternative risk-responsive strategies adopted by the fifteen respondents for each risk factor in the economic and financial risk category were diverse. The contractor considered some criteria before choosing risk-responsive strategies for each economic and each financial risk.

When choosing risk-responsive strategies for C1, cash flow management, the respondents considered the contractor's financial situation to cope with the risks, the contractor's policy, the contract provisions concerning the risks, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for C2, material price fluctuations, the respondents considered the contract provisions concerning cost adjustments, the contractor's policy, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for C3, labor price fluctuations, the respondents considered the contract provisions concerning risks, the project's location, the contractor's policy, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for C4, interest rate changes, the respondents consider the contractor's policy. Lam and Chow (1999) found that the losses due to in fluctuations of interest rates is moderately critical during the pre-investment stage and slightly critical during other stages of build-operate-transfer (BOT) projects (Lam & Chow, 1999). To mitigate the impacts of interest rate fluctuations, Ling and Hoang (2010) found that the contractors raise the construction capital from sources not affected by interested rate fluctuations. Including an adequate contingency in bid proposals is a good solution for the contractor, which was also a strategy selected by the majority of respondents in this study (Ling & Hoang, 2010).

When choosing risk-responsive strategies for C5, exchange rate changes, the respondents consider the contractor's policy. Lam and Chow (1999) found that

exchange rate changes are similar to interest rate changes in being moderately critical in BOT projects (Lam & Chow, 1999). To mitigate the consequences of risk, Ling and Hoang (2010) found that the contractor should set up a stable exchange rate for the materials, equipment and services imported from other countries. Moreover, the contract should ensure an appropriate working capital to reserve in the future. Carefully checking the currency to be used for payments in the contract provisions is also a good solution for exchange rate changes (Ling & Hoang, 2010).

When choosing a risk-responsive strategy for C6, market fluctuations, the respondents considered company policies and the knowledge and experience of project managers.

Ling and Hoang (2010) found that the contractors reduced the impacts of materials price fluctuations by signing exclusive agreements with the suppliers to fix the costs of materials, and used alternative materials that were suitable with the contract standards (Ling & Hoang, 2010).

For risk factors in the legal and contractual risk category, risk retention is the most favorable risk-responsive strategy for the four risk factors in this category. The statistical results of alternative risk-responsive strategies adopted by the fifteen respondents for each risk factor in the legal and contractual risk category were diverse. The contractors considered some criteria before choosing risk-responsive strategies for each risk factor.

When choosing risk-responsive strategies for D1, changes in the scope of the work, the respondents considered the contract provisions, the costs associated with a response strategy, the appropriateness of the resources, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for D2 delays in change negotiations, the respondents considered the knowledge and experience of the contractor's staff.

When choosing risk-responsive strategies for D3, ambiguities in contract documents, the respondents consider the skill of their staff.

When choosing risk-responsive strategies for D4, problems of approvals and licenses, the respondents considered the costs associated with a response strategy and the knowledge and experience of their staff.

The majority of the respondents in this study, as well as Ling and Hoang (2010), realized that networking and maintaining good relationships with local authorities and government officials is the best strategy for solving the legal risks. Moreover, Ling and Hoang (2010) found that obtaining insurance for legal risks is a good solution to this problem (Ling & Hoang, 2010).

For risk factors within the natural risk category, the statistical results have the highest concentration, meaning that most of the contractors used the same strategy to copy with the risks in this category. Risk retention is the most favorable risk-responsive strategy for natural risks. The statistical results of alternative risk-responsive strategies adopted by the fifteen respondents for each risk factor in the natural risk category were diverse. The respondents considered some criteria before making a decision.

When choosing risk-responsive strategies for E1, adverse weather conditions, the respondents considered the project location, the expenditures associated with a response strategy, the appropriateness of the resources, and the knowledge and experience of the contractor's staff.

When choosing risk-responsive-strategies for E2, unforeseen site conditions, the respondents considered the expenditures associated with a response strategy, the project's location and the contractor's experience.

CHAPTER 8 CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

This chapter presents conclusions of the study based on the results given in the previous chapters. Limitations and recommendations of the study are also described in this chapter.

8.1 Conclusions

It is difficult to manage construction risks in Vietnam because of the lack of information concerning risks. Moreover, the contractor needs to comply with the Vietnamese construction law and is affected by social pressure, especially for risk factors related to human health and the environment. In Vietnamese construction projects, the judgment of risk is often executed based on the individual experience of the project manager at the tendering stage. At the construction stage, the brainstorming technique is used to find the appropriate risk-responsive strategies for the risk factors that may occur in the near future. Poor risk management systems are a problem for Vietnam construction firms, some contractors do not even have a risk management system for their companies. Construction risk is a main cause of project delay and cost overruns.

The main objective of this study is to explore the current practice of risk-responsive strategies employed by the local contractors for the IICPs in Vietnam. Through literature reviews and in-depth interviews, the risk identification process established a risk checklist, including 29 risk factors for the IICPs in Vietnam. Then, this study identified 25 risk factors as being the contractor's responsibility, and 4 risk factors as being the owner's responsibility by the comparison of three reference contract formats, consisting of the FIDIC 1999 Red Book, the VSFCC, and the SSFCC, and clarified risk allocation in the IICP through in-depth interviews with a pilot expert group.

The main data of the risk response process was collected by the questionnaires and in-depth interviews based on the principles of the Delphi method. The fifteen respondents who participated in the two-round Delphi processes were or are working

in Vietnamese construction companies. At the first round of the Delphi process, the participants were required to answer the questionnaire based on their practical knowledge and experience. Then, the second round was conducted to justify the answers of the respondents gave in the first round. The respondents were given the opportunity to change their answers in this round.

According to the summary results of alternative risk-responsive strategies, risk reduction is a favorable alternative for technology and management risks, risk reduction by contingency allowances is a favorable alternative for economic and financial risks, and risk retention is a favorable alternative for design, legal and contractual and natural risks. Risk avoidance is not entered into the list of risk-responsive strategies for this study, and "do nothing" was chosen only by a handful of respondents for a few risk factors in the economic and financial risk category.

Furthermore, through in-depth interviews, there are 9 major criteria for choosing risk-responsive strategies, which were identified as: (1) the costs associated with the risk-responsive strategy, (2) the time to execute the risk-responsive strategy fully, (3) the appropriateness of the resources associated with the risk-responsive strategy, (4) the contract provisions concerning the risks, (5) the project's location, (6) the contractor's policy, (7) the contractor's financial situation, (8) the owner's policy, and (9) the knowledge and experience of the contractor. According to the characteristics of each risk factors in IICPs in Vietnam, the contractor considers various criteria when choosing an appropriate risk-responsive strategy.

8.2 Limitations of this research

The results of this study were gathered from a small sample size group that contained the judgment of fifteen respondents from construction firms in Ho Chi Minh City, Vietnam. The group is not sufficient to represent the whole population of Vietnamese contractors. Moreover, due to the limited number of participants, this

research study could miss potential risk-responsive strategies that may be used by other Vietnamese contractors to respond to the 29 risk factors in IICPs.

Most respondents stayed in the role of the manager at the project level. Therefore, for the risks that were perceived as being the company's responsibility, alternative risk-responsive strategies were collected according to the subjective opinions of the respondent, even though some respondents did not have any strategy for responding to the risks. This affects the evaluation process of risk-responsive strategies.

The Delphi technique was used to collect data for this study. However, due to the limited time of the participants, this study only used the first round Delphi process to collect data and the second round Delphi process to justify the respondent's answers. Moreover, the diversity of risk factors and the diversity of the participants are the cause of the differences in the statistical results for the alternative risk-responsive strategies for each risk factor mentioned in this study. Therefore, the consistency of the statistical results will be higher when the study solves these problems.

8.3 Recommendations for further research

In future research work, the scope of the participants should expand not only to include the Vietnamese contractors in IICPs, but also other different construction experiences. Moreover, future research can collect the risk-responsive strategies used by foreign contractors for construction projects in Vietnam to in order to find more potential strategies.

Future projects should find out the criteria for choosing the risk-responsive strategies for each risk event clearly, and the participants should also suggest the re-evaluation of the efficiency of risk-the responsive strategies used for their risks. Furthermore, the participants should present their opinions for alternative risk-responsive strategies for future projects.

Most Vietnamese construction companies do not have risk management systems for construction projects. Therefore, the results of the study can be used as a guideline for developing risk management systems for general construction projects in Vietnam.

Other contractors can refer to the strategies to manage the risks in the IICPs from Vietnamese contractors in order to compare with their companies. Foreign investors have the opportunity to find the proper contractors to carry out their projects.

8.4 Contributions

This study presented results that can help both the contractor and the owner to realize the opportunities and the threats when building industrial facilities for the Vietnamese market. The first output helps the contractor to realize the risk factors affecting the IICPs in Vietnam. The second output helps both the contractor and the owner know more about risk allocation for both contract parties in IICPs can improve their contractual arrangements for future projects. The three outputs presents alternative risk-responsive strategies and criteria for choosing risk-responsive strategies of Vietnamese contractors in the IICPs, which is a guideline for the contractor to choose appropriate strategies to cope with construction risks in projects. These outputs can help the contractor develop a risk management system for their projects in the future.

The benefits of the risk management system is to mitigate disputes in the implementation process, and also to improve the communication, and create friendly relationships among the parties in construction projects. These are advantages for increasing the chance of successful projects.

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APPENDIX

APPENDIX A

QUESTIONNAIRE SURVEY

RISK VERIFICATION FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM

IMPORTANT NOTES:

1. *The main purpose of this questionnaire is verify thirty-two risk factors which may be occur in the IICP.*
2. *Please answer the questionnaire survey carefully. Your truthfulness and openness in response of this questionnaire are highly appreciated.*
3. *Please remember that there are no correct answers, the suitable answers that honestly reflect your opinions.*

SECTION 1: BACKGROUND INFORMATION

1. What kinds of your company business?
2. How many employees in your company?
3. Which types of construction projects your company have implemented?
4. How long have you worked in construction industry?

☐ < 3 years ☐ 3 - 5 years ☐ 5 - 10 years ☐ > 10 years

5. Which your current position is?
6. How many construction projects of foreign investors have you participated in?

☐ Nothing ☐ 1 project ☐ 2 projects ☐ > 2 projects

7. How many IICP have you participated in?

☐ Nothing ☐ 1 project ☐ 2 projects ☐ > 2 projects

8. What is your role in the IICP?
9. What are commonly IICP size that you have participated in?

☐ < 100 Billion VND ☐ 100 - 200 Billion VND ☐ > 200 Billion VND

10. What type of project are you participating in?

11. Do you think risk management for IICP is necessary for Vietnamese contractor?

☐ Unnecessary ☐ Necessary ☐ Very necessary

SECTION 2: RISK VERIFICATION

Please check if the risk factor is applicable in IICP in Vietnam.

Risk category	Code	No.	Risk factors	Applicable	Not applicable	Definition
Technology & Management	A1	1	Suitability and quality of materials and equipment			
	A2	2	Availability and supply of materials, equipment, workmanship			
	A3	3	Productivity of labor and equipment			
	A4	4	New technology			
	A5	5	Inadequate site investigation			
	A6	6	Knowledge and experience of contractor			
	A7	7	Safety			
	A8	8	Labor strikes			
	A9	9	Quality of sampling and testing control			
	A10	10	Third party delay			
	A11	11	Action led to environmental pollution			
	A12	12	Delay in possession of site			
Design	B1	13	Quality of design			
	B2	14	Design changes			
Economic & Financial	C1	15	Cash flow management			
	C2	16	Material price fluctuations			
	C3	17	Labor price fluctuations			
	C4	18	Interest rate changes			
	C5	19	Exchange rate changes			
	C6	20	Market fluctuations			
	C7	21	Availability of funds			
	C8	22	Delays in contract payment			
Legal & Political	D1	23	Changes in work scope			
	D2	24	Delays in change negotiations			
	D3	25	Ambiguities in contract documents			
	D4	26	Problem of approvals and licenses			
	D5	27	Changes in legislations, policies, and regulations			
	D6	28	Dispute with residents around site			
	D7	29	Corruption and bribery			
Natural	E1	30	Adverse weather conditions			
	E2	31	Unforeseen site conditions			
	E3	32	Force majeure			

If possible, please provide your contract:

APPENDIX B

QUESTIONNAIRE SURVEY

RISK ALLOCATION FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM

IMPORTANT NOTES:

1. *This questionnaire has two main purposes. First, to identify risk allocation for some risk factors in IICP. Second, to verify the responsibility of both contract parties with twenty-nine risk factors in IICP.*
2. *Please answer the questionnaire survey carefully. Your truthfulness and openness in response of this questionnaire are highly appreciated.*
3. *Please remember that there are no correct answers, the suitable answers that honestly reflect your opinions.*

SECTION 1: BACKGROUND INFORMATION

1. What kinds of your company business?
2. How many employees in your company?
3. Which types of construction projects your company have implemented?
4. How long have you worked in construction industry?

☐ < 3 years ☐ 3 - 5 years ☐ 5 - 10 years ☐ > 10 years

5. Which your current position is?
6. How many construction projects of foreign investors have you participated in?

☐ Nothing ☐ 1 project ☐ 2 projects ☐ > 2 projects

7. How many IICP have you participated in?

☐ Nothing ☐ 1 project ☐ 2 projects ☐ > 2 projects

8. What is your role in the IICP?
9. What are commonly IICP size that you have participated in?

☐ < 100 Billion VND ☐ 100 - 200 Billion VND ☐ > 200 Billion VND

10. What type of project are you participating in?

11. Do you think risk management for IICP is necessary for Vietnamese contractor?

☐ Unnecessary ☐ Necessary ☐ Very necessary

12. How about risk allocation of construction contract in IICP projects in Vietnam?

SECTION 2: RISK ALLOCATION

Please click inside the squares for your selection.

Risk category	Code	Risk factors	Contractor	Owner	Share	Definition
Technology & Management	A1	Suitability and quality of materials and equipment				
	A2	Availability and supply of materials/equipment/workmanship				
	A3	Productivity of labor and equipment				
	A4	New technology				
	A5	Inadequate site investigation				
	A6	Knowledge and experience of contractor				
	A7	Safety				
	A8	Labor strikes				
	A9	Quality of sampling and testing control				
	A10	Third party delay				
	A11	Action led to environmental pollution				
Design	B1	Quality of design				
	B2	Design changes				
Economic & Financial	C1	Cash flow management				
	C2	Material price fluctuations				
	C3	Labor price fluctuations				
	C4	Interest rate changes				
	C5	Exchange rate changes				
	C6	Market fluctuations				
	C7	Availability of funds				
	C8	Delays in contract payment				
Legal & Political	D1	Changes in work scope				
	D2	Delays in change negotiations				
	D3	Ambiguities in contract documents				
	D4	Problem of approvals and licenses				
	D5	Changes in legislations, policies, and regulations				
Natural	E1	Adverse weather conditions				
	E2	Unforeseen site conditions				
	E3	Force majeure				

If possible, please provide your contract:

APPENDIX C

QUESTIONNAIRE SURVEY

VERIFICATION OF RISK-RESPONSIVE STRATEGIES IN CONSTRUCTION PROJECTS

IMPORTANT NOTES:

1. *The main purpose of this questionnaire is verify twenty-one which may be apply in construction projects.*
2. *Please answer the questionnaire survey carefully. Your truthfulness and openness in response of this questionnaire are highly appreciated.*
3. *Please remember that there are no correct answers, the suitable answers that honestly reflect your opinions.*

Please check if risk-responsive strategy is applicable in your project.

Risk response technique	Risk-responsive strategies	Applicable	Not applicable
Unknowledge	Do nothing		
Avoidance	Tendering a very high bid		
	Pre-contract negotiations about the excusable clause of the contractor's duty		
Transfer	Subcontractor		
	Insurance		
Reduction	Contigency budget		
	Work adjustment		
	Contigency plan		
	Bonus policy and/ or penalty policy		
	Workforce adjustment		
	Employees education and training		
	Addition information acquisition		
	Physical protection		
	Past relationships		
	Good relationship with government		
	Improvement of labor relations policy		
	The limitation of working overtime, especially construction at night		
	The installed system predict & assess the potential risks		
	Contract document re-checking more than one times		
	Notification for designers & owners to visit the site regularly to reduce the design changes		
Retention	Risk retention		

APPENDIX D

QUESTIONNAIRE SURVEY

RISK-RESPONSIVE STRATEGIES BY LOCAL CONTRACTORS FOR INTERNATIONAL INDUSTRIAL CONSTRUCTION PROJECTS (IICP) IN VIETNAM

IMPORTANT NOTES:

1. *The main purpose of this questionnaire is explore the risk-responsive strategies what are employed by Vietnamese Contractors in IICP.*
2. *Please answer the questionnaire survey based on your practice experience carefully. Your truthfulness and openness in response of this questionnaire are highly appreciated.*
3. *Please remember that there are no correct answers, the suitable answers that honestly reflect your projects. You can select many risk-responsive strategies for each risk factor.*

SECTION 1: BACKGROUND INFORMATION

1. How long have you worked in construction industry?

   ☐ < 3 years ☐ 3 - 5 years ☐ 5 - 10 years ☐ > 10 years

2. Your current position is:

3. How many IICP have you ever participated in:

   ☐ Nothing ☐ 1 project ☐ 2 projects ☐ > 2 projects

4. What are commonly IICP size that you have participated in?

   ☐ < 100 Billion VND ☐ 100 - 200 Billion VND ☐ > 200 Billion VND

5. Do you think risk management for construction project is necessary for Vietnamese contractor?

   ☐ Unnecessary ☐ Necessary ☐ Very necessary

6. Which the strategies were using to manage the project risks in your company?

7. How about risk allocation of construction contract in IICP projects in Vietnam?

☐ Very Clear ☐ Clear ☐ Unclear

8. Did you satisfied with the results of risk management in your projects?

☐ Satisfied ☐ Not sure ☐ Dissatisfied

SECTION 2: ALTERNATIVE RISK-RESPONSIVE STRATEGIES

Please click inside the squares for your alternative risk-responsive strategies

Risk factor for IICP in Vietnam			Risk-responsive strategies for the IICP												
			DN	RF		RD									RT
				1	2	1	2	3	4	5	6	7	8	9	10	
Economic & Financial	C1	Cash flow management														
	C2	Material price fluctuations														
	C3	Labor price fluctuations														
	C4	Interest rate changes														
	C5	Exchange rate changes														
	C6	Market fluctuations														
Legal & Contract	D1	Changes in work scope														
	D2	Delays in change negotiations														
	D3	Ambiguities in contract documents														
	D4	Problem of approvals and licenses														
Natural	E1	Adverse weather conditions														
	E2	Unforeseen site conditions														

Note:

DN: Do nothing

RF: Risk transfer by

(1) subcontracting

(2) insurance

RD: Risk reduction by

(1) Contingency allowance

(2) Work adjustment

(3) Contingency plan

(4) Bonus policy or penalty policy

(5) Workforce adjustment

(6) Employee education

(7) Addition information acquisition

(8) Physical protection

(9) Past relationships

(10) Good relationship with government

RT: Risk retention

SECTION 2: ALTERNATIVE RISK-RESPONSIVE STRATEGIES

Please click inside the squares for your alternative risk-responsive strategies

Risk factor for IICP in Vietnam			Risk-responsive strategies for the IICP													
			DN	RF		RD										RT
				1	2	1	2	3	4	5	6	7	8	9	10	
Technology & Management	A1	Suitability and quality of materials and equipment														
	A2	Availability and supply of materials, equipment, workmanship														
	A3	Productivity of labor and equipment														
	A4	New technology														
	A5	Inadequate site investigation														
	A6	Knowledge and experience of contractor														
	A7	Safety														
	A8	Labor strikes														
	A9	Quality of sampling and testing control														
	A10	Third party delay														
	A11	Action led to environmental pollution														
Design	B1	Quality of design														
	B2	Design changes														

Note:

DN: Do nothing

RF: Risk transfer by

(1) subcontracting

(2) insurance

RD: Risk reduction by

(1) Contingency allowance

(2) Work adjustment

(3) Contingency plan

(4) Bonus policy or penalty policy

(5) Workforce adjustment

(6) Employee education

(7) Addition information acquisition

(8) Physical protection

(9) Past relationships

(10) Good relationship with government

RT: Risk retention

VITA

Miss Hang Thi Thu Le was born on January 20, 1990, in Thua Thien Hue Province, Vietnam. She is the second daughter of Mr. Le Van Son and Mrs. Tran Thi Vong. After finished elementary education, secondary education, and higher education in Thua Thien Hue Province. She went to Ho Chi Minh City to continue to study the Bachelor's degree in Civil Engineer of Ho Chi Minh City University of Technology. Then an opportunity came to her as she received a scholarship under the supervision of AUN/SEED-Net to study the Master's degree in Civil Engineer at Chulalongkorn University, Bangkok, Thailand.

During the research process at Chulalongkorn University, she had gained a lot of valuable knowledge and experience in the Construction Management Education Field, special researches in the construction law, the ambiguity in construction contracts, the risk management in the construction industry and the building information modeling (BIM).

An energetic girl, a creative student, a hard-working individual and a trustworthy engineer - there are the words that family, friends and everyone around described Miss Hang Thi Thu Le.