Schedule Risk Assessment in High-Rise Building Construction Projects with Joint Operation Scheme by Foreign Contractor in Indonesia

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DOI: 10.29322/IJSRP.11.07.2021.p11507
http://dx.doi.org/10.29322/IJSRP.11.07.2021.p11507

***Abstract*-** According to The Minister of Public Works Regulations (Permen-PU) No. 10/PRT/M/2014 all Foreign Construction Services Business Entity (FCSBE) in Indonesia are obliged to cooperate in joint operations with the National Construction Services Business Entity (NCSBE) in carrying out construction activities in Indonesia. Projects with joint operation schemes (JO) have more complex risks than projects in general because they involve two or more companies with different characteristics so that they are more vulnerable to delays. In this study, a case study will be conducted at PT. X which is one of the foreign private contractor company that has established its representative in Indonesia specializing in the construction of high-rise buildings in Jakarta. Assessment and analysis is carried out regarding what risk factors are dominant at each stage of the life cycle of high-rise building construction projects with a Joint Operation (JO) scheme that affects the performance of time by conducting risk level analysis using The Project Management Body of Knowledge (PMBOK) 2017 based methods so that a risk rating is obtained for each risk factors. The result of this study is the dominant risk factor at every stage of the project life cycle with the Joint Operation scheme.

***Index Terms*-** Joint Operation, Risk, Performance Time, Project Life cycle

I. INTRODUCTION

The development of construction in Indonesia grows rapidly over time. Given the implementation of ASEAN Economic Community (AEC) or ASEAN free market since 2015, the construction growth has been accompanied by an increasing number of foreign construction service representative offices in the form of BUJKA. According to data from the Directorate General of Construction of the Ministry of PUPR, in 2019 the number of foreign construction service representative offices reached 225 foreign business entities with the number of contractors from China ranked first with 44 FCSBE, followed by Japan with 38 FCSBE, and South Korea with 28 FCSBE. The increasing presence of BUJKA in Indonesia directly threatens the acquisition of the domestic infrastructure construction market by National Construction Business Entity (NCSBE). Therefore, a regulation of Permen-PU No. 10/PRT/M/2014 was established on the requirements of granting representative licenses of foreign construction services business entities with the aim of encouraging the improvement of the business capability of national construction services and the national economy. The regulation requires FCSBE to establish cooperation in the form of Joint Operation with NCSBE. Projects with joint operation schemes have more complex risks than projects in general because they involve two or more companies with different characteristics so that they are more vulnerable to delays (Prasitsom &Likhitruangsilp, 2015).

Bing et al. (1999) and Prasitsom A (2014) stated that there are 3 types of risks in the Joint Operation cooperation scheme, namely: (1) internal risks, which are risks arising from the involvement of 2 different organizations in one project and the risks that develop from the operational basis of a project can lead to conflicts between partner organizations such as the risk of partner selection, contractual agreements, changes in company policies, disagreements in the allocation of labor, and distrust among employees of each partner; (2) project-specific risks, including the relationship between personnel involved in the project and the Joint Operation cooperation scheme; (3) external risks, including political and legal systems, economic conditions and construction industry, society, physical environment. Thus, the implementation of the project with the Joint Operation scheme which is expected to shorten the project implementation time with the application of technology cannot be fully achieved.

In this study, an assessment and analysis was carried out regarding the dominant risk factors at each stage of the project life cycle with the Joint Operation scheme that affected the time performance by conducting risk level analysis using PMBOK 2017 based method. This research was conducted at one of the Foreign Construction Services Companies from Japan that handles many high-rise building construction projects in Indonesia. The objectives of this study are (a) Identifying the life cycle of high-rise building projects under the Joint Operation scheme, (b) Identifying the dominant risk factors at each stage of the life cycle of high-rise building projects with a Joint Operation scheme that affect the time performance admissions in reputed varsity. Now, here we enlist the proven steps to publish the research paper in a journal.

II. THEORETICAL STUDY

1. High Rise Building Project

Classification of high-rise buildings can be found in Government Regulation No. 36 of 2005 and Regulation on the Implementation of Law No. 28 of 2002 on Building Buildings. Broadly speaking high-rise buildings are buildings with a height above 8 floors or above 45 meters, but less than 300 meters.

2. Project with Joint Operation Scheme

In Permen-PU No. 10/PRT-M/2014 Joint Operation is defined as a business cooperation between one BUJKA with one or more BUJK, is temporary to handle one or more construction works and does not constitute a new legal entity based on Indonesian laws and regulations. From a global perspective, Joint Operation is part of a partnership between companies known as Joint Ventures. In general, Joint Venture is the meeting of two or more independent entrepreneurs who have a common goal to achieve certain outcomes which cannot be achieved when run on their own (Wallace, 2004). In the construction services sector in Indonesia, the term Joint Venture is used for companies that form new legal entities (Limited Liability Companies) which is a permanent form of Joint Venture.

The type of Joint Operation scheme can be described based on two perspectives, namely; (a) project control perspective, and (b) working capital management perspective. From a project control perspective, the type of Joint Operation scheme can be distinguished into two categories, namely structured joint control and non-structural joint control. Meanwhile, based on the perspective of working capital management, the type of Joint Operation scheme can be distinguished into joint working capital management, partial joint working capital management and separate working capital management.

In the type of structured joint control, joint operations are formed at the project level where the parties involved agree to form a tangible and structured organization for project control. Negotiations in discussing the form of organizational structure as well as sharing authority are usually conducted before the JO agreement is signed by the parties involved. In non-structural co-control types, parties involved in the Joint Operation scheme do not form joint controls in the form of real and structured organizations in the field. This is because each party is responsible for the segment of the project carried out on the owner.

In the management of joint working capital, parties who will be involved in JO previously negotiated the amount of working capital that will be deposit in the implementation of the work later. After the agreement on the nominal working capital of each party, then each party makes a deposit of the agreed nominal. Partial working capital joint management is actually almost the same as the management of working capital together as described earlier, the difference occurs only in the cost expenditures in terms of payroll of permanent employees of each party involved in JO, where the costs for the payroll of permanent employees are paid directly by the parent management of each permanent employee. While in the management of separate working capital there is a separation of working capital management from each party involved in JO. Parties involved in JO do not interfere with the management of their respective working capital.

According to Prasitsom A, 2014 JO life cycle can be divided into five stages, namely stage, formation, bidding stage, construction stage, guarantee stage and termination stage. Figure 1 shows the life cycle of the project under the Joint Operation scheme.

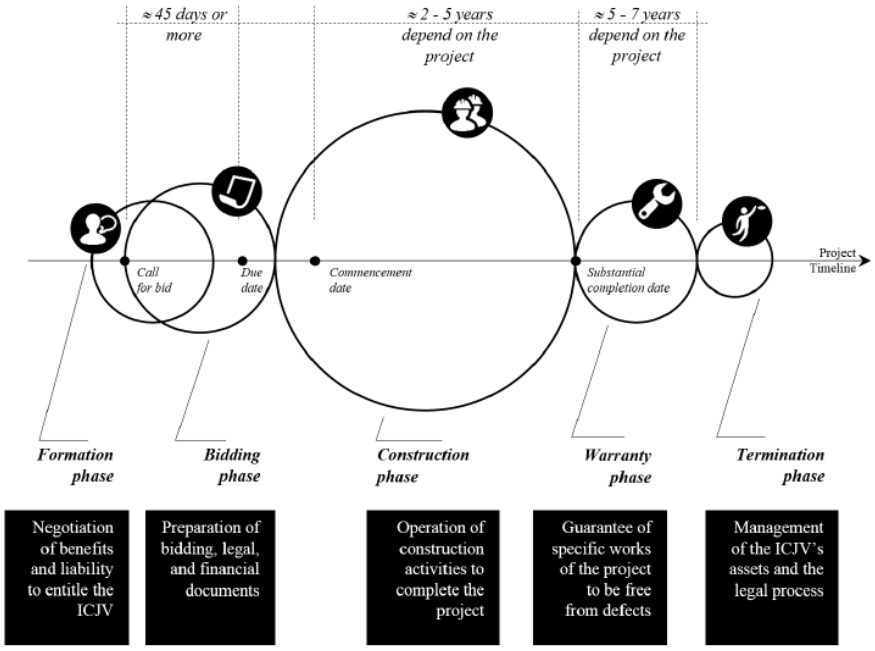

Figure 1. Project Lifecycle with Joint Operation Scheme
Source: Prasitsom &Likhitruangsilp, 2015.

3. Overview of PT. X

PT. X is a foreign private company as a representative office in Indonesia of one of the Japanese contracting companies. PT. X established its representative in Indonesia since 1980 by absorbing foreign workers and Indonesian workers. Joint Operation Project conducted by PT. X implements a structured joint control system and partial joint working capital control.

4. Project Time Performance

Time performance is the process of comparing actual work with a planned schedule (Dispuhusodo, 2006). If the work in the field does not match the planned schedule then it can trigger a delay. This delay can be caused by contractors, owner, planner, other parties and unexpected natural conditions (Callahan, M.T., 1992). Project delays can result in increased overhead due to increased execution time, resulting in losses due to possible rising prices due to inflation and rising labor wages and holding contractor capital that is most likely to be used for other projects (O'Brien J.J., 1976)

5. Risk Management

Risk in a construction project is the probability of an event appearing in a period of time and can occur naturally in certain situations. Risk factors cannot be eliminated but the impact can be minimized. Risk opportunities always exist in all stages of construction project activities including planning, design, construction and maintenance.

Risk management is an effective approach to dealing with risks in construction projects by identifying sources of risk and uncertainty, establishing their influence and developing appropriate responses. The purpose of risk management is not only to reduce risk but can be used by a decision maker in estimating risk by turning risk into profit or income opportunities. Qualitative risk analysis is a process in prioritizing risks that will then be given a response, by means of an assessment of the opportunities and impacts of the occurrence of such risks.

6. Risk Factors of Joint Operation Project

Risks in projects with the Joint Operation scheme are identified by categorization using a structure to comprehensively identify risks into detail levels otherwise known as risk breakdown structures (RBS). Figure 2 shows RBS project with Joint Operation cooperation scheme

In this study, a review of several previous research journals mentions risk events that often occur in projects with the Joint Operation scheme. These risk factors are then categorized based on the risk breakdown structure. Figure 3 shows the risk events of the Joint Operation project which are categorized based on risk breakdown structure.

RISK FACTORS OF JOINT OPERATIONS (JO)

Internal Risk (I)

I.1 Partner Related Risks
- I.1.1 Partner Selection
- I.1.2 Bargain position partners
- I.1.3 Policy Changes in inter-partner companies
- I.1.4 Financial problems in the parent company of the partner
- I.1.5 Lack of management co-ordence in partners
- I.1.6 Organizational changes to on-premises partners

I.2 JO Related Risks
- I.2.1 Contractual Agreement
- I.2.2 Disagreements about profit and loss accounting
- I.2.3 Disagreement over the allocation of staff positions
- I.2.4 Distrust among employees of each partner
- I.2.5 Disagreements on work rules
- I.2.6 Conflicts in work ethic
- I.2.7 Transfer technology dispute
- I.2.8 Financial Problems

Project Spesific Risks (P)

P.1 Organizational Risk
- P.1.1 Bad project relationship
- P.1.2 Incompability of local policies with international practices
- P.1.3 Request and changes from the client

P.2 Management Risk
- P.2.1 Cash flow problems
- P.2.2 Cost control
- P.2.3 Deficit in estimated costs
- P.2.4 Cost over-run
- P.2.5 Selection of specialized contractor
- P.2.6 Management of s pecialized contrator
- P.2.7 Inadequate project organizational structure and inability of the project mangement team

P.3 Techincal Risks
- P.3.1 Labor productivity
- P.3.2 Material and labor shortages
- P.3.3 Suppliers who are not competent
- P.3.4 Accident at the site

P.4 Design Risk
- P.4.1 Inadequate technical spesification in the tender document
- P.4.2 Design Changes
- P.4.3 Error in Drawing design

P.5 Contract Risk
- P.5.1 Disagreement of some contactual conditions
- P.5.2 Contract terms incomplete

External Risks (E)

E.1 Legal and political Risks
- E.1.1 Regulatory changes to foreign investment
- E.1.2 Import Restrictions
- E.1.3 Inconsistencies in legal and regulatory policies

E.2 Social Risk
- E.2.1 Language Barriers
- E.2.2 Socio-Cultural and religious differences
- E.2.3 Worker Strike
- E.2.4 Security Issues

E.3 Economy Risk
- E.3.1 Exchange rate
- E.3.2 Inflation

E.4 Force Majeure Risk
- E.4.1 Force majeur
- E.4.2 Bad weather

Figure 3 Project Risk Factors with Joint Operation Scheme

III. METHOD

It's This research was conducted with literature studies, expert validation using delphi method and questionnaire survey. Figure 4 shows the stages for identifying the life cycle of high-rise building projects under the Joint Operation cooperation scheme.
Validation is done by submitting a project life cycle chart with the Joint Operation (JO) scheme that has been developed based on literature studies to 5 experts with a minimum S1 educational qualification, has at least 15 years experience in handling high-rise building construction projects with the Joint Operation (JO) scheme and has a good reputation at PT. X.

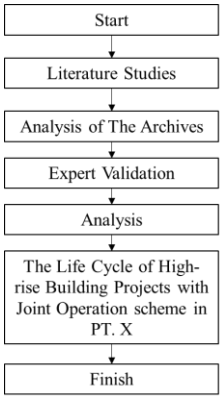

Figure 4 Stages of Project Lifecycle Identification

While Figure 5 shows the stages performed identifying the dominant risk factors at each stage of the project life cycle with the Joint Operation scheme. To identify the dominant risk factors begins with validation of risk factors by asking open questions about risk factors from previous research and asking the possibility of each factor at each stage of the project life cycle to 5 experts with a minimum educational qualification of S1, have at least 15 years experience in handling high-rise building construction projects under the Joint Operation (JO) scheme and have a reputation in PT. X.

Furthermore, a questionnaire survey was conducted with a likert scale measurement to measure respondents' opinions on how big the cause and impact of each risk variable. The form of the likert scale used to measure causes and impacts is a scale of 1 to 5, where scale 5 is the scale used for the size that has the most probability and has a very large effect on its impact. This questionnaire survey is aimed at 29 people with a minimum S1 educational qualification, having at least 10 years experience in handling high-rise building construction projects under the Joint Operation (JO) scheme. The results of the questionnaire survey will be analyzed with homogeneity test, validity & reliability test, descriptive test, and risk analysis.

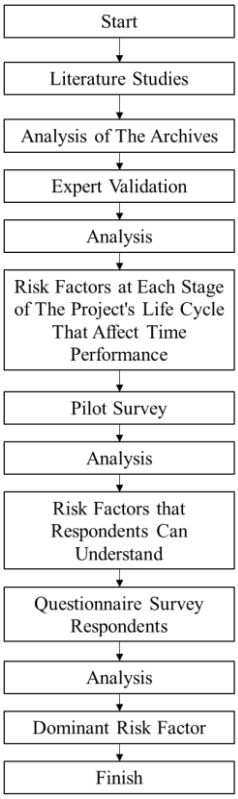

Figure 5 Stages of Identification of Dominant Risk Factors

After tabulation of probability and impact rating, then weighting probability and impact on each variable. Probability and impact weighting can be seen in Table XX

Table 1. Weighting probability and impact

Score	1	2	3	4	5
Probability Criteria	Very Low	Low	Medium	High	Very High
Weighting	0.1	0.3	0.5	0.7	0.9

Score	1	2	3	4	5
Impact Criteria	No Influence	Limited Influence	Moderate Influence	Important Influence	Very Important Influence
Weighting	0.05	0.1	0.2	0.4	0.8

Risk rating analysis is done by multiplying the average impact value by the average probability value in a probability matrix and the impact will then be given a risk rating. The matrix of multiplication of impacts and probabilities can be seen in Figure 6.

Probability \ Impact	0.05	0.1	0.2	0.4	0.8
0.9	0.045	0.09	0.18	0.36	0.72
0.7	0.035	0.07	0.14	0.28	0.56
0.5	0.025	0.05	0.1	0.2	0.4
0.3	0.015	0.03	0.06	0.12	0.24
0.1	0.005	0.01	0.02	0.04	0.08

Figure 6 Probability and Impact Matrix
Source: PMBOK 2017

IV. RESULT & DISCUSSION

1. Life cycle of high-rise building projects with Joint Operation Scheme

Figure 7 shows the results of validation and expert input on the life cycle and activities at each stage of the life cycle of high-rise building construction projects under the Joint Operation scheme.

The selection phase of joint operation partners is conducted by foreign companies taking into account the credibility and track record of prospective partners and the terms of the tender to be followed. The negotiation phase of benefits and liability between partners is carried out by establishing a sharing portion and the company that will be the leader in the Joint Operation. Sharing portion commonly used by PT. X is 70% and 30% where PT. X acts as the lead company. The establishment of the articles of association of the Joint Operation household is carried out by establishing the rights and obligations of each partner which is then set forth on the certificate of establishment of joint operation cooperation. The establishment and approval phase of joint operation is carried out by the directors of each partner and signed on the legal document of the establishment of the Joint Operation. Furthermore, this document becomes one of the requirements for participation in the tender.

The tender phase begins with the establishment of a tender team consisting of representatives of each Joint Operation partner. The tender team is led by a team leader who is a representative of the lead company in the Joint Operation. The team leader will arrange the division of the work of the tender team in preparing the job tender offer document. Once the tender team is formed, the tender documents obtained from the client will be processed and taken into account. At this stage the tender costs including the payment of bidding bonds and the salaries of employees involved in the tender team will be paid by each partner. After the process of drafting and planning the tender documents, the directors of each Joint Operation partner will hold a meeting and agree on the value of the tender to be submitted. After submission is done, clarification will be made regarding the scope, design, and volume of work followed by the recognition of value engineering and project cost negotiation. So that obtained approval and contract agreement between the Joint Operation and the client.

The construction phase begins with the deposit of working capital together in accordance with the sharing portion of the agreed Joint Operation cooperation agreement. The working capital will then be managed jointly by the project team with the appointment of a designated working capital management coordinator from the lead company with the largest portion of working capital deposit. Furthermore, a project team and project organizational structure consisting of companies involved in the Joint Operation will be formed. The number of labor divisions is adjusted to the agreed number of sharing portions. The project team will work according to Job Description to carry out comprehensive project detail planning including project implementation policy, master schedule, QA/QC policy, method statement, procurement schedule and budget planning. Furthermore, the stage of implementation, monitoring and control of the project carried out by the project team with all risks during the implementation will be borne by the Joint Operation. After the project has met the terms and conditions set by the client, the Joint Operation will prepare as built drawing, joint survey implementation with the client, carry out the final account, carry out test commissioning and issue maintenance manuals. So there will be a temporary handover between the Joint Operation and the client.

The maintenance phase begins with the establishment of a maintenance team that will be responsible for carrying out maintenance during the maintenance period. The maintenance team will carry out repairs to defects that become findings in the joint survey during the temporary handover and conduct regular monitoring and inspection during the maintenance period. After the maintenance period ends and it is ensured that the project is in free defect status will be done the final handover between the Joint Operation and the client. The final handover signifies the project ending completely and the project objectives have been fulfilled, so that the next stage of termination and dissolution of the Joint Operation will be carried out considering the Joint Operation is a temporary business entity.

At the termination stage will be carried out the arrangement of assets belonging to the Joint Operation with the auction of assets followed by the dissolution and closure of joint operation business entities by first completing tax and financial audits. The final meeting between the companies involved will be held and the PM will report the profit and loss from the implementation of the project until the maintenance phase ends.

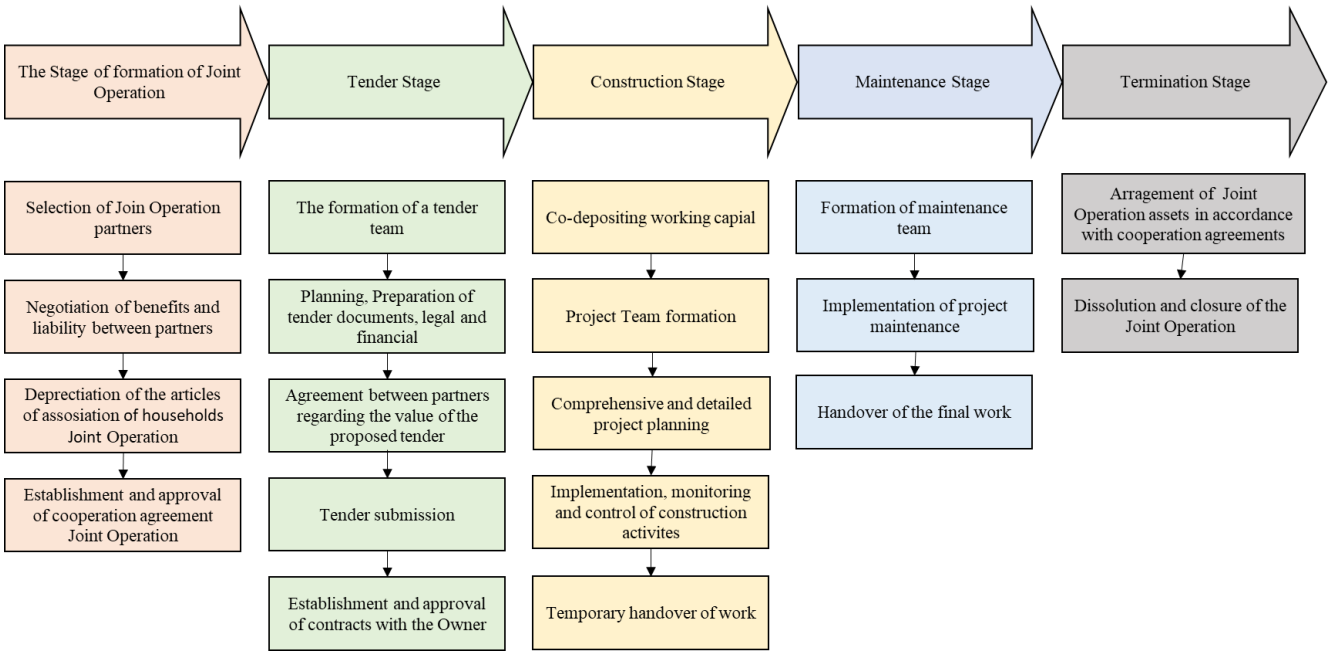

Figure 7 Life Cycle of High-Rise Building Construction Project with Joint Operation Scheme

2. Dominant risk factors at every stage of the project life cycle with the Joint Operation scheme affecting the performance of time

Figure 8 Contour risk at Every Stage of Life Cycle of High-Rise Building Construction Project with Joint Operation Scheme

Figure 8 shows the risk contours at each stage of the life cycle of a high-rise building construction project with a joint operation scheme. The number and value of the risk rating increases from the establishment stage to the highest number and value at the construction stage and decreases significantly at the stage of maintenance until termination stage.

a) Joint Operation Establishment Stage

Table 2 shows the calculation of the value of risk rating at the stage of joint operation formation. Referring to the Probability matrix - Impact on Figure 6 there are 3 dominant risk factors with high categories namely X13 (financial problems), X15 (bad project relationship) and X1 (partner selection). The financial problem is the most concerned issue in JO establishment stage. This is because it is currently affected by complex situation of inflation, high interest rates, and economic fluctuation, which is a major challenge for managing any JO projects (Sy and Likhitruangsilp, 2011).

Table 2. Risk Rating of Joint Operation Establishment Stage

Risk Factors		Risk (PxI)	Category
X13	Financial Problems	0.36	High
X15	Bad Project relationship	0.23	High
X1	Partner Selection	0.22	High
X4	Financial problems at the partner's parent company	0.15	Medium
X5	Lack of competency management in partners	0.10	Medium
X2	Bargain position partner	0.09	Medium
X16	Not Suitable for local policy with international practice	0.07	Medium
X3	Policy changes in inter-partner companies	0.06	Medium
X35	Regulatory changes to foreign investment	0.03	Low
X6	Organizational changes to on premises partners	0.03	Low
X37	Inconsistencies in legal and regulatory policies	0.02	Low
X7	Contractual Agreement	0.02	Low

b) Tender Stage

Table 3 shows the calculation of the value of the risk rating at the tender stage. Referring to the Matrix of Probability - Impact on Figure 6 there are 4 dominant risk factors with a high category of X32 (error in design image), X31 (design change), X17 (request and change from client), and X30 (inadequate technical specifications in the tender document).

Table 3 Tender Stage Risk Rating

Risk Factors		Risk (PxI)	Category
X32	Error in design drawing	0.42	High
X17	Request and changes from clients	0.39	High
X31	Design changes	0.29	High
X30	Inadequate technical spesifications in the tender document	0.23	High
X41	Exhange rate	0.19	Medium
X34	The terms of the contact incomplete	0.18	Medium
X33	Disagreement of some contract conditions	0.14	Medium
X13	Financial Problems	0.11	Medium
X15	Bad project relationship	0.11	Medium
X42	Inflation	0.09	Medium
X5	Lack of management competence in partners	0.08	Medium
X4	Financial Problems at the partner's parent company	0.08	Medium
X16	Not suitable for local policy with international practice	0.05	Medium
X14	Uncertainty of the value of the proposed tender	0.04	Low

c) Construction Stage

Table 4 shows the calculation of the value of risk rating at the construction stage. Referring to the Probability matrix - Impact on Figure 6 there are 16 dominant risk factors with high categories namely X19 (Cost control), X27 (Material and labor shortage), X28 (Suppliers who are not competent), X17(Demand and change from clients), X20 (Deficit in estimated costs), X4 (Financial problems in partner parent companies), X22(Selection of specialized contractors), X18 (Cash flow problems) , X41 (Exchange Rate), X31(Design change), X21 (Cost over-run), X40 (Safety issues), X29 (Onsite accident), X39 (Worker strike), X43(Force majeure), and X25 (Project management team incompetence). Incompetence of suppliers was mentioned as a critical risk factor in construction stage, which was in the third rank. Since inequity and fraud in the bidding process were a very common problem (Long et al., 2004), the awarded supplier were often labeled “incompetent”.

Table 4 Construction Stage Risk Rating

Risk Factors		Risk (PxI)	Category
X19	Cost control	0.39	High
X27	Lack of material and labor	0.36	High
X28	An incompetent supplier	0.35	High
X17	Requests and changes from clients	0.34	High
X20	Deficit in cost estimation	0.32	High
X4	Financial problems at the partner's parent company	0.30	High
X22	Selection of specialized contractors	0.30	High
X18	Cash flow issues	0.29	High
X41	Exchange rate	0.29	High
X31	Design changes	0.28	High
X21	Cost over-run	0.26	High
X40	Security Issues	0.26	High
X29	Crash at the scene	0.23	High
X39	Worker strike	0.23	High
X43	Force majeure	0.22	High
X25	Project Management Incompetence	0.20	High
X44	Bad Weather	0.17	Medium
X23	Management specialized contrator	0.15	Medium
X26	Labor productivity	0.15	Medium
X42	Inflation	0.14	Medium
X15	Poor Relationship project	0.13	Medium
X30	Inadequate technical spesifications in the tender document	0.13	Medium
X2	Bargain position partner	0.11	Medium
X36	Import Restrictions	0.11	Medium
X5	Lack of management competence in partners	0.10	Medium
X32	Error in design drawing	0.10	Medium
X13	Financial problems	0.09	Medium
X33	Disagreement of some contractual conditions	0.07	Medium
X37	Inconsistencies in policies, laws and regulations	0.07	Medium
X34	The terms of the contract are incomplete	0.07	Medium
X24	Inadequate organizational structue of the project	0.06	Medium
X12	Transfer Technology disputes	0.05	Medium

Risk Factors		Risk (PxI)	Category
X11	Conflicts in work ethic	0.04	Low
X6	Organizational changes to on-premises partners	0.03	Low
X3	Policy changes in inter-partner companies	0.03	Low
X7	Contractal agreement	0.02	Low
X9	Distrust between employees of each partner	0.02	Low
X38	Social, cultural and religious differences	0.02	Low
X10	Disagreement about work rules	0.02	Low
X16	Incompability of local policies with international practices	0.02	Low
X14	Disagreement on the value of the proposed tender	0.01	Low

c) Maintenance Stage

Table 5 shows the calculation of risk rating values at the maintenance stage. Referring to the Probability - Impact matrix in Figure 6, there is no risk with a high category at the maintenance stage. The dominant risk lies in the moderate category of X17 (requests and changes from the client). It is clear that as the project nears completion, the risk exposure will decrease. However, there are risks to be considered regarding change requests from clients and the terms of the main contract. Moreover, in the maintenance stage of JO projects, the conflict between profit and loss of clients, main contractors, subcontractors, and suppliers culminated. The clients would like to finish their projects in a short time, and to make use of the project for its intended purpose. While the main contractors and subcontractors desire their work completion and receive all of owner's payments, the contractors may face delayed payments and sometimes nonpayment risk of clients (Sy and Likhitruangsilp, 2011).

Table 5 Maintenance Stage Risk Rating

Risk Factors		Risk (PxI)	Category
X17	Request and changes from client	0.05	Medium
X39	Worker strike	0.04	Low
X15	Bad project relationship	0.03	Low
X34	The terms of the contract are incomplete	0.03	Low
X13	Financial problems	0.02	Low
X33	Disagreement of some contract conditions	0.02	Low
X16	Incompability of local policies with international practices	0.02	Low
X4	Financial problems at the partner's parent company	0.02	Low
X5	Lack of management competence in partners	0.02	Low
X10	Disagreement about working rules	0.02	Low
X6	Organizational changes to on-premises partners	0.02	Low
X7	Contractual agreement	0.02	Low

d) Termination Stage

Table 6 shows the calculation of the value of the risk rating at the termination stage. Referring to the Probability - Impact matrix in Figure 5, there is no risk with a high category at the termination stage. The dominant risk lies in the moderate category of X4 (financial problems in the partner parent company).

Table 6 Termination Stage Risk Rating

Risk Factors		Risk (PxI)	Category
X4	Financial problems at the partner's parent company	0.09	Medium
X5	Lack of management competence in partners	0.05	Low
X7	Contractual agreement	0.04	Low
X8	Disagreement about profit and loss accounting	0.04	Low
X13	Financial problems	0.03	Low
X16	Incompability of local policies with international practices	0.03	Low
X17	Request and changes from clients	0.03	Low
X33	Disagreement of some contract conditions	0.02	Low
X34	The terms of the contract are incomplete	0.02	Low
X41	Exchange rate	0.02	Low
X42	Inflation	0.02	Low

V. CONCLUSION

This study identifies the life cycle of high-rise building construction projects with joint operation cooperation schemes and identifies the dominant risk factors at each stage of the life cycle of high-rise building projects with a Joint Operation scheme that affects the performance of time by involving experts and respondents directly involved in the implementation of high-rise building construction with the Joint Operation cooperation scheme in Indonesia.

The results showed the life cycle stage of high-rise building construction projects with joint operation cooperation scheme consists of 5 stages, starting from the stage of joint operation formation, tender stage, construction stage, maintenance stage, to termination stage or dissolution of Joint Operation.

There are risk factors throughout the life cycle of high-rise building projects with joint operation schemes that affect the performance of time. The risk that affects the performance of time has the highest value during construction and decreases significantly at the stage of maintenance until termination.

The dominant risk factors at each stage of the project's life cycle are identified as follows.

a) Joint Operation Establishment Stage; there are 3 dominant risk factors with high categories with the highest risk factors are X13 (financial problems), X15 (poor project relationship) and X1 (partner selection)
b) Tender Stage; there are 4 dominant risk factors with high categories with the highest risk factors are X32 (error in image design), X31 (design change) and X17 (request and change from client)
c) Construction Stage; there are 16 dominant risk factors with high categories with the highest risk factors X19 (Cost control), X27 (Material and labor shortage), and X28 (Supplier who is not competent).
d) Maintenance Stage; there is no risk with a high category, the dominant risk is in the medium category of X17 (demand and change from the client)

e) Termination Stage; there is no risk with a high category, the dominant risk is in the medium category of X4 (financial problems in the partner's parent company).

Furthermore, risk response planning is needed in the form of a process created to make action choices in improving opportunities and minimizing obstacles to project objectives. Risk response plans are carried out in accordance with risk priorities, including resources and activities related to costs, schedules, and project management plans.

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