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Optimizing Subcontractor Work through ISO 31000 Risk Assessment Method

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ABSTRACT

Every project has its own risks associated with it. The more complex the project, the higher risks embedded within the project. Whenever the risk is not identified and mitigated properly, it will disrupt the project implementation. The article takes case study of a state-owned energy company, XYZ, that build electricity transmission system around Indonesia area. The transmission project requires various expertise that involves using multiple contractors with their subcontractors. Using the chain of contractors/subcontractors is a common thing in transmission project, so the project owner should ensure all risks within the chain should be properly managed. The article proposes the use of ISO 31000 risk assessment method to identify and mitigate all possible risks that may disrupt the project. The use of ISO 31000 method enables to lower the risk of project achievements from 79.74% success rates to more than 90%. The outcome of the article is expected to be used as a reference for project owner of transmission projects in Indonesia to manage the risks associated with the use of chain contractors and subcontractors.

Key words: Project Risk Management, Electricity transmission system project, Chain of Contractors/ Subcontractors, Risk Flow assessment, ISO 31000 risk assessment method.

1. INTRODUCTION

Project risk is an unavoidable thing that may occur in every project. Every project has its own risks associated with entire phases starting from acquiring user needs, design and plan, delivery, and implementation. The project risks may increase with more external parties that are involved in the project [1].

Electricity transmission system construction has high complexity since it involves various expertise, such as contractor along with her subcontractors. A transmission project may have more than one contractor, while each contractor can have some subcontractors. Using subcontractors is a common thing in transmission project, since it is conducted to meet the complexity of the project. The article takes case study of a state-owned energy company, XYZ, that currently has many electricity transmission projects construction around Indonesia area. The project construction needs the involvement of contractors, along with their subcontractors to make sure the project can be completed according to restricted budget and time. The project owner (XYZ) needs to make sure all parties work according to the project plan and reach expected results.

The project owner has noted the performance of transmission construction cumulative reached 79.74% achievement rate of entire target works in 2021 (completes according to project plan). With around 80% of achievements, it shows many improvements can be made to increase achievement rates. The transmission system construction has high complexities, and they are shared amongst contractors (along with their subcontractors). The article applies ISO 31000 risk assessment method to manage risk associated with the chain of contractors (and subcontractors) and propose preventive measures to avoid any disruption.

The article examined the common risks in the previous projects such as: poor workforces in the chain of collaboration (contractor and subcontractors), poor quality of work shown by subcontractors, ineffective budget management, and elapse schedule. Managing contractors and subcontractors is not an easy task since it involves a long chain of cooperation. Whenever one point is not managed properly, it may disturb some or all chain of works.

Project owners should make sure the information chain of works is properly managed amongst the contractor/ subcontractors. Developing an effective communication is an essential task to make sure the information chain works properly. It plays an important role to ensuring all parties kept on-track. The hierarchy of project owner, contractor and subcontractors is illustrated in Figure 1 below.

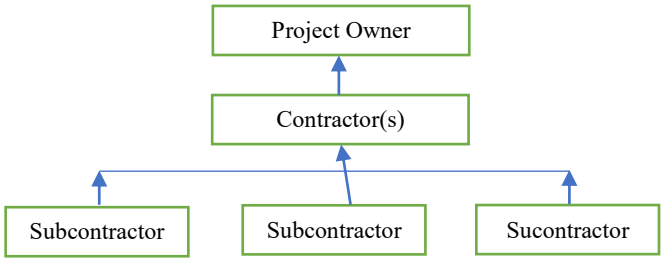


Figure 1: Hierarchy of Project Execution.

Figure 1 shows common hierarchy project execution:

1. Project Owner assigns work to a contractor or more.
2. A contractor can delegate work to various subcontractors. Subcontractors can work with one or more contractors at the same time.
3. If the communication does not work well from Project Owner to Contractor, or Contractor to Subcontractors. Either of the miscommunication occurrence may create project uncertainty in the project chain (project risk increases).

2. THEORETICAL FRAMEWORK

2.1. Project Risk.

Risk always relates with uncertainty achievement. Risk occurs due to the probability of uncertainty events that may deliver loss or disruption [2]. Scholars addressed that project risk as a measurement of the probability and consequence of unachieved project objectives [3]. Risk can be identified based on 2 criterions such as: probability of the occurrence(s) and its impact. Flanagan and Norman defined a risk as a cause factor to the unexpected that may create damage or loss [4]. Wideman defines a risk as: [5]

1. Unrecognized, unmanaged, or ignored (by default).
2. Recognized but no action taken (absorbed as a matter of policy).
3. Avoided (by taking appropriate steps).
4. Reduced (by an alternative approach).
5. Shared (with others, eg. By joint venture).
6. Transferred (to others through contract or insurance).
7. Retained and absorbed (by prudent allowances).
8. Handled by a combination of the above.

Every company has responsibility to address any type of risk and make formal judgements with appropriate decision that will lead the organization to a successful destiny [5]. The article examines all potential risks that are associated with the chain of works. The chain of work can produce two possibilities such as: good and poor results. Good results may occur to certain contractors that come up with innovative solutions. They enable to create new opportunity of improvements where improvements of cohesion work amongst contractor and subcontractors; Poor results is common problems arising that involves with multiple contractors (subcontractors). Poor results are unavoidable things faced by the project owner. Project owners needs to develop further risks preventive measurements to manage all associated risks [6] .

2.2. Project Risk Management

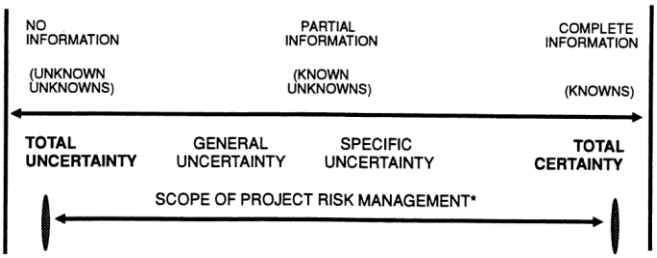


Figure 2: Scope of Project Risk Management [5].

The scope of project risk management can be categorized into four domains: (see Figure 1. Scope of Project Risk management).

- Total uncertainty (No information). No risk is identified, and no further preventive measures are introduced.
- General uncertainty and Specific uncertainty (partial known or unknown information). Some of the risks are identified and preventive measures are introduced limited.
- Total certainty (complete information). All possible risks are identified in the early stage, and preventive measures are introduced in all stages of the project.

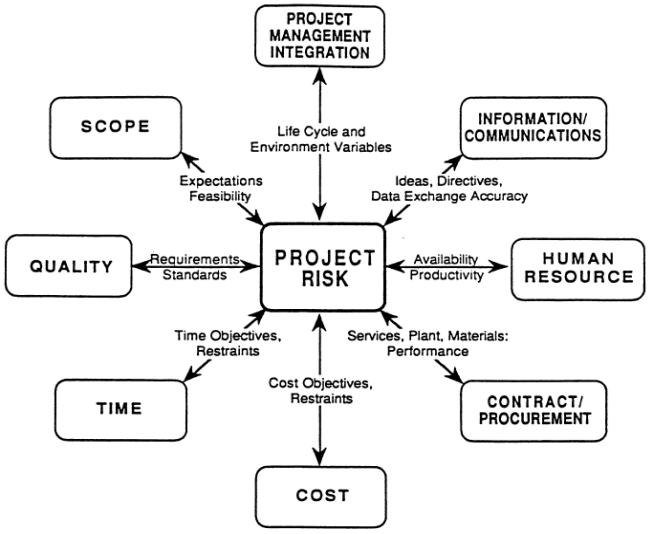


Figure 3: Integration Risk with Other Project Management Functions.

Project risk normally relates with other project management functions: [5]

1. Project Management Integration. The article examines the integration smooth work between contractor with her subcontractors.
2. Scope. The scope of work should be properly understood by contractor/subcontractors.
3. Information/Communication. Better information and communication mechanisms should be developed between the project owner with contractor(s) and subcontractors.
4. Quality. Project owner needs to ensure the quality

work is maintained in the chain of contractor/ subcontractors.

5. Human Resource. The use of the workforce (human resources) should meet the minimum criterion of the project requirements.
6. Time and Cost. Any deviation of schedule and budget should be identified as early as possible along with their mitigation measures.
7. Contract/Procurement. Ensuring all contractors/ subcontractors comply with the contract is not an easy task. Project owners should develop comprehensive risk management to cope with the chain of works. Any change in contract/ procurement should be managed properly. Project owner needs to ensure the change of contract/procurement does not necessarily disrupt the chain of works.

Wideman [5] further elaborated all possibility risks of the project includes:

1. Direct property damage, such as:
   a. resulting from auto collision done by various contractors or subcontractors.
   b. or other auto events. One event may collide with other events due to improper project planning or execution.
   c. to equipment, in transit or handling, etc.
   d. to project materials, including theft.
   e. (sub) and contractors' property.
2. Indirect consequential loss.
   a. Cost of removing direct loss debris.
   b. Equipment replacement.
   c. Rental income loss.
   d. Business interruption.
   e. Liquidated damages.
   f. Increased financing.
3. Legal liability.
   a. Public image of contractors and subs harms.
   b. Property damage arising from the negligence of others.
   c. Personal injury arising from the negligence of others.
   d. Damage to the project entity due to design errors, execution errors,
   e. Project failure to perform as specified.
4. Personnel-related.
   a. Employee bodily injury.
   b. Cost to replace employee.
   c. Resulting business loss.

2.3. Risk Assessment Techniques

The article applies ISO 31010 risk assessment techniques to identify and manage all potential risks of project. Risk assessment technique is used to ensure minimum errors or defects in the project results. The principal benefits of a performing risk assessment include some benefits [7], [8]:

- Providing objective information for decision making.
- An understanding of uncertainties, risks and opportunities, their potential impacts upon objectives and success.
- Identifying, analyzing, and evaluating risks and determining the need for their treatment.
- Quantification of ranking of risks.
- Contributing to the understanding of risks to assist in the selection of treatment and cost-effective options.
- Identify important contributors to risks and weak links in systems and organizations.
- Comparing the risks in alternative systems, technologies, or approaches.
- Identification and communication of uncertainty, risks, and opportunities.
- Rationalizing a basis for preventive maintenance and inspection.
- Post-incident investigation and prevention.
- Selecting different forms of risk treatment and mitigation.
- Meeting regulatory and compliance requirements.
- Providing information that will help the tolerability of the risk when compared with pre-defined criteria.

Project manager needs to ensure all these resources have been used effectively. Project controlling includes achieving objectives such as: [5]

- Achieving a desired result using limited resources,
- Advancing the state-of-the-art (innovation),
- Meeting a required end date or improving a better schedule,
- Enhancing profitability,
- Increasing a budget or schedule contingency,
- Saving money or offsetting a fiscal variance,
- Improving the firm's market position, or
- Ensuring customer satisfaction.

3. RESEARCH METHOD

3.1. ISO 31010 Risk Assessment Framework

Figure 4: ISO 31010 Risk Assessment Techniques [9].

The article applies ISO 31010 Risk Assessment Techniques to identify and mitigate the risk of contractor-subcontractors collaboration. The risk assessment techniques comprises of:

1. Techniques for eliciting views from stakeholders and experts. The stakeholders involves project owner staffs, contractor and subcontractors.
2. Techniques for identifying risk. We use corporate risk management framework to identify and mitigate risks.
3. Techniques for determining sources, causes and drivers of risk. Further data gathering methods are used to identify and mitigate all potential project disruptions.

We develop risk map based on the XYZ risk profile [10], and direct further measures to mitigate the risk of subcontractor works through using the following techniques:

4. Techniques for analysing controls.
5. Techniques for understanding consequences and likelihood.
6. Techniques for analysing dependencies and interactions.
7. Techniques that provide a measure of risk. We anticipate the potential risks may occur after measurement has been applied.
8. Techniques for evaluating the significance of risk. This is repeating work to evaluate and ensure all risks are in manageable domain.
9. Techniques for selecting between options. Adjustments are made to make to lower all risks are categorised in high, very high and extreme risks to moderate and low area.
10. Techniques for recording and reporting. All risks and measurements are recording and reporting in project documentation for further study.

3.2. Risk Profile

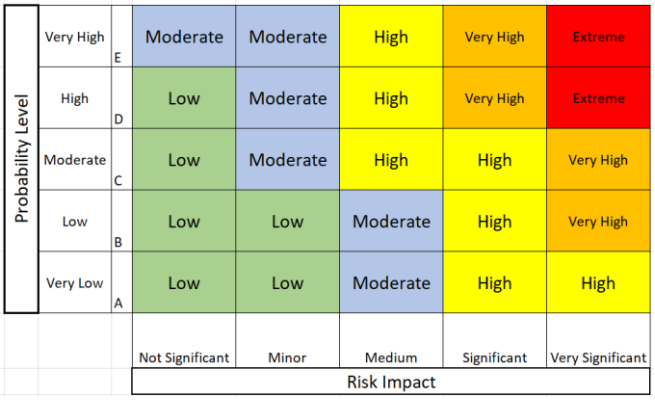


Figure 5: Risk Profile Matrix [10].

The XYZ has developed the risk management plan that is used as a reference for project risk managemnt. It is summarised as follow: [10]

- Risk Profile matrix (see Figure 5).
- Risk Level description (see Table 1).
- Risk Parameter and Probability (see Table 2).

Table 1: Risk Level Description.

Risk Level	Description
Low	Has no impact to the project objective. There is no further risk prevention measurement is required. Risk management is embedded with business process.
Moderate	Has little impact to project objectives. Current control measurements is still effective to manage the risk; however it needs further prevention steps (to higher degree).
High	Has direct impact to project objectives. Current control measurement is ineffective to lower the risk. It requires additional risk control measurements.
Very High	Has high potential to disrupt the project. Probability of project failures is high. Urgent project control measurement needs to apply immediately.
Extreme	Risk has disaster impacts to strategic objectives and systematic plan, and has high potential to halt entire business process and project implementation.

Table 2: Risk Parameter and Probability.

Le-vel	Risk Para-meter	Proba-bilities	Des-cription	Previous events
E	Very High	> 90%	Almost certain to occur.	Occurence more than once within last 6 months.
D	High	70% - 90%	Most Likely to occur.	Occurence once within last 6 months.
C	Moderate	>30%-<70%	Likely to occur.	Occurence once within last 1 year.
B	Low	10%-30 %	Less Likely to occur.	No Occurrence within last 1 year.
A	Very Low	<10%	Almost no chance to occur.	No Occurrence more than 1 year.

3.2. Data Gathering Methods

The article conducts data gathering in the electricity transmission construction area that involves contractors and subcontractors. The data gathering methods involves observation and interviews with key stakeholders such as

project owners, project managers in the contractors and subcontractors. The data gatherings were conducted in 2022, and the findings were further compared with history records in last 5 years, literature studies, and standard risk profile in XYZ company.

The preliminary study showed the high risks has occurred associated with transmission projects, with the involvement of contractors/ subcontractors. Common problems has been identified such as: project delays was quite frequent. The delays were related to poor project design and implementation, unavailability of resources, improper work methods, and so on.

4. FINDINGS AND DISCUSSION

Based on the data gathering results, we elicit views from project managers and identify the risks as follows:

4.1. Risk Identification.

A. Flow of Information.

No	Risk Identification
1	Uncertainty information work of scope and specification at the initial stage.
2	Weakness in contract content that manages criterion and specification of the subcontractors.
3	Information manipulation by subcontractors.
4	Lack of resources possessed by subcontractor to fulfill the specification.
5	No SOP controlling work-transfer from project owner and contractor to subcontractors.

B. Flow of Materials/ Equipment.

No	Risk Identification
1	There is technical change in scope of work of Project Owner.
2	Subcontractor results do not meet specification of contract.
3	Lateness to complete the work.
4	Late workforce (subcontractor) allocation.

C. Flow of Budget.

No	Risk Identification
1	Payment pending from project owner to contractors.
2	Payment pending from contractor to subcontractors.
3	Change in monetary policy causes payment pending to contractors/ subcontractors.

4.2. Risk Analysis

Based on the risk identification above, we determined the sources, causes and driver of risk. We made further assessment on risks identification along with their possibility level, impact level and risk level. It is shown in Table 3**.**

Table 3: Current Risk Assessment.

			Risk Asessment		
No		Risk Identification	Possi-bility Level	Im-pact Level	Risk Level
Infor-mation Flows	1	Incomplete information scope of work that transfers to subcontractors (initiation plan).	Modera te	Mode-rate	High
	2	Weakness in contract that manages criterion and specification of subcontractors	Modera te	Mode-rate	High
	3	Information manipulation oleh subcontractors	Low	Mode-rate	Moder ate
	4	Lack of resources that fulfill specification of subcontractors	Low	Mode-rate	Moder ate
	5	No SOP control transfer work to subcontrator from project owner to main contractor.	High	Mode-rate	High
Flow of Mate-rials/ Equip ment	6	Technical change of Project Owner	Modera te	Minor	Moder ate
	7	Work of subcontractors do not comply with contract requirements	Modera te	Signi-ficant	High
	8	Subcontractor lateness in completing work	High	Signi-ficant	Extrem e
	9	Lack allocation of workforce done by subcontractor	Modera te	Minor	Moder ate
	10	Lack of monitoring and work supervision	Modera te	Minor	Moder ate
Flow of Budget s	11	Pending payment from Project Owner to contractors.	Low	In-signi-ficant	Low
	12	Inappropriate internal financial management contractors that cause delay to subcontractors.	Modera te	Mode-rate	High
	13	Monetary policy change that cause pending payment to contractors /subcontractors.	Low	In-signi-ficant	Low

4.3. Risk Evaluation

Based on risk assessment in Table 3, we conduct further control measures, and understand the consequences and likelihood of associated risk into risk evaluation. XYZ company has addressed all project managers should lower all potential risks to the level moderate-low. We pay special attention to the area that has risk levels: high, very high and extreme (No.1,2,5,7,8 and 12).

4.4. Risk Map

We further developed further analysis into dependencies and interaction amongst contractors and subcontractors; and provide a measure of risk possibilities according to levels and their impacts. The risk event is done based on 2 things: (1) event possibility; and (2) impact or consequence of the event.

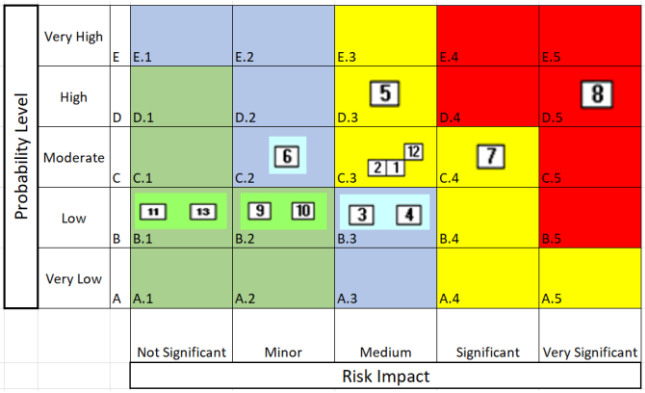


Figure 6: Risk Map.

3.3. Risk Mitigation

We evaluate the significance of risks and select between possible options. Risk mitigation is introduced to address the risk level high, very high, and extreme as follows:

A. Flow of Information.

No	Risk Identification	Mitigation measurements
1	Uncertainty information scope of work and specification at the initial stage.	Setup minimum requirements/ criterion type of works that can be delegated (initial technical planning).
2	Weakness in contract content that manages criterion and specification of the subcontractors.	Setup minimum requirements/ criterion qualification of subcontractor in tender contracts
3	No SOP controlling work-transfer from project owner and contractor to subcontractors.	Make SOP transfer work and agreement to use contractors/ subcontractors.

B. Flow of Materials/ Equipment.

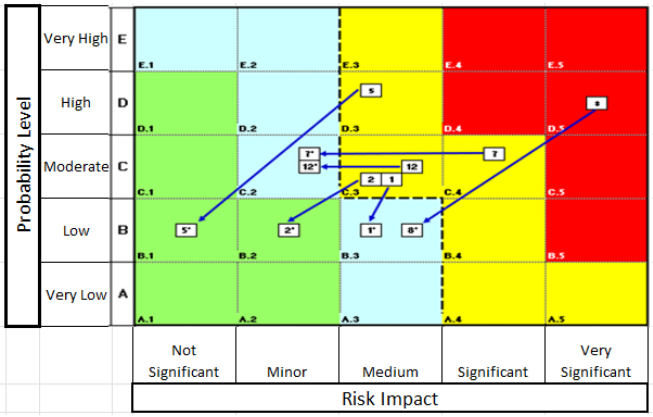
No	Risk Identification	Mitigation measurements
1	Subcontractor results do not meet specification of contract.	Intensify monitoring/ control and legal awareness to contract compliance and regulation.
2	Lateness to complete the work.	Intensify monitoring/control and legal awareness to contract and regulation.

C. Flow of Budget.

No	Risk Identification	Mitigation measurements
1	Payment pending from contractor to subcontractors.	Impose penalty and delay payment according to contract agreement.

We redefine the risk mitigation matrix as: (See Table 4).

Table 4: Risk Mitigation Matrix.



Applying risk mitigation method has enabled to increase the project achievements to 93.93%, in end of December 2022, from 79.74% in 2021. The risk assessment method enables to identify the hidden factors that causes risks in the chain of subcontractors. All techniques that have been applied in the ISO 31000 has been recorded and reporting to management to be used as further staff training.

5. CONCLUSION

Transmission system construction has high complexities since it requires the involvement expertise of contractors and subcontractors. A transmission project may have more than one or more contractor, while 1 contractor can have several subcontractors. It creates an associated chain of risks within contractors and subcontractors. To cope with the associated chain of risks, XYZ company has established a risk assessment method based on ISO 31000, to identify and mitigate all possible risks. XYZ company has required all project managers to lower all possible risks in the level high, very high and extreme, to moderate and low level. The application of ISO 31000 risk method has identified 13 risks associated with work transfer to subcontractors that comprised of 5 risks within the flow of information, 5 risks

within flow of material/equipment, and 3 risks within flow of budget. Those risks are further mapped and mitigated according to the risks preventive measures within XYZ company policy. As a result, the project achievement rates have reached a satisfactory rate.

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