Risk analysis of time on road infrastructure development (Case study: Construction industry in Papua)

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Abstract. The transportation service of the land, sea and air transportation of Papua Province is still very low, due to geographical, topographic, soil conditions and social constraints that hamper infrastructure development. The development of the road network is only focused on meeting the accessibility needs of the production centers to the distribution centers. The phenomenon of inequality that occurs in the world and the territory of Indonesia also occurs in the province of Papua. The gap between regions can be seen primarily by the lagging regions of the Central Highlands of Papua with other regions, especially with the coast of the North Coast of Papua. Identified there are still 14 (fourteen) isolated points/areas, where the development has not touched at all (Regional Development Planning Board of Papua Province, 2007). Many obstacles faced in the implementation of road pavement projects in Papua Constraints encountered, among others, very difficult geographical conditions, unpredictable weather, material, and In addition, security problems and customary rights issues in Papua are also a constraint on the implementation of infrastructure development roads in Papua that have an impact on cost performance. Data collection was conducted on 45 construction service companies in Papua. The data used are primary data and secondary data. Primary data based on questionnaires and interviews, while secondary data based on data collected from various agencies, both government agencies and private agencies, namely Public Works, Central Bureau of Statistics, and others. From the results of this study there are five issues that are most considered to be the biggest risk that affects the time is the risk of uncertain weather, material damage to the project due to the transportation process, the dismantling of storage & the low quality of materials, the lack of expertise, the risk of political and social stability on site. The study in this research is an analysis of risk assessment on-time performance on road infrastructure development in Papua.

Keywords: Papua road infrastructure, risk, severity index

1. Introduction

Papua is a province located in the easternmost region of Indonesia; the province has a vast territory as well as abundant natural resources and diverse traditional cultures. Papua Province has a very varied topographic conditions ranging from swampy lowlands, hills, highlands to steep hills with an area of

317,062 km2 consisting of 29 districts/cities. The transportation service of both the land, sea, and air transportation of Papua Province is still very low, due to geographical, topographic, soil conditions and social constraints that hamper development. The climate of Papua is also one of the challenges (risks) that confronting the perpetrators in the construction world because Papua is included in the climate of the tropical rainforest, which is affected by the dry season, rain and wind of Muson. The determination of rainy and dry seasons in Papua is rather difficult to do firmly because in the dry season for some time even the rainfall remains high. In line with the rapid development of road infrastructure in Papua, some problems result in delays and even a failure of construction. Many risks are faced in the implementation of pavement projects in Papua. Including uncertain climate, geographical conditions, transportation, political and social conditions, human resources, overpriced indices, and ulayat rights issues. The case of the Hamad-Enggros Beach Ring Road construction is delayed due to the unfinished customary rights process, the community still demands the payment of customary land, even though it has been paid in advance, resulting in misfortune to the project. The following research has presented the facts and descriptions of land disputes in Papua, Imagining adat: A study of customary land, disputes, and settlement. Describe the conflict and conflict resolution process of domestic land disputes in Jayapura where there is an ambiguous condition that there are multiple interpretations in the eyes of indigenous peoples as well as the state (government) as the rulers and holders of control over the regulations used in the process of land dispute settlement. So that the settlement of land disputes becomes prolonged.

Figure 1. Illustrated information banners

Figure 2. Example of Road Conditions in Papua

From the events that developed as above, led to several contracts that late settlement and even a failure of construction. So in this study will identify the risk assessment on the performance of time on the development of road infrastructure in Papua.

2. Theoretical Basis

2.1 Risk Management

According to [1] risk management is defined as the process of identifying, measuring, and financing control of a risk that threatens the assets and earnings of a company or project that can cause damage or loss to the company. According to risk management is defined as a comprehensive approach to deal with all incidents that cause losses. According p.27, risk management is also an application of general management that attempts to identify, measure, and handle the causes and effects of uncertainty in an organization.

2.2 Risk Management Process

Risk management is basically done through the following processes:

1) Risk Identification

From the definition of contractual risk attributed in the process of construction, implementation can be taken red line, that a construction process can be identified based on risk, risk type risk, risk type, and risk influence. Risk identification is used to explore risks that may affect the implementation of a construction project. The identification of risk according to is the activity of identifying all business risks faced, either speculative risk or pure risk. Any information about the effort collected is then analyzed.

2) Risk Analysis

Risk assessment is a systematic process for assessing and integrating professional judgments about adverse conditions. Risk assessment is expressed by the relationship between the impact of a hazard (impact) and the probability of future hazard events (likelihood), which is displayed in a risk ranking and risk map. Qualitative Risk Analysis This analysis can usually be done quickly and inexpensively, useful for prioritizing risk mitigation planning, and providing the basis for quantitative analysis if necessary. The basis for qualitative analysis, among others are:

(a) Previous project data from which the data can be learned what are the risks of the project;
(b) A clear scope of work will help to know what will be done to complete the project so that the risks it faces are also clear;
(c) a risk management plan in which there are regulations and responsibilities of individual personnel involved in the project;
(d) a list of risks that have been made at the risk identification stage.

3. Research Methods

3.1 Research Design

The research was conducted through a survey method to build a problem-solving framework which then applied the framework in a case study. The research was conducted based on 4 stages namely preliminary study stage, the preparation stage of the research instrument, data retrieval phase, and the data analysis phase

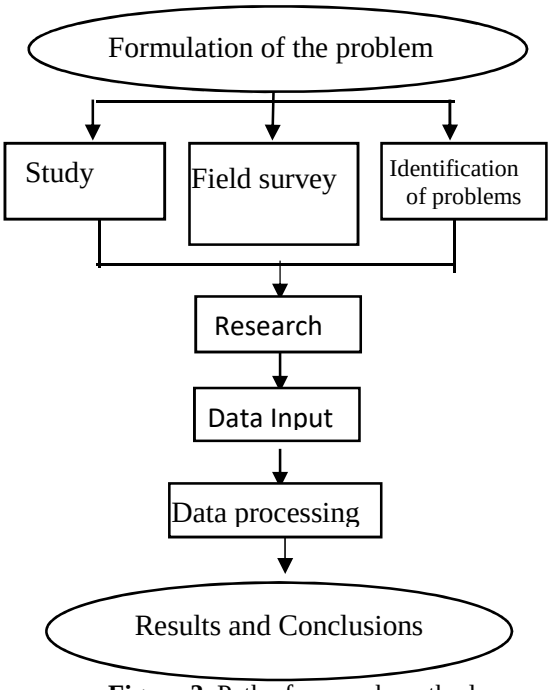

Figure 3. Path of research method

3.2 Data Collection and Processing Techniques

Sampling is done by quota sampling method, that is a technique to take a sample from the population by first specifying certain characteristics or characteristics and then collecting the respondent until the desired quantity (quota) is [2]. There are 15 construction service companies (contractors) who become respondents in questionnaires. Characteristics of respondents applied is minimum education S1 or work experience for more than 5 years. This characteristic is intended to make the information given by the respondent as expert judgment. Here is a table 1 profile that will be the respondent:

Table 1. Profile of respondents

Profile of respondents			
No	Position	Education	Work experience
1	Director	S1/s2	> 15 years
2	manager	S1/s2	10 - 15 years
3	Site manager	S1/s2	5 - 10 years
4	Executor	S1	< 5 years

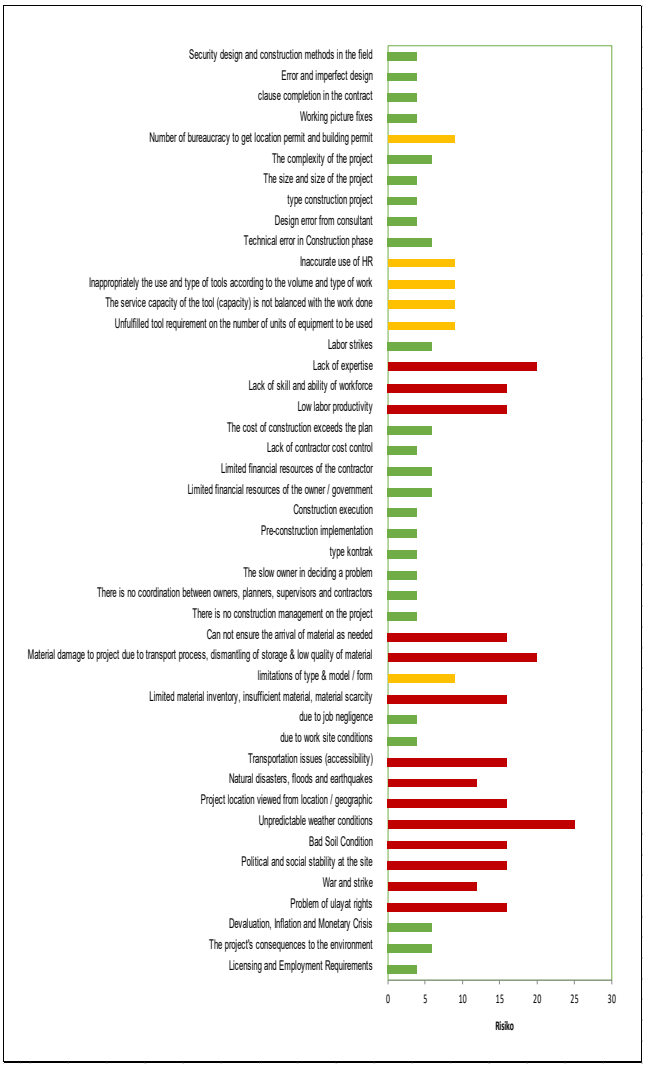

Figure 4. Sample Indicator Survey Table

The concept of Severity Index is a way of knowing the level of risk by multiplying between probabilities and the impacts of made probability and impact matrices. Severity index (SI) is calculated by the formula 1.

$$S(I) = \frac{\sum_i^5 a_i x_i}{5 \sum_i^5 x_i} (100\%) \quad (1)$$

a_i = score answers
x_i = frequency of respondents
i = 1, 2,…, n
x1, x2, x3, x4, x5
a1=1, a2=2, a3=3, a4=4, a5=5
x1= frequency rensponden "very rare / very small"
x2 = frequency rensponden "rarely / small"
x3 = frequency of rensponden "moderate"
x4 = frequency rensponden "frequent / large"
x5 = frequency rensponden "very often / very large"

The potential risk is a risk that needs to be considered because it has a high probability of occurrence and has a large negative consequences and the occurrence of risk is marked by errors in time estimation, cost estimation, or design technology [3].

The process of measuring risk by estimating the frequency of occurrence of a risk and the impact of risk. The scale used in measuring the potential risk to frequency and impact of risk is to use the range of numbers 1 through 5.

The probability and impact matrix is used to measure the level of risk that determines the Significant Risk. The risk level is the multiplication of Probability score and Impact score obtained from the respondents of Severity Index [4].

4. Discussion

In collecting information to support this research, some respondents are selected to obtain information on identification (fill in the questionnaire). There are 45 contractor companies deployed in Papua.

After the collection of questionnaires then held recapitulation. From the recapitulation results obtained risk assessment that is some fairly high risks affect the performance of road construction project time. The following table presents high-level risks that affect timing performance in Papua road building.

4.1 Risk Analysis

There are forty-five risk indicators for time performance in road infrastructure development projects (table 2). From the results of data analysis obtained the top 5 risks that are the problem of unpredictable weather conditions into the most significant risk. Weather problems are a significant constraint in most parts of Papua in particular and generally in northern Papua, as rainfall levels are also high. In contrast to the general territory in Indonesia in Papua relative does not have a period of permanent rain, but the rainfall is uncertain.

The second biggest risk is material damage to the project due to the transport process, the dismantling of storage & the low quality of the material, the third risk of the lack of availability of experts, the fourth problem of ulayat rights being the most typical risk occurring and affecting the cost performance due to the complexity of land acquisition (customary land), although it has been paid and the work has been done, the customary community will return even to the point of making a payment to the contractor or assisted by the government to make the payment. Similarly, the political and social stability in the location due to the location of road construction located in the interior so often the occurrence of security disturbances such as loss of material, heavy equipment destruction and even injured labor.

Table 2. Time Performance Risk Scale in Papua

Source of Risk	Sub Sources of Risk	Indicator	D	P	R	Risk Scale
External Predictable	Environmental Situation	Uncertain weather conditions	5	5	25	High
External Predictable	Material	Material damage to project due to transport process, dismantling of storage & low quality of material	4	5	20	High
Technical	Human labor	Lack of availability of experts	4	5	20	High
External UnPredictabl	Cultural customs	Issues of communal land	4	4	16	High

e		rights				
External UnPredictable	Cultural customs	Political and social stability at the site	4	4	16	High
External Predictable	Environmental Situation	Bad Soil Condition	4	4	16	High
External Predictable	Environmental Situation	Project location viewed from location / geographic	4	4	16	High
External Predictable	Environmental Situation	Transportation issues (accessibility)	4	4	16	High
External Predictable	Material	Limited material inventory, insufficient material, material scarcity	4	4	16	High
External Predictable	Material	Cannot ensure the arrival of material as needed	4	4	16	High
Technical	Human labor	Low labor productivity	4	4	16	High
External UnPredictable	Cultural customs	War and riot	4	3	12	High
External Predictable	Environmental Situation	Natural disasters, floods, and earthquakes	4	3	12	High

4.2 Allocation And Response To Risk

The allocation and risk responses of road infrastructure development in Papua province are allocated to the private sector, except for war and riot problems, most of which choose to allocate to the government with a drastic response. The risk of environmental and material conditions is allocated to swata with bearer response. The risk of labor math is allocated to the private sector with a reduced response.

Table 3. Allocation and Response to Risk in Papua

Indicator	government				Share				Private			
	A	B	C	D	A	B	C	D	A	B	C	D
Issues of communal land rights					5	1	4		32		3	
War & riot	5		4	17	2	1		8	7			1
Political and social stability at the site	9	1	3	2	9	1	3	4	11			2
Bad Soil Condition									38		7	
Uncertain weather conditions									45			

Project location viewed from location / geographic					44			1
Natural disasters, floods, and earthquakes		12	2	6	21		1	3
accessibility			2		33	2	8	
Limited material inventory, insufficient material, material scarcity					21	5	19	
Material damage to the project due to the transport process, dismantling of storage & low quality of material					23	4	18	
Can not ensure the arrival of material as needed					20	6	19	
Low labor productivity					1	18	26	
Lack of skill and ability of the workforce	1				6	2	32	
Lack of availability of experts	1		1		1	6	36	

5. Conclusions

In infrastructure development work, especially road infrastructure in Papua, there is often a risk that the service provider (contractor) must face. From the results of this study there are five issues that are most considered to be the biggest risk that affects the time is the risk of uncertain weather, material damage to the project due to the transportation process, the dismantling of storage & the low quality of materials, the lack of expertise, the risk of political and social stability on site. One of the peculiarities is the risk of being caused by ulayat rights. The unwritten and unlawful tenure of customary land rights makes this issue vulnerable to repeated claims by other families who do not receive land title payments.

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