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TECHNICAL NOTE

THE RISK RATING OF DELAY RISK FACTOR OF ROAD CONSTRUCTION PROJECT IN PAPUA

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Abstract: Papua Province is one of the target areas of national development program in Indonesia. The development program covers the acceleration of road construction. The issue regarding this acceleration is the frequent occurrence of delay in the road construction project in Papua. This research delivers the risk rating of delay risk factors of road construction project in Papua. The delay risk factors are grouped into project factors; owner; contractor; consultant; design; materials; equipment; labor; external factor; finance and economic; and finance and political factors. Nine risks with high categories are generated from the risk assessment, which are (1) Social and Cultural Effect; (2) Physical factors in the working field; (3) Traffic obstruction within and around the project area; (4) Public security; (5) Ineffective delay penalties; (6) A poor relationship with local communities; (7) Lack of productivity; (8) Change-order by owner during construction; and (9) Delay in revising designs by owner. The risks with high category should be mitigated by performing several methods since the early stage of the project. The methods include conducting public discussion, performing comprehensive field survey, performing adequate cost estimation, preparing a sufficient contract, and executing a proper site supervision system.

Keywords: *Road construction, risk rating, delay risk factor*

1.0 Introduction

In accordance to the Strategic Plan of Ministry of Public Works and Housing Republic of Indonesia 2015 – 2019, the national development acceleration program covers several areas in the eastern part of Indonesia, including Papua Province (Ministry of Public Works and Housing Republic of Indonesia, 2015). The acceleration program concentrates in the enhancement of accessibility within and into the respected areas.

Accordingly, the government of Papua Province focusses on the acceleration of road construction (BPS Provinsi Papua, 2015).

In contrary, the most common issue which frequently occurs in Indonesian construction project is delay (Unas *et al*., 2014). Papua encounters severe delays which are mainly generated by its geographic and topographic factors (Sjawal and Wiguna, 2009). This research is aimed to support the mitigation of delay during the execution of road construction project in Papua Province. This research delivers the risk rating of various risk factors which potentially cause delay during road construction project in Papua.

The objective of this research is to identify and rate any risk factors related to project delay in road construction project in Papua. Moreover, this research also provides recommendation for the risk mitigation method of the risks with high category.

2.0 Research Methodology

This research focusses on two stages of the Project Risk Management Processes from PMBOK® Guide, which are risk identification and qualitative risk analysis. The qualitative risk analysis covers the risk rating using probability and impact matrix (Project Management Institute, 2013). The risk factors are identified from several related academic studies (Project Management Institute, 2013). Moreover, the risk factor is assessed by performing questionnaire survey. The questionnaire evaluates the frequency and impact of the risk factor to the project in terms of time (Kendrick, 2015). The respondents consist of 16 practitioners who are involved in the road construction project in Papua Province. In order to ensure the reliability of the survey, the respondents must have a minimum experience of ten years in project management. The output of the survey is classified afterwards using the probability and impact matrix in order to obtain the risk rating (Project Management Institute, 2013).

3.0 Literature Review

The risk factors are generated from several well-established studies regarding road construction risk analysis (Project Management Institute, 2013) . Those studies are developed by Assaf and Al-Hejji (2006), Othman (2005), Perera *et al*. (2009), Kaliba *et al.* (2009), Gündüz *et al*. (2013), and Aziz and Abdel-Hakam (2016). The selection of risk factor considers the characteristic of Indonesian construction project, which has been studied by Alwi *et al*. (2002). There are 82 risk factors which are grouped into project factors; owner; contractor; consultant; design; materials; equipment; labor; external factor; finance and economic; and finance and political factors. Those risks are presented in the Table 2 in the next chapter.

4.0 Results and Discussion

4.1 The Description of Respondent

The role of respondent varies between project manager, site engineer, and owner. Due to the fact that all of the road construction project is owned by government, the owner also runs the role as regulator. The table below presents the description of the respondent.

Table 1: The Description of Respondent

No	*Role*	*Experience*
R1	Regulator	10-15 years
R2	Regulator	10-15 years
R3	Regulator	10-15 years
R4	Regulator	10-15 years
R5	Regulator	10-15 years
R6	Regulator	10-15 years
R7	Project Manager	10-15 years
R8	Project Manager	10-15 years
R9	Project Manager	15-20 years
R10	Project Manager	15-20 years
R11	Project Manager	10-15 years
R12	Project Manager	> 20 years
R13	Project Manager	> 20 years
R14	Site Engineer	10-15 years
R15	Site Engineer	10-15 years
R16	Site Engineer	10-15 years

4.2 Risk Rating

The questionnaire survey generates the frequency and impact on project delay of each risk factor. These results are thereupon classified into three risk rating category such as low, medium, and high risk. The table below presents the identified risk code, risk group, related literature, and risk category of each risk factor.

Table 2: The Risk Rating

Code	*Risk Factor*	*Related Literature**	*Category*
Project			
X1	Tight schedule for the contracted project	A	Low
X2	Legal dispute	A,B,C,E	Low
X3	Insufficient substantial requirements	A	Low
X4	Ineffective delay penalties	A,E	High
X5	Intervention from certain parties	A,D	Medium

Table 2 (con't): The Risk Rating

Code	*Risk Factor*	*Related Literature**	*Category*
Owner			
X6	Delay in payment from the owner	A,C,D	Low
X7	Delay in site handover from the owner to the contractor	A,E	Medium
X8	Change-order by owner during construction	A,B,C,E	High
X9	Delay in revising designs by owner	A,B,C	High
X10	Delay in approving designs by owner	A,B,C	Low
X11	Poor communication between owner and site engineer	A	Low
X12	Owner's indecisiveness	A	Medium
X13	Conflict between joint-ownership	A,E	Low
Contractor			
X14	The lack of incentives for the contractor to complete the work on time	A	Medium
X15	Delay in work because of instructions from the owner	A,B,C	Low
X16	Re-working due to construction errors	A,E	Low
X17	Conflict between the contractor and other stakeholder	A,F	Low
X18	Poor supervision by contractor	A,C,D	Medium
X19	Poor coordination between contractor and other stakeholder	A,D	Low
X20	Ineffective plan and schedule	A,B,C,E	Low
X21	Mishandling in construction method implementation	A,B,C	Low
X22	Postponement by sub-contractor	A,F	Low
X23	Uncompleted target, unfinished job	A	Low
X24	Regular sub-contractor switching	A	Low
X25	Contractor-recruited technical staff's incompetency	A,C,D	Low
X26	Delay in field mobilisation	A	Medium
X27	Contractor is not the company owner	A	Low
X28	The offering price is too low	A	Medium
X29	Scarcity of qualified contractors	A,C,D	Low
X30	Frequent change of sub-contractor	A,C,D	Low
Consultant			
X31	Delay in conducting inspections	A,E	Medium
X32	Delay in the approval of major changes in the construction	A,B,C	Low
X33	Poor communication between consultant and site engineer	A	Low
X34	Delays in reviewing and approving the design	A,E	Low
X35	Conflict between consultant and design engineer	A	Low
X36	Lack of experience of the consultant	A	Low
Design			
X37	Mistakes in the design document	A,B,C	Medium
X38	Delay in making the design document	A,C,D	Low
X39	Unclear detail in design	A,B,C,E	Low
X40	Lack of data collection before making a design	A	Low
X41	Misunderstanding the technician in translating the criteria	A	Low

Table 2 (con't): The Risk Rating

Code	*Risk Factor*	*Related Literature**	*Category*
X42	Lack of experience from the design team	A,D	Low
X43	The design is not environmentally friendly	A	Low
Material			
X44	Construction material shortage in surrounding areas	A,E,F	Medium
X45	Changes in material specification and types during construction	A,C,D	Medium
X46	Delay in material dispatch.	A,B,C	Medium
X47	Material damage at the essential stage of construction	A	Medium
X48	Delay in the production process of material	A	Medium
X49	Delayed material procurement	A,C,D	Medium
X50	Pricing outside the standard	A,F	Low
Equipment			
X51	Equipment damage during construction	A,B,C	Medium
X52	Lack of availability of equipment during the construction	A,D	Medium
X53	The lack of experts	A,D,F	Medium
X54	Lack of productivity and efficiency of equipment	A,D,E	Medium
X55	Lack of availability of training ground	A	Low
Labor			
X56	The shortage of field workers	A,B,C	Medium
X57	The lack of expertise of field workers	A,B,C	Medium
X58	Lack of productivity	A,D,E	High
X59	Personal conflict between laborers	A,E,F	Low
External			
X60	Physical factors in the working field	A	High
X61	Climatic factors	A,B,C	Medium
X62	Traffic obstruction within and around the project area	A	High
X63	Safety issues	A	Medium
X64	Extreme working conditions	A	Low
X65	Natural disasters	C,E	Medium
X66	Delay in inspection from the third party	A,E	Low
X67	Social and Cultural Effect	A,F	High
X68	Intervention from other parties	A	Low
X69	Pricing outside of the standard on certain works	A	Low
Economics and Finances			
X70	The insufficiency of funds (*start-up funds*)	C,D,F	Medium
X71	Payment postponed	C,D	Medium
X72	Dependence on foreign loans	C	Low
X73	A less exact estimation	C	Low
X74	The cost of environmental protection and mitigation	C	Low

Table 2 (con't): The Risk Rating

Code	*Risk Factor*	*Related Literature**	*Category*
	Social and Policies		
X75	Difficulty in obtaining a license	C	Low
X76	A poor relationship with local communities	C,E	High
X77	Public security	C	High
X78	Excessive social and politic cost	C,D	Low
X79	Intervention from the local government	C,D	Low
X80	The changing laws of local government	A	Low
X81	Delay in obtaining permits from local government	A,E	Medium
X82	The impact to the local community around the site	A	Medium

*Related Literature (A: Assaf and Al-Heijj (2006), B: Othman (2005), C: Perera (2009), D: Kaliba (2009), E: Gündüz *et al*. (2013), F: Aziz and Abdel-Hakam (2016))

4.3 Discussion and Recommendation

The risk rating generates nine risk factors with high category. This study discusses the risk response as the basis of delay prevention. The risk response focusses in decreasing the impact of the risk factor, or diminishing the frequency of risk occurrence. The rank of high-category risk factor is presented sequentially in the table below.

Table 3: The Rank of High-Category Risk Factor

Rank	*Risk Group*	*Code*	*Risk Factor*
1	External	X67	Social and Cultural Effect
2	External	X60	Physical factors in the working field
3	External	X62	Traffic obstruction within and around the project area
4	Social-Politic	X77	Public security
5	Project	X4	Ineffective delay penalties
6	Social-Politic	X76	A poor relationship with local communities
7	Labour	X58	Lack of productivity
8	Owner	X8	Change-order by owner during construction
9	Owner	X9	Delay in revising designs by owner

The prevention from social and cultural impact (risk code X67), public security (risk code X77), and relationship with local communities (risk code X76), lies on the effort to obtain input from the society during the preparation of the project (Connor, 1976). Throughout the feasibility study, the representative of the society should be invited to a public discussion to present their concern in regards to the project (Koehn and Winkleman, 1981). This public discussion could also enhance the relationship with society and ensure the public security. By performing this public discussion, all inputs

and concerns could be addressed earlier, in order to prevent any society repudiation during the execution of the project.

Road construction project in Papua is aimed to build accesses to several isolated area. This would cause several issues, including physical condition of the project site (risk code X60) and any transportation to project site (risk code X62). The topographic condition of Papua consists of mountains, forest, ravine, river, and valley with very soft clay type of soil (Sjawal and Wiguna, 2009). An adequate and comprehensive field survey should be conducted to accommodate the topographic condition of the project site (Jahanger, 2013). These issues should be addressed from the early stage of project, so the construction method and equipment could be designed in accordance with the survey result. The survey has to be the basis of design and scheduling, in order to anticipate any obstacles which potentially occur on the project site.

Ineffective delay penalties (risk code X4) could be anticipated by adequate project cost estimation. Therefore, the effective amount and rule of delay penalties could be generated from the estimation. An effective amount of delay penalties would prevent contractor from choosing to pay penalties other than accelerates the project. The delay penalties should be stated clearly in the contract clauses. The labour's lack of productivity factor (risk code X58) could be addressed through proper system of site supervision (Aziz, 2013). Site supervisor should maintain the productivity of labour in accordance with the project schedule. Any additional labour incentive should be considered, if such issue happens repeatedly.

The change order (risk code X8) and delay in revising design by owner (risk code X9) could be prevented by providing sufficient time for design (Gündüz *et al*., 2013). Besides, the owner should realize that any change of design would generate a significant delay to the project execution (Aziz, 2013). Moreover, the procedure of revision approval should be designed well (Marzouk and El-Rasas, 2014), so the revision approval would not damage the project schedule severely.

5.0 Conclusions

The risks with high category are (1) Social and Cultural Effect; (2) Physical factors in the working field; (3) Traffic obstruction within and around the project area; (4)Public security; (5) Ineffective delay penalties; (6) A poor relationship with local communities; (7) Lack of productivity; (8) Change-order by owner during construction; and (9) Delay in revising designs by owner. The risk mitigation method should be performed since the early stage of the project. The methods include conducting public discussion, performing comprehensive field survey, performing an adequate cost estimation, preparing a sufficient contract, and executing a proper site supervision system.

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