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RISK ANALYSIS IN DEVELOPING HORIZONTAL TO VERTICAL HOUSING USING SEVERITY INDEX METHOD (CASE STUDY: RUMAH SUSUN PALDAM, BANDUNG)

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ABSTRACT

Currently the gap between the demands with the supply of livable homes is relatively large. From various national figures, it is noted that this challenge requires a structured, systematic and massive handling / management effort, with no exception in the Capital of West Java Province, Bandung City. To fulfill the community's need for housing, the government has financial constraints due to the limited State Budget, so the government needs the help from business entities to meet the housing needs, as know as PPP. In this case, the construction is on land that is inhabited by the retired TNI community, so it is a separate and risky challenge. In general, any infrastructure development has a risk that needs to be mitigated. Therefore, it is necessary to carry out further and in-depth studies on what risks are affected and the allocation of risks so that management can be prepared. This paper aims to determine the risks posed in the construction of the Paldam Flats in Bandung. The analytical method used is the Severity Index Method. The analysis phase is carried out by starting with a preliminary survey of the parties concerned, then identifying risks. From the main survey results, this data will be processed with a risk probability matrix and risk impact, so it can be seen that the variables are included in the high category. From the results of data analysis, the risk that gives the greatest influence is the increase in construction costs and commercial revenues.

Keywords— *Risk Analysis, PPP, Severity Index, Housing, Bandung*

A. INTRODUCTION

Every citizen of the Republic of Indonesia, has the right to inhabit a decent dwelling in accordance with the norms in the 1945 Constitution, Article 28H paragraph (1) which reads: Every person has the right to live in physical and spiritual prosperity, to live, and obtain a good and healthy living environment and entitled to receive health services. So, now the government is trying to provide affordable and livable housing for the community.

According to National Medium Term Development Plan (RPJMN) 2015 – 2019, the goal of housing development is to facilitate provision of adequate housing for 18.6 million low-income households (MBR). The facilitation included

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the construction of new housing for 9 million households through self-help housing stimulant assistance for 5.5 million households and the construction of low-cost housing for 514.976 households. And increasing quality of housing as many as 9.6 million households in achieving zero percent slum alleviation. In addition, the government also plays a role in increasing access to low-income households (MBR) to obtain decent, safe and affordable housing and is supported by the provision of adequate infrastructure, facilities and utilities. So there needs to be a strategy in increasing the role of government and local government facilitation in providing new housing (rent/ownership) and improving the quality of housing. Provision of new housing (rental / ownership) is done through the development of an effective and efficient national housing finance system.

The limitations of the APBN or APBD are one of the obstacles in providing housing for the MBR. Thus, creative financing is needed to meet the housing needs for the MBR. Financing schemes that are currently trending, namely the Public-Private Partnership or known as PPP. This PPP means the government is cooperating with the private sector in terms of financing. If the conventional financing scheme only uses the APBN or APBD, then all risks are borne by the government, with the PPP, these risks are not all borne by the government, but there is a risk sharing between the government and the private sector.

There are several benefits ftom this PPP scheme, such as increasing the effectiveness of public services, it means the service provided are right on target. Other benefits include improving the quality of public services, reducing the cost of public services due to the loss of inefficiencies and resulting in savings in the use of inputs, spending allocations that are more oriented to the public interest and increasing awareness of government costs (public cost awareness) in order to be more efficient, effective and transparent, as a basis for implementing public accountability in the use of government funds.

Currently the PPP has entered the housing infrastructure, especially the construction of low-income housing for low-income households in urban areas (Parashar, 2014). The housing crisis in developing countries has made partnership in the housing sector (Obeng-Odoom, 2009). Partnership in the provision of housing requires a greater role for the private sector because it requires special expertise, financial capacity, technical expertise, efficient management, and effective time schedules in project work. The PPP scheme in the housing sector can be said to be too late to be implemented in Indonesia compared to other infrastructure sectors. This may be related to the inherent complexity of PPP in housing was different compared to other sectors (Parashar, 2014).

On a national scale, the distance or gap between the amount of demand with supply of livable homes is still relatively large. From various national figures, it is noted that this challenge requires a structured, systematic and massive handling / management effort, with no exception in the Capital of West Java Province, Bandung City. From available data, this city has recorded a housing backlog of 378,384 units in 2017. This number increased by 21.5% from the previous year (2016) of 311,410 units. Meanwhile, looking at the existing performance, the City of Bandung has only been able to provide 1,071 public housing units, this number is relatively small when compared to the estimated need for additional public

housing units of 11,460 residential units per year for the next 20 years. Construction plan for this Paldam flats will stand on the11,336 m^2 land area of the Bandung City Government. In this case, the construction of flats is on land that is inhabited by the retired TNI community and will be built using a PPP scheme, so that in this case it becomes a separate and risky challenge. In general, in any infrastructure development there is a risk that needs to be mitigated for the continuity development and achievement.

Research on risk analysis in the PPP project has been conducted by several researchers. However, until now there has been no consistency of research results and it is still rare to discuss the risks to the PPP housing project. Therefore, this study will analyze the level of risk in the construction of paldam Bandung flats with PPP schemes. The results of this study are expected to provide a reference for the government and companies regarding the level of risk of the construction of flats with a PPP scheme so that the project achieves the expected results.

B. LITERATURE REVIEW

1. Risk

Risk management is a process of risk identification, risk analysis, risk management, and risk monitoring. Risk identification activities are carried out at an early stage of risk management where at that stage an inventory of potential risks will occur along with a simple assessment and initial allocation. These risks can be assessed qualitatively or quantitatively. The purpose in carrying out risk management is so that stakeholders can obtain maximum financial benefits through a risk management process that includes eliminating, minimizing, transferring, and absorbing / accepting the risk. Inventory risks need to be further analyzed to determine risk assessments and their handling patterns.

Traditonally, risk were different from uncertainty (Trangkanont & Charoenngam, 2014). The results of risks can be quantified using probabilities, while the results of uncertainties cannot be measured (Davidsson, 2010). Risk can be opportunities or threats. In PPP, risk considered as a threats and can cause project delays (Akintoye & Chinyio, 2005).

2. Public- Private Partnership

In terms of sources, funding to finance a large scale investment project such as an infrastructure project can come from equity and debt. In terms of its structure, funding for investment projects can be divided into two, namely corporate finance and project financing (PPP). In corporate finance, the assets and sources of funds from the project being funded will be part of the assets and sources of funds from the company the owner of the project was built on. Conversely, at the PPP, the company who implementing the project or acting as the sponsoring company will form a special entity that will be a consortium to carry out the project to be built (Rajan Annamalai & Jain, 2013). A project that uses a project finance funding scheme can make it possible to obtain substantial funding, because there is a role for a company as additional funding (Yescombe, 2014). In addition, in the PPP scheme, all risks that occur within the project will be borne by the parties directly related to the project, so that risk management can be maximized.

According to Yescombe 2013, A common characteristic of the PPP scheme is that the projects undertaken usually relate to the main infrastructure with a long construction and operational period (15-25 years). Another characteristic is that lenders will depend on the cash flow that has been projected to pay debts and interest provided, so the need for a legal protection in the form of a limited company that only applies when the project is done. The debt ratio under the PPP scheme also covers 70% -90% of the project's capital costs. The final characteristic is that the project has a concession period, so that when the concession period ends and the debt is paid, the project will be handed over to the government.

C. RESEARCH METHODOLOGY

The method used in this study there are three approaches, namely identification of risk factors, conducting data collection stages, and data analysis. The risk factors used in this study are derived from the risk allocation reference of Indonesian Infrastructure Guarantee Fund (Persero), that consisting of 11 risks which are divided into 58 sub categories. That variable become reference in the preparation of the questionnaire by developing questionnaire statements based on indicators / criteria from each sub category. Assessment questions in this study will be answered with a 5-point Likert scale. Scale 5 shows the response "very high (extreme)" while scale 1 shows the response "very low".

Data collection is done through the distribution of questionnaires to respondents. In this study there were 33 respondents who returned the questionnaire and filled in all the questions. The respondents in this study were people who understood PPP. Respondents in this study came from business entities, academics, and government. Following are the demographics of the respondents in this study.

Tabel 1. Respondent Demographics

Respondent Profile	Categories	Total
Sector type	Public	24
	Private	5
	Academic/Researcher	3
Educational Background	<D3	1
	D4/S1	17
	S2	12
	S3	3
Industrial experience (Years)	0-5	15
	6-10	1
	11-15	4
	16-20	4
	>20	9

D. RESULTS AND DISCUSSION

The data that has been collected will be analyzed using a severity index to see the level of risk probability and impact on the project. The severity index used in this study is presented in the formula below :

$$Severity\ Index\ (SI) = \frac{(\sum_{i=1}^{5} aiXi)}{(\sum_{i=1}^{5} Xi)} \times 100\%$$

Information : I = Severity index, Xi = Respondent frequence, ai = 1,2,3,4,5
Severity index value can be divided into five categories below:

Table 1. Severity Index Classification

Classification	Description
0% < PI ≤ 20%	Very Low
21% < PI ≤ 40%	Low
41% < PI ≤ 60%	Moderate
61% < PI ≤ 80%	High
81% < PI ≤ 100%	Extreme

After getting the value of the probability index and impact index of each variable, then mapping the value is carried out on the probability and impact matrix. The mapping was carried out to find out each risk variable included in the very low (green), low (blue), medium (yellow), high (orange), and very high (red) categories as shown in the following figure.

Table 3. Probability and Impact Matrix

Probability	Impact				
	Very Low	Low	Moderate	High	Very High
Very High	Moderate	High	Very High	Very High	Very High
High	Low	Moderate	High	Very High	Very High
Moderate	Low	Moderate	Moderate	High	Very High
Low	Very Low	Low	Moderate	Moderate	High
Very Low	Very Low	Very Low	Low	Low	Moderate

Based on data from respondent, severity index results are obtained as follows:

Table 4. Risk Analysis

Categories	Sub Categories	Probability Index		Impact Index		Risk Value
		Percentage	Classification	Percentage	Classification	
Location Risk	The land cannot be used because of the need for resettlement	67%	High	67%	High	Very High
	Complex resettlement process	65%	High	64%	High	Very High

	Limited working space construction	48%	Moderate	47%	Moderate	Moderate
	Damage to artifacts and ancient items at the location	31%	Low	29%	Low	Low
	Land status risk	57%	Moderate	62%	High	High
	Contamination/pollution to the location environment	64%	High	66%	High	Very High
	Disruption to the comfort of the community living near the project area	73%	High	70%	High	Very High
Design, Construction, and Operational Test Risk	Unclear output specifications	42%	Moderate	55%	Moderate	Moderate
	Failed to maintain safety on location	41%	Moderate	48%	Moderate	Moderate
	Increase construction cost	70%	High	77%	High	Very High
	Poor contractor/sub-contractor performance	60%	Moderate	69%	High	High
	Contractor/sub-contractor default	56%	Moderate	64%	High	High
	Design error	40%	Low	56%	Moderate	Moderate
	Delays in construction completion	60%	Moderate	67%	High	High
	Operational test risk (testing & comissioning)	47%	Moderate	53%	Moderate	Moderate
Sponsor Risk	Private default	52%	Moderate	56%	Moderate	Moderate
	Project sponsor default	49%	Moderate	53%	Moderate	Moderate
	Project lender default	45%	Moderate	54%	Moderate	Moderate
Financial Risk	Failure to reach financial close	55%	Moderate	62%	High	High
	VGF disbursement risk (infrastructure cash support funds)	49%	Moderate	55%	Moderate	Moderate
	Exchange rate risk	45%	Moderate	52%	Moderate	Moderate
	Inflation and interest rate risk	51%	Moderate	61%	High	High
	Insurance risk	48%	Moderate	51%	Moderate	Moderate
Operational Risk	Facilities availability	61%	High	63%	High	Very High
	Poor/unavailability of service	52%	Moderate	61%	High	High
	Industrial action	52%	Moderate	54%	Moderate	Moderate
	Social and local culture risk	56%	Moderate	56%	Moderate	Moderate
	Project management failure	53%	Moderate	64%	High	High

	Project control and monitoring failure	51%	Moderate	60%	Moderate	Moderate
	Increased O&M costs	61%	High	64%	High	Very High
	Life cycle cost estimation error	55%	Moderate	64%	High	High
	Increase in energy costs - due to unit inefficiency	53%	Moderate	60%	Moderate	Moderate
	Irregular availability of utilities	50%	Moderate	57%	Moderate	Moderate
	Security and safety risk	49%	Moderate	58%	Moderate	Moderate
Income Risk	Failure to submit tariff adjustments	53%	Moderate	63%	High	High
	Delayed periodic tariff adjustments	52%	Moderate	57%	Moderate	Moderate
	The rate of tariff adjustment is lower than projected	45%	Moderate	48%	Moderate	Moderate
	Miscalculated tariff estimates	48%	Moderate	61%	High	High
Network Connectivity Risk	Road and transportation network connectivity risk	44%	Moderate	48%	Moderate	Moderate
	Smoothness of transportation system risk	50%	Moderate	49%	Moderate	Moderate
	Competitor facilities risk	48%	Moderate	52%	Moderate	Moderate
Interface Risk	Time inequality and quality of work risk	53%	Moderate	62%	High	High
	Different service methods risk	51%	Moderate	58%	Moderate	Moderate
	Relationship risk	47%	Moderate	48%	Moderate	Moderate
Political Risk	Foreign currencies cannot be converted	27%	Low	36%	Low	Low
	Foreign currencies cannot be repatriated	29%	Low	34%	Low	Low
	General regulatory (and tax) changes	51%	Moderate	61%	High	High
	Discriminatory and specific regulatory (and tax) changes	42%	Moderate	53%	Moderate	Moderate
	Delay in obtaining planning approval	52%	Moderate	61%	High	High
	Failed/delayed approval	52%	Moderate	65%	High	High
	Delay in obtaining access to the project site	49%	Moderate	55%	Moderate	Moderate
	Parastatal risk (poor quality of BUMN performance)	42%	Moderate	53%	Moderate	Moderate
Force Majeure Risk	Natural disaster	48%	Moderate	68%	High	High
	Politician force majeure	46%	Moderate	62%	High	High
	Extreme weather	42%	Moderate	55%	Moderate	Moderate

	Prolonged force majeure	30%	Low	52%	Moderate	Moderate
Asset Ownership Risk	Decrease of asset value risk	47%	Moderate	48%	Moderate	Moderate
	Transfer assets after the PPP contract ends	55%	Moderate	53%	Moderate	Moderate

Source : Risk Allocation by Indonesia Infrastructure Guarantee Funds

Based on table 4, the interpretation can be taken as follows:

1. The land cannot be used because of the need for resettlement
   The project development starts with the determination of the project location. Determination of the location will be a reference for the implementation of land acquisition and preparation of technical planning details. The technical obstacle that is often experienced in infrastructure development is land acquisition due to citizens building on the land. Land acquisition in construction projects especially in Indonesia is the most crucial stage. Many problems in the construction of public infrastructure have been delayed due to the incomplete issue of land acquisition. The current condition of the land is still inhabited (not yet clean & clear) by retired TNI members, so it needs to be relocated first, as well as the existing building assets on the ground need to be further confirmed.
2. Complex resettlement process
   The construction of this apartment project is on land that has been occupied (not yet clean & clear) by retired TNI members so that the first phase requires readiness to relocate residents who live on the land during the construction process, the City Government of Bandung will relocate residents affected by the project development with the concept of building without displacing through a mechanism by preparing a temporary settlement area so that the community can inhabit new residence and the people affected by the development get compensation for development, so that the risk of a complex resettlement process can be resolved by first relocating.
3. Contamination / pollution to the location environment
   In the construction of this project, there may be pollution in the location environment that interferes with project implementation due to the already crowded environment. Unhealthy environment will be an additional burden for workers, among others, noise generated from construction equipment that can disturb concentration, smoke and dust inhaled causing respiratory distress so as to reduce work productivity. Although this sometimes seems small but actually this problem is interesting enough to be observed to be more careful in building projects because losses can arise in terms of material and the comfort of the community itself, so it needs good planning so as not to cause adverse environmental impacts for environment.
4. Disruption to the comfort of the community living near the project area
   Projects can cause health and comfort disturbances, for example community houses damaged due to construction activities. The convenience of the community around the project area is disrupted due to the congested environmental conditions. In addition, environmental impacts such as flats

waste need to be considered because it can affect the environmental conditions of the surrounding community.

5. Increase in construction costs
   In the case of completing the construction of the project flats required accuracy in the process of the process and timeliness in accordance with the planned schedule without any delay. However, in reality, constraints or obstacles are often encountered that have delayed project progress so that they can be overcome by rescheduling so that the project can be completed sooner than the specified time. This is closely related to the risk of an increase in construction costs that could possibly occur because of the possibility of an increase due to changes in the volume of work. An increase in construction costs can cause an increase in interest resulting from a loan tenor that is not timely (Xenidis & Angelides, 2005).
6. Availability of facilities
   In Indonesia, PPP's in the Housing Sector is new, so adequate facilities are needed in the construction phase. This risk occurs because of inexperienced business entities and incomplete designs (Cheung & Chan, 2012). Besides in the process of building this apartment project, it should not only focus on providing the physical building of the apartment, but also must pay attention to the availability of facilities that must be provided, because this risk could arise due to the facility could not be built. So that the fulfillment of facilities requires an experienced business entity.
7. Increased O&M costs
   The housing sector is unique, because the operations are relatively complex and operating costs are unstable and difficult to predict. This risk is related to the increase or lack of operating costs due to improper calculations, poorly planned schedules, and poor operating efficiency. In the PPP, the increase in operational costs can be caused by residents of flats and external factors that cannot be controlled. These conditions include movements in foreign exchange rates and inflationary pressures (Sachs, Tiong, & Qing Wang, 2007). In addition, maintenance and operational costs of housing are mandatory so that these costs often increase and burden residents.

E. CONCLUSION

Based on the research results, it can be concluded that there are 11 risk categories and 58 risk sub-categories. The risk with the highest severity index is first on location risk with sub-category of land risk can not be used because of the need for resettlement, complicated resettlement process, contamination / pollution to the location environment, disruption to the comfort of the community living near the project area, secondly to the design risk, construction, and operation test with sub-category such increase in construction costs, thirdly on operation risk with sub-category availability of facilities and increased O&M cost.

The findings in this study are useful in risk management in PPP projects, especially in the housing sector. This research has limitations so it needs improvement in the future. First, it is necessary to increase the number of experts as respondents in order to get good results. Second, similar research can be carried

out in different locations as a reference for government and business entities in risk management.

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