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Risk Analysis of Apartment Project Development

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ABSTRACT: Strategic decisions on capital investment in investment development projects are important and require depth analysis and consideration. This is related to the characteristics of apartment development projects that are very vulnerable to risk and uncertainty. Risk analysis becomes necessary in the feasibility study, especially at the moment of financial feasibility study because uncertainty in income and construction costs always exist. This study took a case study on an apartment project development in Jakarta. The research aims to developers so they can see the feasibility of developing this apartment from risks that can occur in the future. In this study the analysis of financial feasibility and risk analysis used Monte Carlo simulation to consider the probability distribution of variables that had been determined into a model chosen to see the feasibility of developing this apartment. The results of the research on the analysis of the financial feasibility study showed that this apartment development project had a fairly good level of feasibility. This was supported by the results of risk analysis using the simulation method which showed that the development of apartments had a level of feasibility of 83.9% even though the IRR value was different from the results of the analysis of financial feasibility studies.

KEYWORDS: investment, feasibility study, risk analysis, monte carlo simulation.

I. INTRODUCTION

DKI Jakarta is one of the metropolitan in Indonesian that keep developing rapidly in business, industrial, and also infrastructure construction. As the capital city of a country and also the largest city in Indonesia, Jakarta keep experiencing the growing number of population. In 2015, the number of population in DKI Jakarta reached 10.18 million people, then in 2016 rose into 10.28 million people, and kept growing into 10.37 million people and in 2017 (central bureau of statistics). The rapid growing number of population leads the rising needs of home.

Now, living in apartment is a lifestyle and becomes a need for modern community. society especially people in upper class consider that living in apartment is more practice because it is supported by various facilities which easier the resident to do activities. Besides, the location of apartment usually is built in strategic location, such as close to office area, business, school, shopping center, and also entertainment center.

On the investment implementation of that project, much risks can trigger project failed. Those risks can come both from internal and external. Internal failure which often occurred in a project is a cost overrun and delays, meanwhile for external risks the project funding based on unit selling also refers to failure factor in apartment project. The growing number of developers makes land of property business become a tight competition. Funding is the main factor of consideration. Therefore, funding project must be run properly both in internal and external factor.

This study aims to discuss about the risks that might cause apartment project failure. Those conditions make risk analysis important to be obtained. Risk analysis can be also combined to feasible study in financial aspect so that developer or investor can consider the possibilities that will come to anticipate threat which can cause failure of that project.

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II. WHAT METHOD TO CALCULATE RISK ANALYSIS

Economic Feasible Study Analysis

There are several methods that are common to be used to analyze feasible project from financial side, especially to observe time value of money, as follows:

- a. Net Present Value
Net present value (NPV) is an analysis that calculates the gap between PV investments with PV net cash. In this analysis, the feasible level of investment can be valued from the observation of NPV obtained, If NPV value obtained is bigger than zero (NPV positive) then the investment occurred can be said beneficial.
- b. Internal Rate of Return
Internal rate of return (IRR), is an analysis that used to know the level of payback from fund that already used in an investment. Meanwhile, feasible analysis of an investment can be valued by observing IRR value obtained.

Risk Management

Risk management is an effort to know, analyze and also to control risk in every company activities with the purpose to get higher efficiency. Management definition based on Djohanputro[8] risk management is structured and systematic process in identifying, measuring, mapping, developing alternative risk management, and monitoring and controlling risk management. The focus on this study is in identifying the risk and analyzing the risk.

Risk Identification

According to Darmawi[6] the first stage in a process of risk management is a stage to identify the risk. Risk identification is a systematic process and continuing activity to identify the possibilities of risk or loss in material, debt, and company personnel. Identifying risk process is an important process in a project, and must be identified.

Risk Analysis

The choosing of approach in risk analysis is very related with the size, type, and the rule of project and also the problem that its model is made, number and data reliability, and also the last result wanted from its analysis. There are several approaches that can be chosen to do risk analysis [13]:

- a. Risk premium – by adding unexpected costs to the cost component
- b. Sensitivity testing – by measuring the effect of changes in a variable on the expected output;
- c. Expected monetary value (EMV) – by conducting sensitivity to the cost component according to its probability;
- d. Expected net present value (ENPV) – by studying the probability of the amount of NPV that will be generated in a project;
- e. Stochastic dominance – that is by considering the probability of a cost component into the simulation

In this study, one of the approaches used is stochastic dominance using Monte Carlo simulation. This simulation is a method to analyze uncertainty propagation where the aim is to determine how random variation or error affects the sensitivity, performance, or reliability of the system being model. The simulation is classified as sampling method because input is generated randomly from a probability distribution for the sampling process of a real population. Therefore, a model must choose an input distribution that is closest to the data they have [14]. The model used in this simulation is discounted cash flow. The simulation in this study uses the @RISK application, which is one of the risk analysis software that is capable of conducting the simulation through thousands of random iterations of a mathematical model.

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III. RESEARCH METHODOLOGY

Research Sequence

In general, there were three major analyzes in this study, namely Financial Feasibility Study (Financial/Financial Analysis), Risk Identification, and Risk Analysis used the help of the computer program @risk. Figure 1 is an analytical framework that showed the input data, methods and analytical, tools, and output in this Analysis.

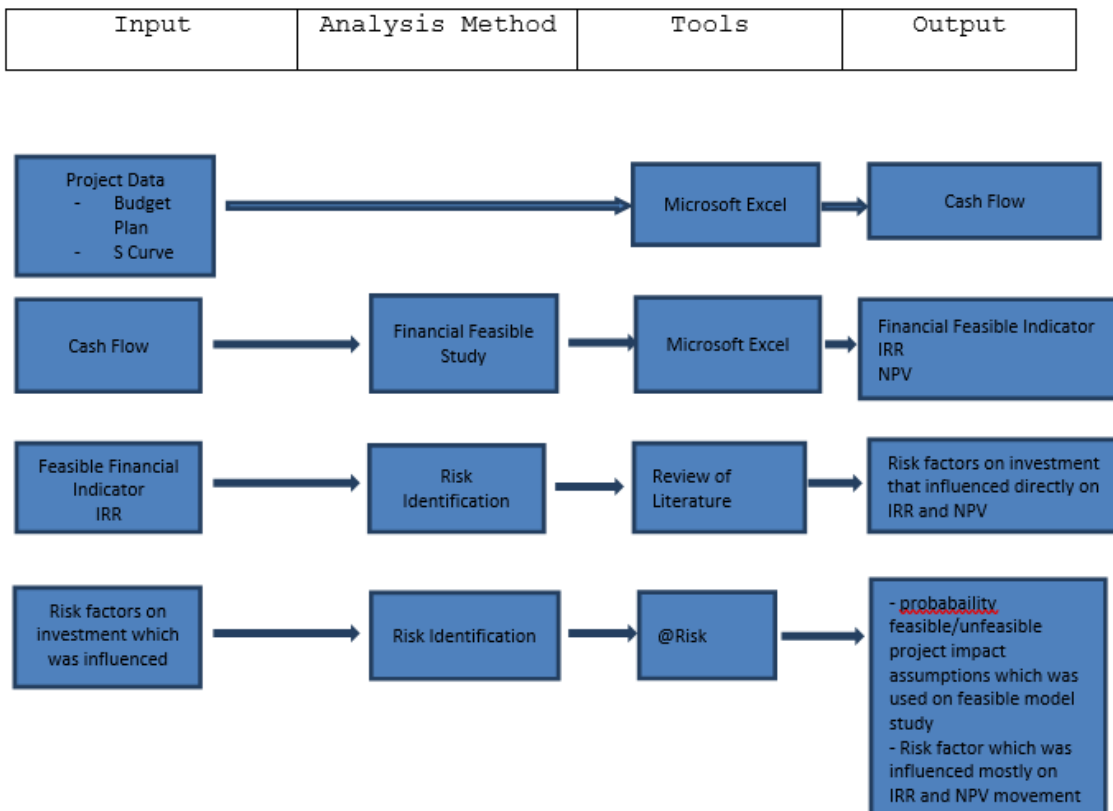


Figure 1. Analysis Framework

IV. ANALYSIS AND RESULTS

The project was an apartment that was planned to stand out on a land of 7.000 m² located in Jakarta. The total saleable area (semi gross) of this project was around 111.000 m² consist of 1 basement floor, 1 semi-basement floor, and 45 floors. The total rooms built were 480 units with 4 years duration.

Financial Feasible Analysis

The aim of this analysis was to build a projected feasibility model for the project based on project data and assumptions built. The method used in this analysis was Discounted Cash Flow method. In this method, the net cash flow multiple by the discount factor every year used a discount rate in order to obtain the NPV from the project. The additional data was to support financial feasible analysis calculation, including land values, construction costs, operational costs,

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projects funding, selling, discounted level, income tax. After these data were processed in cash flow, it was obtained the cash outflow curve and cash inflow.

From Figure 2 it could be seen that the cash outflow in the first 43 months were so great because in the first 46 months construction period and for the remaining cash outflow were bank debt interest payments. For the inflow in the first 39 months was so small, this happens because at this time it was still at the down payment of apartment unit. After the down payment was completed, it would be obtained the payment of the remaining apartment units from the bank which made cash inflow sharply rising in the 39th month and so on.

Based on the financial feasibility analysis, the project could be concluded to be feasible to build because the NPV and IRR were above the existing conditions, as shown in Table 1.

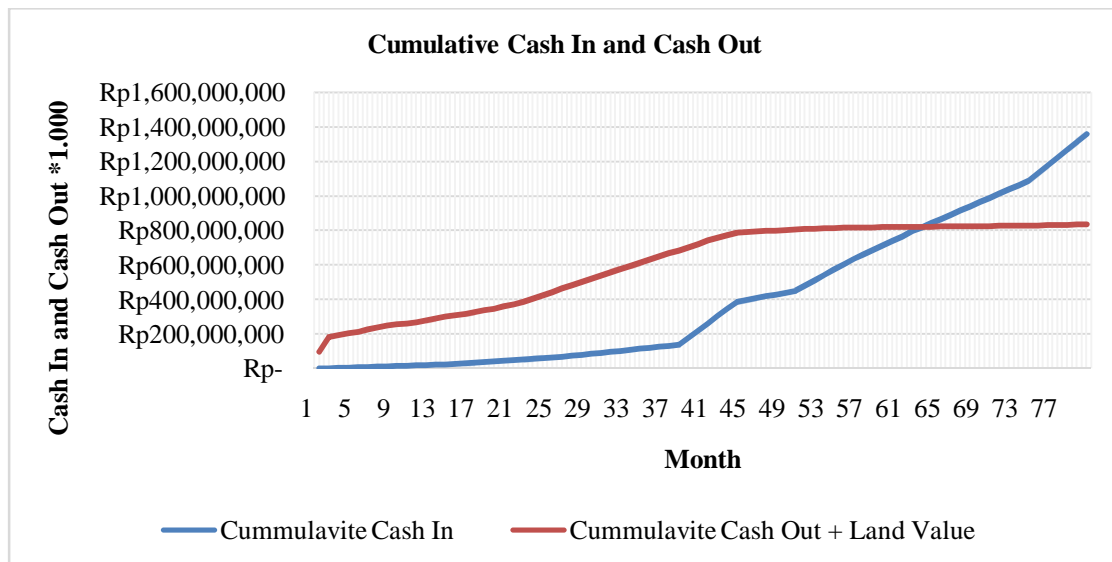


Figure 2. Cumulative Cash In and Cash Out Diagram

Table 1. Conclusion on Financial Feasibility

Feasible Indicators	Analysis Result	Terms	Conclusion
NPV	RP 108,476,585,000	>0	Feasible
IRR	17,34%	MARR 12%	Feasible
ROE	31,1%	>0	Feasible
Payback Period	5 years		Feasible because of the 4-year construction period

Sensitivity Analysis

Variables carried out by sensitivity analysis is, a decrease in selling prices, a rise in construction prices, a rise in debt interest rates, the use of debt and capital ratio. All were explained to each of the financial value parameters such as the IRR, ROE, NPV, and payback period values. By describing all available data into each variable to the value of the parameters, then the level of sensitivity of each variable toward parameters value would be reviewed.

In Figure 3 and Figure 4, could be seen the result of the sensitivity analysis showed most sensitive influence to financial parameter was selling prices, construction prices, capital and debt ratios, debt interest rate, and sales time.

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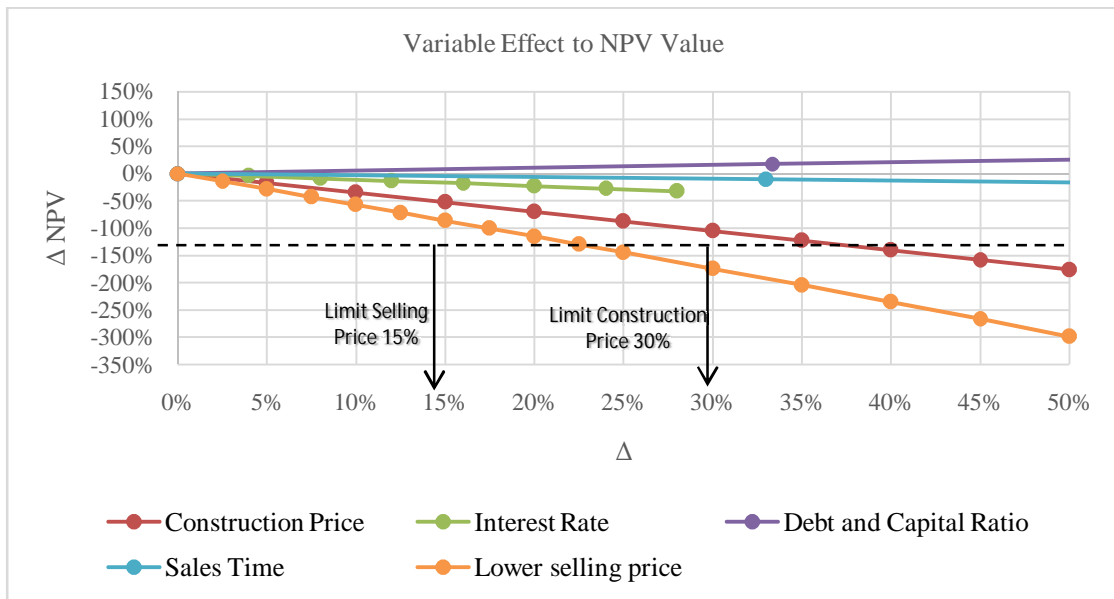


Figure 3. Variable Effect to NPV Value

The result of the sensitivity analysis also showed the pessimistic condition that the minimum selling price was possible to only decrease 15 % more than this value, so the project was unfit to be carried out. Considering that this condition was far below the initial target, the price reduction should not be carried out.

The simulation the rise of construction price show the increase in construction price had high level of influence on the achievement of the profit from developers, therefore developers needed to pay attention to several factors that might lead to a rise in construction prices such as variation orders that occur in many other projects. The simulation was found that a price increase of 30% from the estimated price caused the investment to be improper.

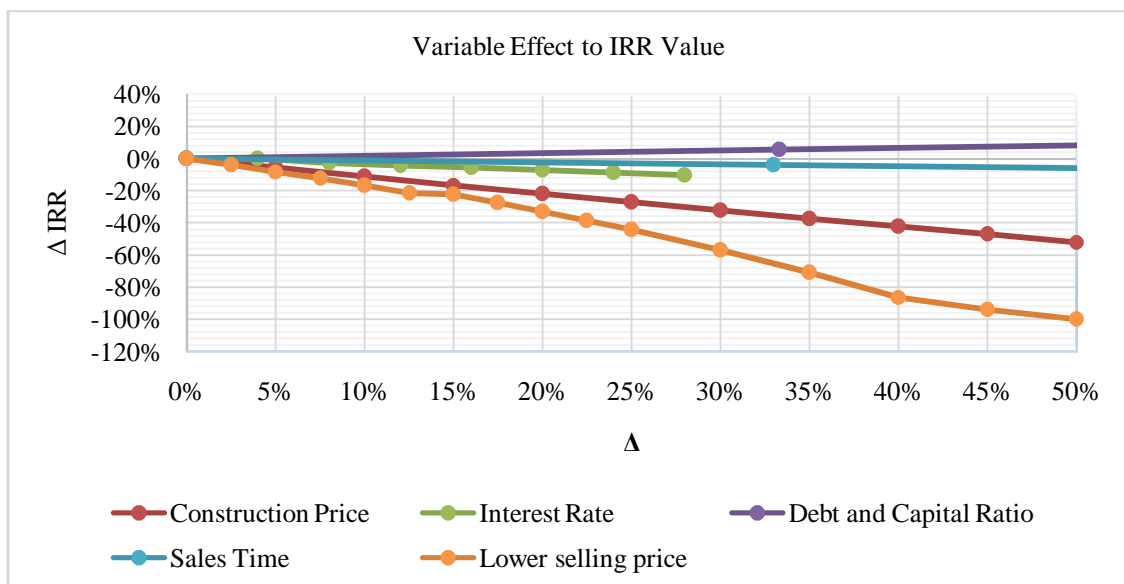


Figure 4. Variable Effect to IRR Value

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Capital and debt ratio simulations showed that the number of percentage value of capital used as an investment would increase the feasibility of this investment. The simulation of the rise in debt interest rates showed that the investment still could be said feasible. For selling delay simulation showed this variable effect could not give big change towards parameters value IRR, ROE, NPV, and payback period.

Risk Identification

According to Duffiel and Trigunarsyah[7] the sources of risk in a construction project could include aspects: financial, construction, planning, logistics, security, operational, physical, environmental, legislation, permits, and politics. Table 2 showed some aspects that affect financial feasibility and impact on the project.

Table 2. Risk Identification of Project

Aspects	Source of change and uncertainty	On Project
Financial	Financial availability and adequate insurance, sufficient cash flow, loss due to contractor, supplier, fluctuations in exchange rates and inflation, taxation, interest rates, and loan.	A good level of sales and certainty of value construction were the main things for the availability of funds. Changes in construction cost and selling price had a direct impact on the feasibility study in this study, seen in previous analysis. Based on the data of the project management team and the list of consultant obtained from the developer, the project had been handled by competent resources, so these risks were not considered in this study. Force majeure was not included in this study. Broadly speaking, the project was located around the construction of apartments, supported by accessibility infrastructure, and government policies. There were many buildings with similar functions around project. It showed the condition that could provide a parallel impact from outside that had been fulfilled.
Construction	Feasible of construction method, safety, industrial relations, rate of change from initial design, weather, quality, management availability and supervision, and hidden condition	
Planning	New technology, new application, test durability, and security, details, and specification suitability, design risk arising from measurement and investigations, possible changes to approved design, design interactions with construction methods.	
Logistics	Loss or damage to material and equipment in travel, availability of special resources, separation of organization	
Security	Intellectual property security	
Operational	Operational fluctuation in market demand for products and services produced, maintenance needs, reliability, implementation safety, availability factory, managements.	
Physical	Loss or damage due to fires, earthquakes, floods, accidents and landslides.	
Environmental	Ecological damage, pollution, and waste management, investigation of community conditions.	
Legislation	Changes are caused by legislation or the government	
Permit	Rights on land and use	
Politics	Politic risk in the country of the project owner, supplier, and contractor, war, revolution and legal changes, uncertainty from government policies.	

It was concluded that construction costs and selling prices were the biggest investment risk factors in this project, so that in the following analyse the impact of these risk factors on feasibility projections would be estimated.

Risk Analysis

Based on the analysis that had been obtained in the financial feasibility study analysis, it could be said that apartment projects had a financial risk. Of the five aspects contained in the financial aspect, two variables would be taken for this

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risk analysis, namely the selling price and the cost of the construction project. The other 3 variables in the previous analysis were assumed to be excluded from this calculation because the ratio of capital and debt had little effect and the developer would not add capital that had been agreed upon at the beginning of the agreement, for the time of selling because the project was assured on time so the change in selling time was not included in identifying this risk, as well as the interest rates on loans which had little effect on the previous analysis and the open rates in Indonesia did not move very much on extreme numbers, the debt interest rates were not included in the identification of these risks. The simulation method was used in this analysis to quantify the magnitude of the risk to project feasibility. The selling price and construction costs were then tested on the simulation model using the @RISK software. Both of these factors were determined first by the probability distribution with the following details:

- a. Construction costs were assumed to have a triangular distribution. This assumption was based on estimates that project costs always increase initial estimates; there was rarely a project cost that decreases from the initial estimate. Triangular probability distributions were often used in project management, by assuming that there were generally three estimated project costs which were optimistic, most likely, pessimistic. In this study the estimated construction costs were assumed to have no optimistic value which indicates the estimated cost was lower than the initial estimate because construction costs tend to increase rather than decrease as previously explained. The estimated pessimist used was + 20% from the initial estimate could be seen in Figure 5.

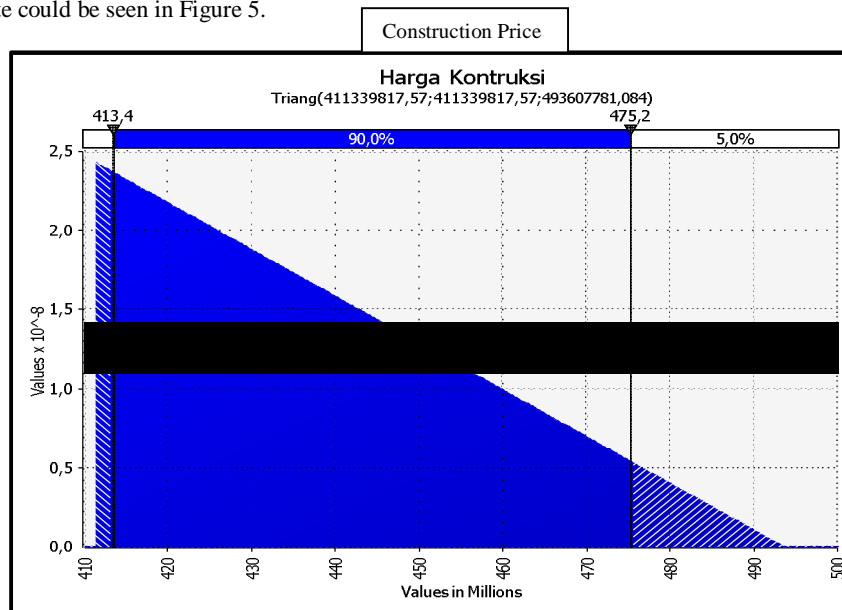


Figure 5. Probability Triangular Distribution on Construction Cost

- b. From the apartment data in Central Jakarta and North Jakarta had similar function with apartment project and located in project area, around 56 buildings which had similar function with apartment project only had 29 buildings apartment which had similar classification, middle class with selling value around 14 – 25 million/m², therefore calculation with sample number around n: 29 apartment buildings only had 29 buildings apartment which had similar classification, middle class with selling value around 14 – 25 million/m², therefore calculation with sample number around n: 29 apartment buildings already represented the existing population. Selling price had a standard deviation around Rp 3.057.684. Selling price used as in input on simulation was Rp 23.285.371/ m². On Figure 6 showed that probability of assumption distribution for selling price was a normal distribution.

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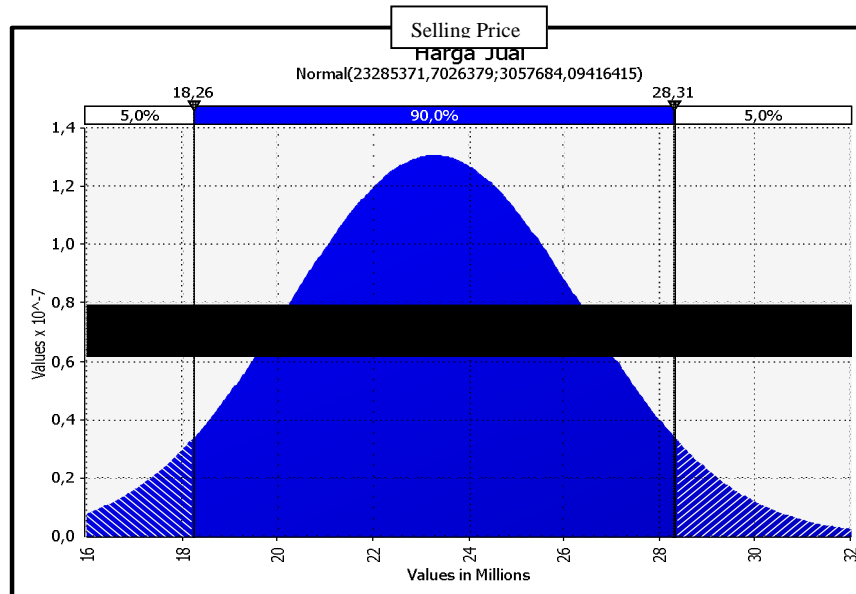


Figure 6. Selling Price of Probability Distribution

After 50.000 iterations random of rise/decrease in income and construction cost on Discounted Cash Flow Model, the result obtained as follows:

- a. It could be seen in Figure 7, the average IRR resulted around 15.723%, decrease from 17.34% which generated on financial feasible analysis study. According to 50.000 simulations, it was known that feasible probability with MARR 12% was 83.9% so that project still could be said feasible to run.

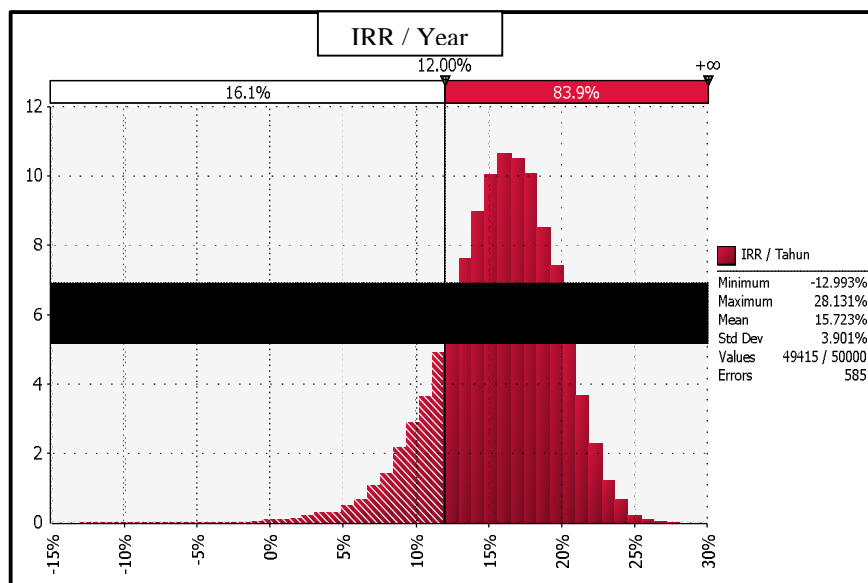


Figure 7. Histogram of IRR MARR 12%

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- b. Then, the value of IRR was obtained from this financial feasibility study was used in this analysis could be known from its level probability. On figure 8 it could be seen for IRR value of 17.34% probability level of 36.9%.

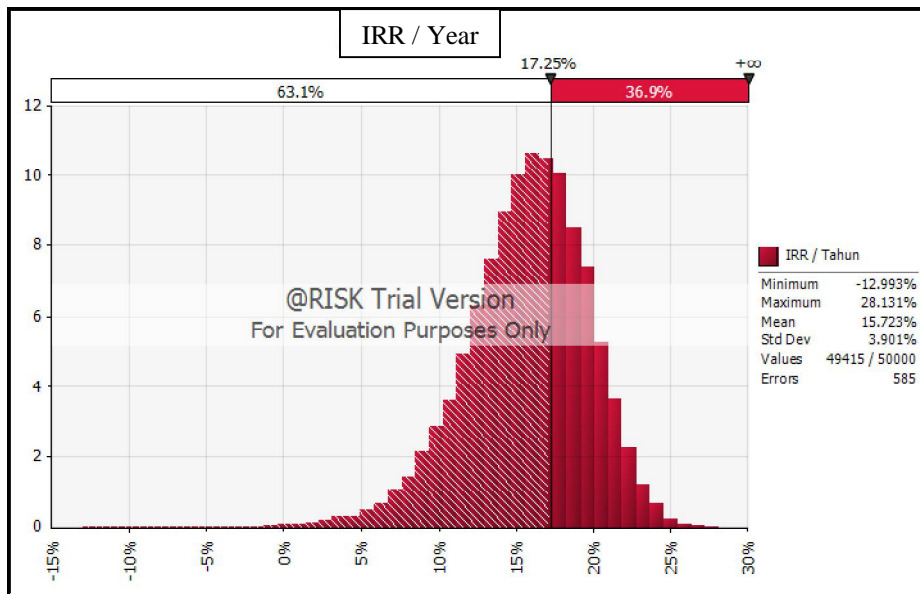


Figure 8. Histogram IRR Mean 17.34%

- c. On figure 9, it could be seen that the average NPV generated was Rp 82.847.993, or lower around 23.64% from calculation result on financial feasibility analysis study. Even though, that number could still bigger from 0 and project could be said feasible.

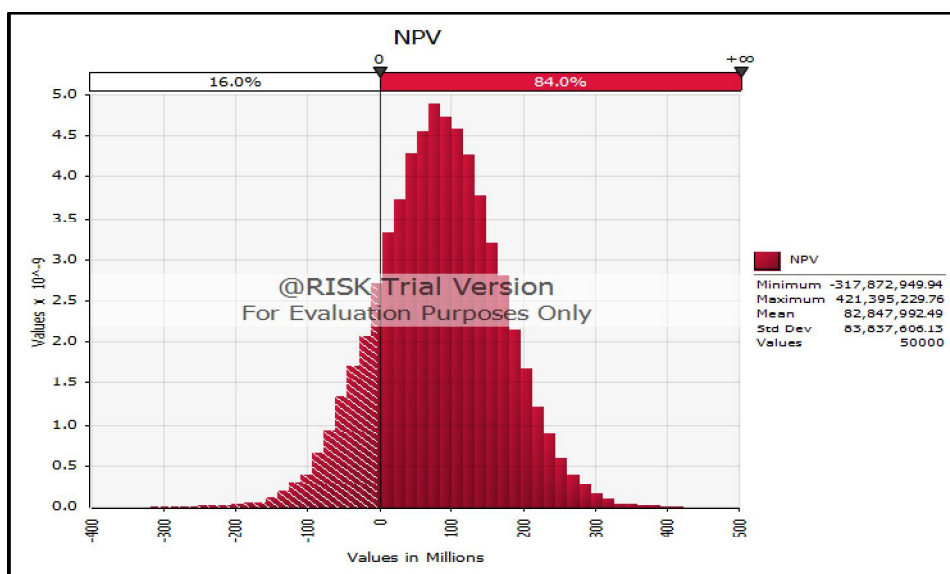


Figure 9. Histogram of NPV

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V. CONCLUSION

From the analysis that had been done on apartment project, the conclusion could be drawn as follows:

- a) Financial feasible analysis showed that apartment was feasible to run. With MARR value 12% so that NPV value could be reached of Rp 108.476.585.000, meanwhile for IRR value reached of 17.34%, and for ROE value of 31.1%
- b) Based on sensitivity analysis which had been done on project, so that the sensitive variable order of financial parameter was:
 - a. selling price
 - b. construction price
 - c. debt and capital ratio
 - d. debt interest rate
 - e. selling time
- c) Sensitivity analysis result showed if selling price low around 15% from initial price or construction price rise into 30% from initial estimation so that initial project unfeasible to be run.
- d) Risk analysis result from 50.000 used Monte Carlo simulation by using @risk Software showed MARR value of 12% project had probability of 83.9% feasible to be run, and reached IRR value was 15,723%, meanwhile for average NPV produced was Rp 82.847.993.000.
- e) Risk analysis result showed probability level with IRR value bigger /similar to 17.34% which was obtained from financial feasibility calculation was 36,9%.

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