Managerial flexibility role on financial investment analysis: a case study of public housing

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Managerial flexibility role on financial investment analysis: a case study of public housing

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Abstract. The limitations of Discounted Cash Flow (DCF) method for capturing the opportunity value phenomenon in the uncertainty of housing investment analysis cause difficulties in the decision-making process for the investors. Flexibility factor becomes the obstacle for investors in project uncertainty. Real Options Analysis (ROA) is an important factor included in the DCF method because it offers managerial flexibility in the uncertainty of housing investment decision making. Flexibility in ROA is a right and investors do not have an obligation to respond to uncertainty in project investment. In this research, the type of flexibility on ROA used is an option to carry out promotional activities. The research results indicate that promotional activities affect the increase in Net Present Value (NPV) so that the benefits are maximized. Comparison of the results of investment analysis between ROA and DCF methods indicates an added value due to the existence of such flexibility. The investment simulation of ROA method was conducted using Monte Carlo method approach. The role of flexibility from the simulation is obtained by increasing the added value by 5.2%, and optimal promotion occurs in the first two years of investment.

1. Introduction

Indonesia is the 4th largest population in the world, with a total population of 261 million in 2016. According to data released by National Planning Body (*Bappenas*), in 2015 there was a gap between the number of houses built and the number of houses needed by Indonesian people (backlog) by 11.8 million units [1]. The government has One Million Houses Program agenda to provide 1 million houses each year and provide subsidies for 1.75 million new housing units. Therefore, investment and development of low-cost housing in Indonesia in the future will be greatly needed, both by the central government, regional governments, and even the poor.

Warsito [2] found that low-income people still had difficulty buying affordable houses. The realization of low-cost housing policies is still not fully enjoyed by these low-income people. The issue of low property prices in Indonesia still faces the highest loan interest rates. The realization of low-cost housing construction in Indonesia in the 2010-2016 period only reached 26.31 per cent [1]. These conditions affect the lack of interest in home property developers to build affordable housings for the poor. Other causes are the minimum limits on the type of house and plot area, expensive licensing fees and document management and the availability of land for the location of the affordable

house. The calculation of property investment still uses the DCF method, which tends to be inflexible, looking at conditions that affect investment. In this research, DCF as the most often used method for investment modelling was used to model affordable housing investment and then it will be compared with ROA that can overcome the lack in DCF. The purpose of this research is to calculate the added value due to managerial flexibility in evaluating a low-cost housing investment and analyze the role of managerial flexibility in maximizing profits and minimizing potential losses due to uncertainties that arise when the project is in progress.

2. Literature review

Real estate development projects in developing countries have several unique characteristics consist of large working capital needs, low liquidity, slow return on capital, investments that cannot be returned in a short time, long construction time, challenges and obstacles from local government regulations, as well as various uncertainties, causing real estate investment faces high risk [3, 4]. In addition, some uncertainties in real estate development are related to the demand, house selling price, land acquisition cost, unsold inventory, government regulation, and the risk of local government (i.e. approval, building permits), and all can increase the investor risk [4]. Thus, choosing the right investment valuation method is very crucial.

There are three methods that can be used to assess the feasibility of a real estate investment, namely traditional method, Discounted Cash Flow (DCF) method, and Real Options Analysis (ROA). Traditional methods include Accounting Rate of Return (ARR), and Payback Period (PP), while DCF method consists of Net Present Value (NPV), Internal Rate of Return (IRR), and Profitability Index (PI) [5-8]. All of the mentioned methods besides the Real Option Analysis have the same disadvantages, which is the absence of management flexibility factor in making decisions due to the uncertainty that occurs in the future.

The method that is most often used by analysts or investors to make investment decisions is the DCF method [3, 9-14]. Regrettably, the DCF method is not good because, on investment projects with high uncertainty, the DCF method will produce incorrect value calculation [12]. This method is also able to capture the opportunity value due to uncertainties that occur in the future [3]. Also, the DCF method is lack of flexibility in the decision making, where flexibility has added value due to project uncertainty [15].

In most simple real estate projects with a lower-middle-class market share in Indonesia, the method commonly used to assess the feasibility of a project is the traditional method of ARR and PP. While DCF and ROA methods have never been used since the management knowledge of this method is limited. As a result, there is no management flexibility in the project, and if there is uncertainty when the project is in progress, management will find it difficult to make a decision on the project.

Flexibility in real estate development can make added value for real estate developers react to market trends when new information emerges, and uncertainty in fundamental factors (such as property prices) is obtained. This added value does not exist in the DCF method because it ignores management flexibility [16]. According to Mintah et al. [17], residential property developers must consider flexibility in evaluating financial feasibility as there are hidden values due to uncertainty in property projects. It is important to calculate the optionality value in financial evaluation of a property project to obtain the maximum value.

According to research conducted by Lucius [18], ROA offers managerial flexibility and capability in terms of assessing uncertainty in various investment projects. While the research conducted by Mintah et al. [17] shows that ROA can model uncertainty with higher accuracy compared to the DCF method. ROA applied by Mintah et al. [17] can capture around 2.7% of the project value lost from DCF. ROA can also offer the opportunity to leave the project if it is considered unprofitable so that losses can be minimized. Therefore, ROA is practically suitable for various cases in real estate development projects [16, 17].

3. Research method

The approach used in this research was a quantitative approach, and the data used were numerical data to explain the phenomenon of what happened. The quantitative section included making DCF models, Monte Carlo simulations, and real options models. This model was applied to evaluate the feasibility of a housing project. Data that had been obtained, then were entered into the model. The results obtained then were analysed and discussed for conclusions and suggestions. The research type used is by examining a specific case study. The case study that became the object of this research was affordable housing investment in Pemalang Regency, Central Java.

The data used in this research was secondary data about the cost of land acquisition, the number of housing units built, the ability of developers to sell houses in 1 year, the selling price of the house, operational costs, construction costs of 1 house and supporting facilities. Other costs which may arise due to unexpected events, consideration of the developer to divide the stages of housing construction into blocks/phases, marketing strategies, as well as obstacles and challenges in housing development. Primary data in this research were obtained by direct observation of conditions in the field and interviews with parties directly involved with a case study. The interviewee was one of the owners of affordable housing projects in Pemalang Regency, Central Java, Indonesia. The interviewee has ten years' experience in the field of construction, especially in the housing sector. The population in this research was all real estate or housing in Indonesia, while the sample used in this research was one of the low-cost housing projects in Pemalang Regency, Central Java. The full interview transcript from the developer of this case study was coded to justify the Monte Carlo simulation.

Based on the research objectives that have been stated, at first, the value of net cash flow each year and NPV for each house sales scenario (optimistic, realistic, and pessimistic) would be calculated using DCF method. There were 33 house sale scenarios which was a combination of optimistic, realistic and pessimistic scenarios. After that, the Monte Carlo simulation was conducted to calculate the volatility of NPV due to uncertainty. By using ROA, we could calculate the probability of the optimistic, realistic and pessimistic scenarios based on the volatility. Then, the scenario diagram model was created, which contained the cash flow each year along with its probability. By using a weighted average, the NPV value could be calculated based on the scenario.

Furthermore, by incorporating the element of flexibility for promotion, it was expected that sales would increase. With the increase in sales, the potential NPV obtained would also increase due to the increase in the probability of sales, so the weight of scenario changes based on table 3. The increase in NPV is called the option value, which is the final result of research, the added value arising from the role of managerial flexibility. It also has a role as the added value that can be used to maximise profits.

4. Results and discussion

At first, affordable housing projects are evaluated using the Discounted Cash Flow (DCF) method to find out the NPV of the project in various conditions with the pessimistic, realistic, and optimistic scenarios. Table 1 shows three scenarios used in DCF modeling, namely pessimistic, realistic (most likely), and optimistic scenarios. With the pessimistic scenario, the NPV of Rp. 5,442,201,615 is obtained, and it assumes to take six years to sell the entire houses. With a realistic scenario, the NPV of Rp. 7,860,963,805 with an expectation of 4 years to sell the entire house. While in the optimistic scenario, it takes only two years to sell the entire house and the NPV obtained can reach Rp. 10,535,867,714.

Monte Carlo simulation (MCS) then was carried out by entering an element of uncertainty into the DCF model. The uncertainty in this research used a triangular distribution with a range, as shown in table 1. Then, the MCS was conducted as many as 5000 iterations to calculate the standard NPV deviation value. From the 5,000 MCS samples, the NPV average is Rp. 9,474,747,958 with a standard deviation of Rp. 1,049,943,305. From the results of MCS, the maximum and minimum NPV values were also obtained, and it is in the range of Rp. 7,552,239,910 and Rp. 10,934,398,219.

Table 1. The assumptions used and NPV in DCF calculations are pessimistic, realistic, and optimistic scenarios.

Scenario	Pessimistic	Realistic	Optimist
Number of houses sold per year	83 units (16,66%)	125 units (25%)	250 units (50%)
Growth in selling price per year	6%	8%	10%
Number of houses built per year	100 units (20%)	175 units (35%)	300 units (60%)
Growth in construction cost per year	14%	10%	8%
Growth in operational cost per year	9%	7%	5%
NPV	Rp. 5.442.201.615	Rp. 7.860.963.805	Rp. 10.535.867.714

Furthermore, the volatility of NPV is obtained by dividing the standard deviation of the NPV with the average NPV, so the volatility of 11.08% is obtained. This volatility value is a variable that will be used in calculating the probability of a scenario in Real Options Analysis (ROA). Probability in the outline is divided into the up, middle, and down probabilities. The greater the volatility, the down probability will be greater and vice versa. After performing a Monte Carlo simulation (MCS), the next step is to conduct Real Options Analysis (ROA). In this research, the model used for ROA is a combination of binomial lattice and trinomial lattice. Data obtained from the results of DCF and MCS are used as inputs for calculating the up, middle, and down probabilities for the trinomial lattice, as well as the up and down probabilities for binomial lattice. The results of probability calculation can be seen in table 2.

Table 2. Probability calculation results for binomial lattice and trinomial lattice.

Probability Calculation Data Input	
Time step (dt) =	1 year
Average NPV (μ) =	9,474,747,958
Standard deviation of NPV (SD) =	1,049,943,305
Volatility (σ) =	11.08%
Risk free investment return (rf) =	5.00%
Binomial Lattice Risk-Neutral Probabilities	
Up factor (u) =	1.1172
Down factor (d) =	0.8951
Up probabilities (pu) =	70.32%
Down probabilities (pd) =	29.68%
Trinomial Lattice Risk-Neutral Probabilities	
Up factor (u) =	1.1696
Middle factor (m) =	1.0000
Down factor (d) =	0.8550
Up probabilities (pu) =	41.19%
Middle probabilities (pm) =	45.98%
Down probabilities (pd) =	12.83%

Note: all currency value in IDR (Indonesian Rupiah)

Next, a scenario of several possibly obtained net cash flow is made. Overall, there are 33 scenarios/ probabilities of house sales every year from the 0th year to the end of the 6th year until all houses are sold out. The used probability uses a probability value in Table 2. This scenario can be seen in Figure 2. For example, in Figure 1, the expected cash flow in the first scenario is Rp. 7,916,964,286 with a probability of 41.19% in the 1st year and Rp. 12,971,821,429 with a probability of 41.19% in the second year. In the 25th scenario, the expected net cash flows are as follows: year 1 Rp 2.026.303.571, year 2 Rp 1,838,528,380, year 3 Rp 1,704,729,694, year 4 Rp 1,513,351,325, 5th year Rp. 5,729,936,127, 6th year Rp. 3,679,740.161. The probabilities of obtaining these cash flows in a row

are 12.83%; 12.83%; 45.98%; 29.68%; 29.68%; and 100%. Based on the cash flow calculation according to the combined weight between optimistic, realistic and pessimistic, according to the scenario shown in figure 2 produce the NPV value of Rp. 8,761,910,056.

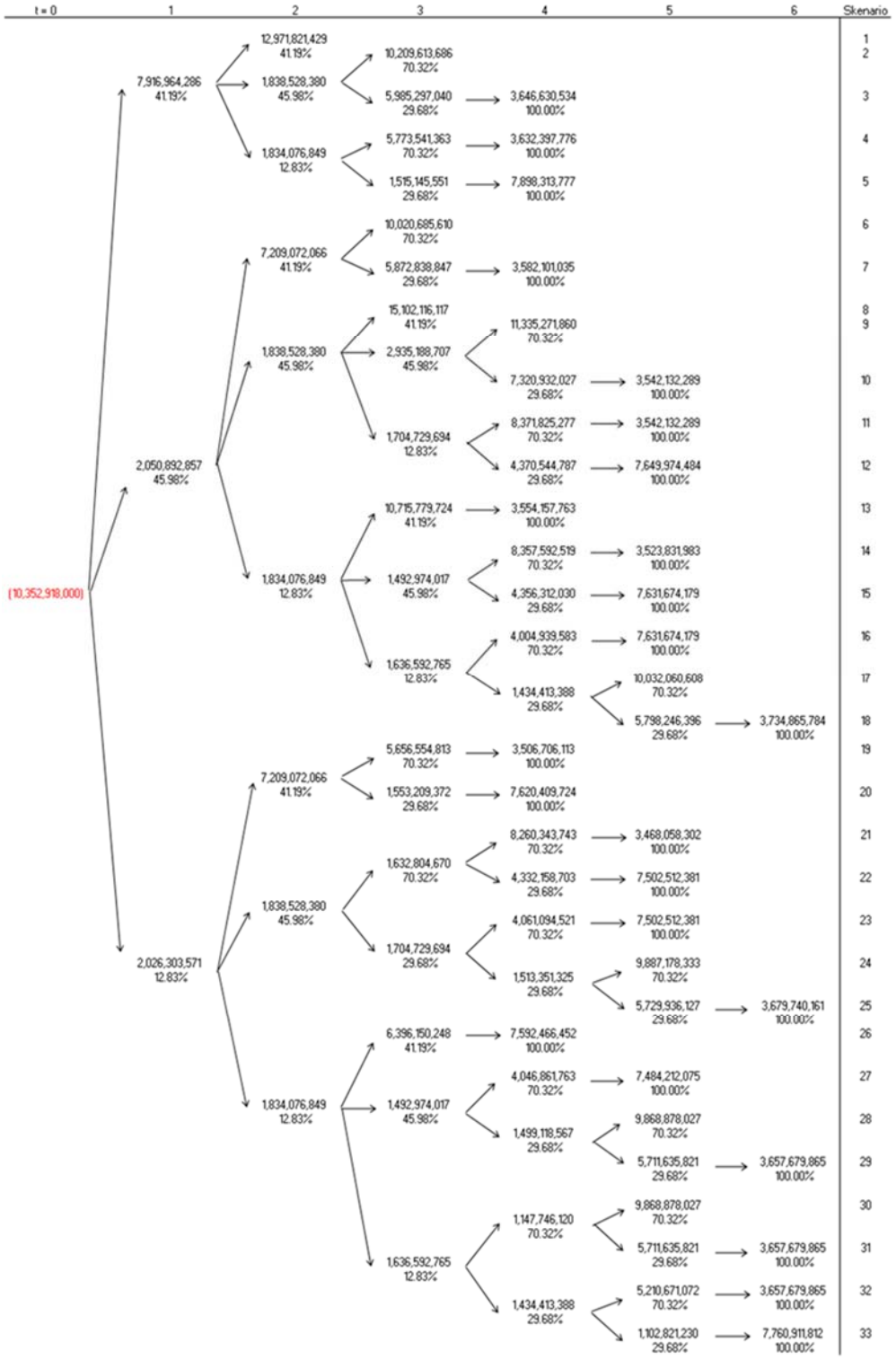

Figure 1. Discounted Cash Flow scenario based on a combination of optimistic, realistic, and pessimistic scenarios.

Table 3. Changes in the probability of the number of houses sold due to promotional activities.

Binomial Lattice Risk-Neutral Probabilities		
	Old	New
Up probabilities (pu) =	70.32%	100% – 14.84% = 85.16%
Down probabilities (pd) =	29.68%	0.5 × 29.68% = 14.84%
Trinomial Lattice Risk-Neutral Probabilities		
	Old	New
Up probabilities (pu) =	41.19%	100% – 45.98% – 12.83% = 62.78%
Middle probabilities (pm) =	45.98%	0.67 × 45.98% = 30.81%
Down probabilities (pd) =	12.83%	0.5 × 12.83% = 6.41%

Table 4. The added-value of 1 time promotional activities to NPV at different periods.

Are there any promotional activities? (Year)						NPV	Δ NPV 1	Promotion Cost	Δ NPV 2
1	2	3	4	5	6				
No	No	No	No	No	No	8.761.910.056	-	-	-
Yes	No	No	No	No	No	9.161.965.315	400.055.259	100.000.000	300.055.259
No	Yes	No	No	No	No	9.006.577.715	244.667.659	100.000.000	144.667.659
No	No	Yes	No	No	No	8.862.887.355	100.977.299	100.000.000	977.299
No	No	No	Yes	No	No	8.768.885.057	6.975.001	100.000.000	(93.024.999)
No	No	No	No	Yes	No	8.762.721.480	811.424	100.000.000	(99.188.576)
No	No	No	No	No	Yes	8.761.910.056	0	100.000.000	(100.000.000)

Table 5. The added-value of 1 to 6 times promotional activities.

Are there any promotional activities? (Year)						NPV	Δ NPV 1	Promotion Cost	Δ NPV 2
1	2	3	4	5	6				
No	No	No	No	No	No	8.761.910.056	-	-	-
Yes	No	No	No	No	No	9.161.965.315	400.055.259	100.000.000	300.055.259
Yes	Yes	No	No	No	No	9.417.635.320	655.725.263	200.000.000	455.725.263
Yes	Yes	Yes	No	No	No	9.478.871.253	716.961.197	300.000.000	416.961.197
Yes	Yes	Yes	Yes	No	No	9.480.734.941	718.824.885	400.000.000	318.824.885
Yes	Yes	Yes	Yes	Yes	No	9.480.810.334	718.900.277	500.000.000	218.900.277
Yes	Yes	Yes	Yes	Yes	Yes	9.480.810.334	718.900.277	600.000.000	118.900.277

To increase house sales, developers can hold a housing exhibition, open house, increase the number of salespeople, increase sales targets, provide more incentives to the salesperson every year, give a bonus of 1 AC unit for each purchase of 1 house unit, and give 1 motorbike unit for the lucky ones (hereinafter referred to as promotional activities). The costs required to carry out all of these activities are estimated at Rp. 100,000,000 every year. This promotional activity is an optional action. That is, the developer is not required to do so. Developers can choose to sell houses organically or conventionally (not giving bonus and lottery, not adding salespeople, not increasing sales targets and salesperson incentives, and not holding housing exhibitions and open houses). However, if needed, developers can increase sales by these methods. This flexibility is modeled in ROA.

From the results of interviews with the developers, the promotional activities above can increase the probability of house sales, which means that the expected NPV value or profit potential will also increase. This increase in probability is shown in table 3, where the down and middle probabilities are reduced by 50% and 33%. If the developers carry out this promotional activity in the first year and second year of the project, then the weight of the Discounted Cash Flow scenario that is originally similar to table 2 changes to table 3. From calculations with new probability weight (table 3) with the costs of promotional activities (i.e. housing exhibitions, open house) of Rp. 100,000,000 per year, then the NPV obtained is Rp. 9,217,635,320.

With various possible periods to carry out one promotional activity, we will try to find out the best NPV value due to one promotional activity in a different period. At first, it is assumed that the costs of promotional activities are Rp. 0, then how many additions to the NPV is calculated, then deducted by the promotion cost, it will obtain how much the increase or decrease in the NPV value. The results of this calculation are summarised in table 4. From table 4, it can be seen that promotional activities provide significant benefits in the first year, and each year the benefits keep decreasing to NPV. If promotional activities are carried out in the first year at a cost of Rp. 100,000,000, it will provide an NPV added value of Rp. 400,055,259, so the potential for additional profits obtained is Rp. 300,055,259 (+ 3.42%). However, if promotional activities are carried out in the third year at a cost of Rp. 100,000,000, then the NPV added value is only Rp. 977,299 (+ 0.011%). Specifically, if promotional activities are carried out in the 4th, 5th and 6th years, the NPV value will decrease below the basic value of NPV.

Furthermore, the number of additional NPVs will be calculated if within 6 years of the project, each promotional activity is carried out once, twice, up to 6 times. The results of this calculation are summarized in table 5. Based on the results of the calculation of table 4 and table 5, it can be seen that the most effective promotional activities are carried out only in the 1st and 2nd year in sequence with an additional NPV value of Rp. 455,725,263 (+ 5.20%), followed by promotional activities in the 1st, 2nd and 3rd year in sequence with an additional NPV value of Rp. 416,961,197 (+ 4.76%). Table 5 shows results similar to table 4, in which the promotion activities in the 4th, 5th and 6th years are not effective in increasing the NPV value. By using ROA, the benefits of affordable housing can increase up to Rp. 455,725,263/Rp. 8,761,910,056 = 5.2%. This value is quite significant because it is larger than the findings of Mintah et al. (2018), where the use of ROA by Mintah et al. [14] can increase the project value by 2.7%. However, this value is still smaller than the results of research conducted by Dinica [19], where ROA can increase profits up to 10%.

In line with the opinion expressed by Mintah et. al. [13], the ROA analysis results give more potential project benefits due to the managerial flexibility to carry out promotional activities aimed at increasing house sales. ROA realistically models this flexibility and combines it into the calculation of investment feasibility and does not assume a static management approach.

The results of the research using a case study of low-cost housing in Pemalang Regency, limited to the type of uncertainty, in terms of housing demand, growth in house selling prices, number of houses built, construction costs, and operational costs, as well as flexibility used viz. promotional activities. The obtained results are also caused by the aspect of interviewee subjectivity in assessing various existing variables. Projects with different types of uncertainty and the same risk profile can produce different results using ROA. Likewise, with the type of option chosen, the option to postpone a project or to scale the project can produce new and different findings from this research. Even though the ROA strategy used in this case study is effective and provides better results than DCF analysis, each analyst still has to carry out similar steps starting from DCF because each housing project has the characteristics, certainty, and risk respectively.

5. Conclusions

The role of managerial flexibility in providing added value to the evaluation of affordable housing investment is to include the flexibility aspect when conducting promotional activities to increase house sales. With the increase in house sales, the NPV value or potential profits that can be obtained will be

even greater. This flexibility factor proves that affordable housing profits have increased by 5.2%. Promotional activities carried out in the 3rd to 6th years do not provide significant added value for NPV. The simulation results indicate a decrease in NPV value and profit potential.

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