

Private financing of toll road infrastructure development is mainly based on non-recourse scheme. The loan are most commonly secured by the project assets and paid entirely from project cash flow, rather than from the general assets or creditworthiness of the project sponsor. Estimation of cash flow has been mainly based on fixed assumption of input variables, and does not allow any variation or uncertainty in its values. This conventional method assumes that project cash flow is certain. In other word, only single value of forecast is produced. They do not provide information about the likelihood of the output value. Therefore, it is necessary to consider possible change in input variables, and apply risk analysis or probabilistic approach in the forecast of cash flow and discount rate.

This research, which apply probabilistic approach, use Monte Carlo Simulation to the spreadsheet model for calculation of project NPV, to allow uncertainty in input variables in the valuation of toll road investment viability. For the purpose of risk analysis, Crystal Ball, the software for Monte Carlo Simulation that is add-ins to the Microsoft Excel spreadsheet, is used. The process is straightforward, first define the input variables that have uncertainty, and select the most appropriate distribution function that could properly represent the distribution of input variables. Then, set up the forecasted output variable and determine the number of trial runs (iteration) for simulation. For the purpose of this research, the number of iteration is 10.000.

The result shows that Monte Carlo Simulation could provide better information than that of the conventional approach, since the output is available in the form of distribution curve and its related other curve that give information about the likelihood of the forecasted output of NPV. At the same time, the application of Monte Carlo Simulation and Crystal Ball for toll road investment risk analysis in the Middle link of Surabaya, allows us to have information about the sensitivity of input variables to the forecasted output. This information is important for the improvement of spreadsheet model. Furthermore, Monte Carlo Simulation is also an alternative solution to overcome the complexity of many related input variables that may involved in the modeling.

**Keyword:** input variables, uncertainty, risk analysis, Monte Carlo Simulation, NPV