



Assignment No 4:

NPV Estimation of R&D Project

1. Assignment Description

One of the major activities the firm may have is R&D in an effort to reduced the production costs. Six different projects (labeled project 1 to 6) enable a firm to reduce different aspects of the production costs. Each project has different amounts of investment needed in order to generate a patent that can be implemented in the production line.

It is important to note that the optimal amount of investment needed is not always the maximum allowed. Also note that the timing of investment affects their value.

The efficiency of the R&D process depends (among other things) the number of engineers the firm recruits.

The purpose of the assignment is to calculate the NPV (net present value) of an R&D project. The students needs to select one project, run a simulation over several quarters in which she/he needs to apply decisions related to the R&D process and based upon these results to build a project case that calculates the NPV of the project.

2. Background Theory

NPV (Net Present Value) is defined as the current value of discounted flow of income. A typical project starts with an investment and generates future incomes that should be discounted using an interest rate. The general formula for of such cash flow is described as follows:

$$NPV = -I + \sum_{t=1}^N \frac{S_t}{(1+r)^t}$$

Where I is the initial investment, r is the interest rate and S_t is the periodical income that the project yields. Note that periodical income may be positive or negative (in the case that investment is done over several quarters).

The IRR (Internal Rate of Return) is the interest rate the zeros out the cash flow). Sometimes this measurement is used also to evaluate a project. In this case if the IRR is greater than the interest rate the project is rejected and visa versa.



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3. Data Source

- Build a single firm with a selected technology.
- Run eight quarters of maximizing the firm's production of the product which is related to the selected project. Record the production costs in these quarters. Try to perform as efficiently as possible.
- Select a project (one out of 1 to 6).
- Decide about investment policy (amount of money to invest and in which quarters).
- For each hourly rate level, run a simulation.
- Rerun the same simulation and perform the same production decisions.
- Record the actual production costs this time. Note that due to the nature of the simulation there may be slight differences between the results.

4. Analysis Required

- a. Build a cash flow that represents the difference between the two situations.
- b. Calculate the NPV of this cash flow with the normal interest rate in The Green State which is charged by banks (note that this interest rate depends on the level of investment needed). Discuss the results.
- c. Calculate the IRR of the project and discuss the results.
- d. What is the cost of a delay of two quarters in the project?
- e. Assuming that for an investment of 80% of the maximum amount needed the project has an 80% chance to end on time with success. At which point is it cost effective to pay more in order to ensure that these chances are increased to 100%