

## Investment Decisions in Volatile Circumstances

### Beyond Net Present Value

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## The Traditional Approach to Investment Decisions

- **Capital budgeting is the planning process used to determine which long term investment projects are worth pursuing.**
- **Methods include techniques such as rate of return, net present value, profitability index, equivalent annuity, and others.**
- **These methods use the incremental cash flows from each potential investment.**
- **As a result, for each investment project a specific number is computed: the NPV, the IRR, the EAC, ...**

## Shortcomings of these Capital Budgeting Techniques

- Comparing projects by just one number for each project is overly simplistic.
- The development of each project over time is not transparent – no scenario along the time axis is produced. But quite different scenarios might have nearly identical NPVs.
- Sensitivity analysis is difficult thus the volatility of each computed number – NPV, IRR, EAC, ... – is rarely assessed. But minor changes in some data or some assumptions might lead to totally different computed numbers and thus to different investment decisions.
- Both, negative as well as positive externalities cannot be incorporated into these techniques. However, in long term investment decisions externalities need to be taken into account.

## Consequences of these Capital Budgeting Techniques

- Long term investment decisions do not take risks, externalities, and the time profiles of the various options into proper account.
- The volatile dependence on certain assumptions or on certain data is not known and thus not considered.

## System Dynamics as a More Appropriate Option

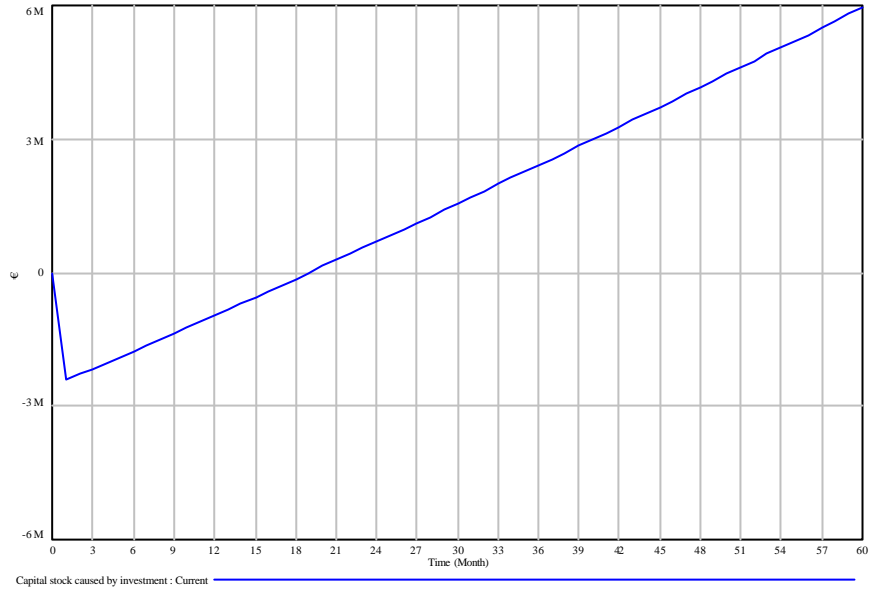
- **System Dynamics is an approach to understanding the behavior of complex systems over time.**
- **System Dynamics is based upon the identification of key system variables, the interactions between them and the study of the effects of these interactions over time.**
- **System Dynamics was created by Professor Jay Forrester of the Massachusetts Institute of Technology.**
- **Today, System Dynamics is being used throughout the public and private sector for policy analysis and design relying on software tools like Vensim and iThink.**
- **However, its usefulness in capital budgeting has not yet been fully exploited.**

## System Dynamics in Capital Budgeting – a Case Study

- **Analyzing a large investment project in distribution logistics.**
- **Traditional techniques failed because extensive sensitivity analysis was required to analyze potential risks.**
- **The System Dynamics model was developed within three person days using Vensim.**

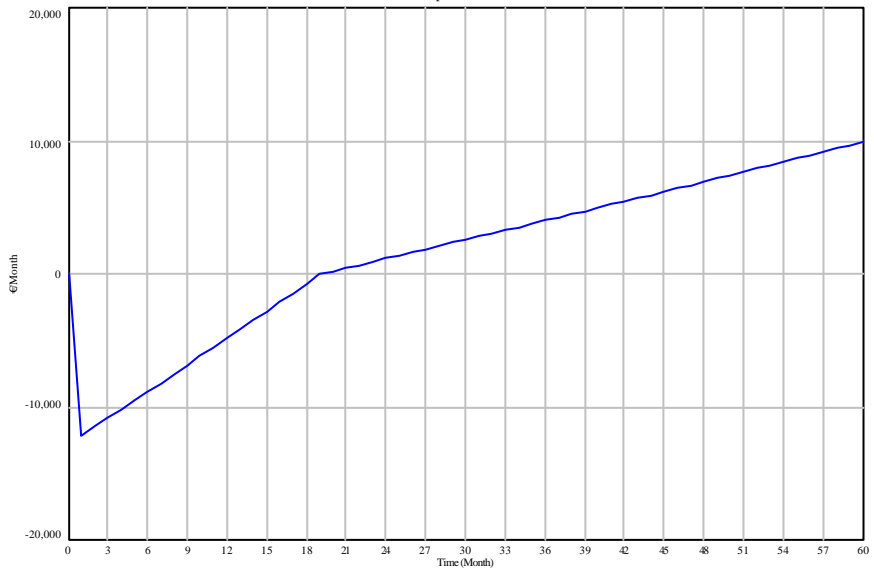


Capital stock caused by investment



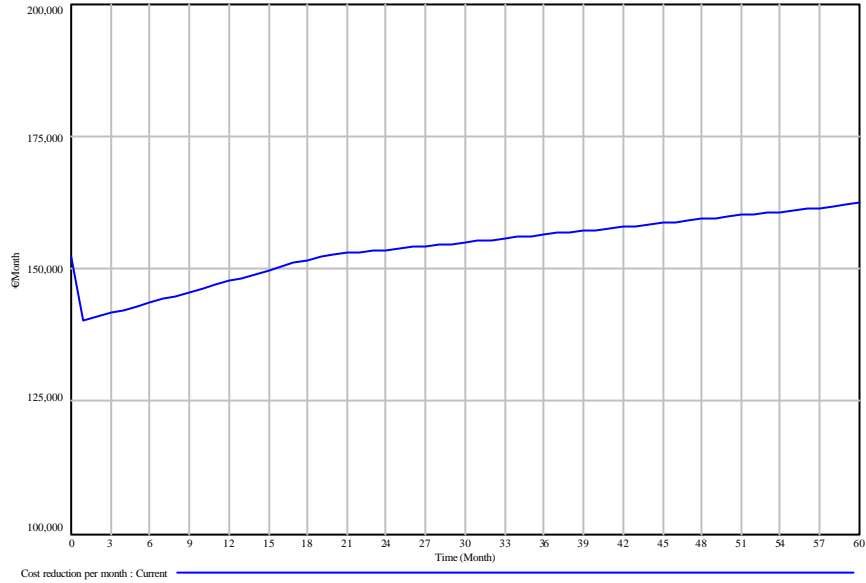
Capital stock caused by investment : Current

Interest per month

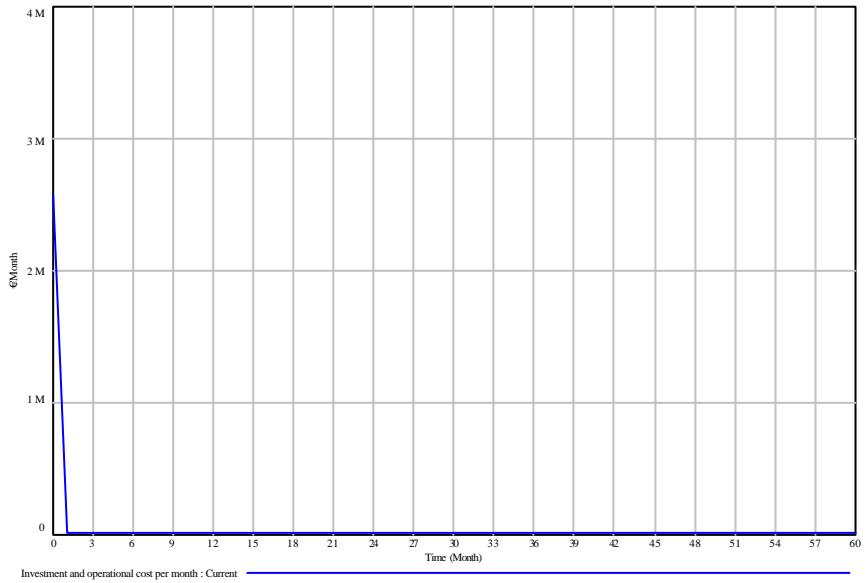


Interest per month : Current

Cost reduction per month



Investment and operational cost per month



## Results

- **Approximately 50 different scenarios were analyzed within one day together with all the decision makers.**
- **The effects of uncertainties – future interest rates, future labor cost, ... – could be easily assessed as part of the scenario analysis.**
- **Overall, the decision makers felt that they made a much better investment decision than by using NPV.**