This article on **Modelling & Simulation** is a **stub**. You can help the Foresight Wiki by expanding it with new sections on the usage of this method in foresight exercises.

Modelling & Simulation is a method, which aims at developing a level of understanding of the interrelations and interdependencies between the parts of a system, and of the system as a whole. A model is a simplified representation of a real system, which is produced to develop understanding on how the actual system works. Simulation is a usually computerized version of the model which is run over time to study the behavior of the system and its elements under different circumstances. Computer simulation has become an integral part of modelling many natural systems, which can be found in physics, chemistry and biology; and human and social systems as well as in engineering. Some of the common objectives of Modelling and Simulation evaluation of decision or alternative actions, development of alternative scenarios, forecasting, evaluation strategies for transformation or change, prototyping and concept evaluation, risk and safety assessment, support for acquisition and procurement decisions.

Contents

The FOR-LEARN Guide to Modelling & Simulation

This is a summary of the article on the Modelling & Simulation from the FOR-LEARN guide. To read the full article go here.

As defined in the FOR-LEARN guide, Simulation and Modelling is the process of creating and experimenting with a computerized mathematical model imitating the behavior of a real-world process or system over time. Simulation is used to describe and analyze the behavior of a system when asking "what-if" questions about the real system and aid in the design of real systems. The main objectives are:

- Gaining insight into the operation of a system;
- Developing operating or resource policies to improve system performance;
- Testing new concepts and/or systems before implementation;
- Obtaining information without disturbing the actual system.

Using the method

Modelling and Simulation is a versatile technique well suited for the study of some complex problems, to tackle previously untouched, often apparently unmanageable problems. Simulation is often the obvious tool to be tried.

Step-by-step

FOR-LEARN guide identifies four steps for Modelling & Simulation:

Step 1: Scope and set up of model. First the study is defined, objectives are inventoried and the model is set up, including general assumptions on relevant factors, either variables or constants and how they are related.

Step 2: Data collection. Simulation modelling stands or falls on the availability, applicability, and reliability of the data: garbage in, garbage out (GIGO) applies.

Step 3: Model testing. The relevant data is entered into to the model and calculated. Outcomes are compared to reality, such that the model is validated. Possibly, some factors are calibrated such that outcomes are more realistic.

Step 4: Analysis. Finally, the model can be used to change some factors, either 'what if'-scenarios or predicted changes for example based on extrapolation.

Pros and cons

The main benefits of Modelling and Simulation can be summarised as (Chung, 2004):

- Experimentation in limited time
- Reduced analytical requirements
- Easily demonstrated models

The main limitations are:

- Simulation cannot give accurate results when the input data are inaccurate
- Simulation cannot provide easy answers to complex answers
- Simulation cannot solve problems by itself

Other considerations

- Simulation model building can require special training
- Simulation modelling and analysis can be costly
- The results of simulation involve many statistics

Using Modelling and Simulation it should be also born in mind that the variables and data chosen for the model are still subjective, although the calculations suggest objectivity. In some instances it may be non-transparent and difficult to explain, what the model does and how it is calculated.

Variations

Variations of simulation modelling incorporate, among other things, continuous or discrete models, descriptive or normative analysis. There is a wide range of models, mathematical and/or statistical, such as input-output models and equilibrium models.

Sea also

Environmental Scanning & Monitoring
System Dynamics
Structural Analysis
Agent Modelling
SWOT Analysis
Trend Intra & Extrapolation
Gaming
Creativity Methods
Expert Panels
Delphi survey
Backcasting
S&T Roadmapping
Critical & Key Technology Study
Scenario Building
Morphological Analysis & Relevance Trees
Cross-Impact Analysis
Multi-Criteria Analysis