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Cross-impact analysis is a family of techniques designed to evaluate changes in the probability of the occurrence of a given set of events consequent on the actual occurrence of one of them.

Contents

The FOR-LEARN Guide to Cross-impact analysis

This is a summary of the article on the methods of Cross-impact analysis from the FOR-LEARN guide. To read the full article go here.

Overall Description

Cross-impact analysis is the general name given to a family of techniques designed to evaluate changes in the probability of the occurrence of a given set of events consequent on the actual occurrence of one of them. Theodore Gordon and Olaf Helmer developed the method in 1966. The idea started from a game called ?Future?. The method was introduced as a means of accounting for the interactions between a set of forecasts, when those interactions may not have been taken into consideration when individual forecasts were produced. Cross impact method can stand alone as a method of futures research, or can be integrated with other method(s) to form powerful forecasting tools.

The following resume mainly describes the SMIC method ? Cross Impact Systems and Matrices.

STEP 1 Choice of issue and selecting experts. The purpose of a cross-impact exercise is primarily to gain more insight into future developments. Future developments may be defined as the result of interactions between trends, events and the actions of societal actors. A preliminary list of events has to be formulated. The survey is usually carried out by mail or over the Internet. The chosen experts should be familiar with the issue under study.

Experts are normally asked to do the following:

- Appraise the simple probability of a hypothesis occurring by means of a scale from 1 (very low probability) to 5 (highly probable)
- Appraise the conditional probability of a hypothesis if the others occur or not.

Step 2: Final selection and definition of the events. The final list of events should be as clear as possible, definitions and wording must be carefully checked and defined. The selection of events should be as clear as possible. It can cover both the occurrence and non-occurrence of events. Events considered can be totally

independent or connected in some way.

Step 3: Design of the probability scale and definition of the time horizon. The definition of a probability scale is needed to translate qualitative appreciation from the experts on the degree of occurrence (e.g. most probable, very probable etc.) into probabilities. In general, the probability scale for cross-impact methods usually goes from 0 (impossible event) to 1 (almost certain event).

A time horizon has to be stated explicitly. In Foresight the short term is considered to range from the present to five years from now; the medium term from five to ten years; and the long term from twenty to fifty years. The time horizon to be considered in a cross-impact analysis must be stated explicitly.

Step 4: Estimating probabilities. In this step the initial probability of the occurrence of each event is estimated. Asking this question for each combination of occurring event and impacted event completes the entire cross-impact matrix. Conditional probabilities in a cross impact matrix are estimated in response to the following question: 'If event x occurs, what is the new probability of event j's occurring?' The results are entered on the computer and the program is run.

Step 5: Generation of scenarios. The outcome of applying a cross-impact model is a production of scenarios. Each run of the model produces a synthetic future history, or scenario, which includes the occurrence of some events and the non-occurrence of others. The model is thus run enough times, so that the collection of output scenarios represents a statistically valid sample of the possible scenarios and which the model might produce.

On the basis of the specific cross-impact model applied, the output scenarios attempt to generate either the best scenario - in the sense of likelihood of occurrence; or a set of statistically consistent scenarios; or one or more plausible scenarios from the total set of the sequence of possible scenarios (from the most probable to the least probable). Once the cross-impact matrices are calculated, it is possible to carry out a sensitivity analysis. Sensitivity analysis consists of selecting an initial probability estimate or a conditional probability estimate, about which uncertainty exists. This judgment is changed and the matrix is run again. If significance differences appear between this run and the original one, then it is apparent that the judgment that was changed plays an important role. It may be worthwhile to reconsider that particular judgment.

Pros and cons

Pros:

- It provides insight into the results of long causality chains.
- It?s easy to implement a SMIC questionnaire.
- Cross-impact methods forces attention into chains of causality.
- It can be used to clarify and increase knowledge on future developments.

Cons:

- Limitation in the number of events to be included in the inquiry
- It is very difficult to explore the future of a complex system with limited number of hypotheses.
- It is difficult to understand the consistency and validity of the technique.
- The method relies on the level of expertise of respondents.

Variations

- KSIM, a simulation technique developed by J. Kane (1972) was based on expected interactions between time-series variables rather than events.
- EXPLOR-SIM developed by Duval Fontela, and A. Gabus in 1974 for the use of cross impact analysis in scenario generation.
- INTERAX developed by S. Enzer in 1980 an interactive model for studying future business environment that incorporates cross-impact concepts.

Complementary methods

Cross-impact analysis can be used in combination with the Delphi method to check cross impacts between events, as a tool to build scenarios, in combination with structural analysis or other strategy building methods.

See also

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