Designing surveys and statistical systems - complex decision processes

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To design a statistical study can be regarded as a complex decision process. The complexity is of course even greater for the design of statistical systems, consisting of many surveys, registers, databases, etc. To see the similarities with other complex decision processes, one may describe the design of a statistical survey (or system) as follows:

- There are several stakeholders in the decision process, such as
  - the Ministry of Finance as user of statistics - and as funder
  - other ministries as users and funders
  - researchers and analysts as users and sometimes funders
  - companies as users of statistics - and as respondents and data providers
  - the general public, the citizens, as users and respondents
  - teachers and students
  - journalists

- Different stakeholders have different and sometimes contradictory (wishful) objectives in terms of statistical content, quality (different aspects: relevance, timeliness, accuracy, comparability, etc) – and costs (including response burden)

- Even each stakeholder separately will usually have partly conflicting (wishful) objectives

- There is a very large number of decision alternatives (possible designs) that can be difficult to grasp in a systematic way - and even harder to evaluate and compare in terms of outcomes in relation to the various stakeholders' different (desired) goals, especially as some factors may be quantifiable (in different ways), while others are not

This type of decision situation occurs in many different contexts. There is research in decision analysis, for example at Stockholm University, Department of Computer and Systems Sciences (DSV), which studies such decision problems and develops methods and tools to support those decision processes. Some typical foci of ongoing research:

- getting constructive interactions between various stakeholders and experts throughout the whole decision process
- structuring the decision alternatives in a transparent manner
- structuring the various stakeholders' wishes and preferences, using weights
- making the decision process transparent, for example by using sensitivity analysis
- finding satisfying and Pareto optimal solutions, solutions that stakeholders "can live with", rather than the overall optimal solutions (which hardly exist)
- developing methods and tools and tool kits that support the complex decision process throughout all steps and iterations

A common application area for these theories, methods and tools for decision analysis and decision support, where for example the EU research programs contribute substantial resources, is constructive citizen participation in political decision processes, particularly at the local level, decision-making where citizens generally come in relatively late in the process.
and thus often have only had the choice between a rather passive role as receivers of information, and a loudly outspoken but rather undifferentiated protest-engagement with focus on stopping something.

A research group at DSV has developed a decision-making model and a toolkit for this type of processes, DSV-DECIDE. The model and the toolbox has been tested in a number of projects, including in some Swedish municipalities, and are briefly described in the attached appendix, "The DSV-DECIDE model for participative decision analysis and decision support", which was developed in conjunction with an application for EU research funding. The applications can be, for example, localisation of unattractive activities (which no one wants in their backyard), or projects with diverse and complex environmental effects.

According to Lars Lyberg, it is still relatively sparse with articles and books in the statistical analysis literature, which deal with trade-offs between different (desired) goals in the design of statistical surveys, such as trade-offs between quality and cost, and between different aspects of quality, different qualities. However, he has himself together with Paul Biemer made a contribution in the book "Introduction to Survey Quality (Wiley, 2003), Chapter 10.

A possible continuation of the discussion, which Lyberg & Biemer have initiated in their book, would be that statistical agencies started discussions and projects with research groups on decision analysis and decision support. This has just happened in the form of a cooperation between Statistics Sweden and the DSV-DECIDE research group at Stockholm University. The first decision problem that has been selected for analysis and experiments concerns the choice between a traditional statistical survey and a register-based survey (or combinations of those two strategies).
Appendix.

The DSV-DECIDE model for participative decision analysis and decision support

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The DSV-DECIDE model enhances traditional decision models in a representative democracy by enabling citizens concerned by a decision to provide input in a constructive way in all steps of the decision-making process. This is in contrast to decision-making processes, where politicians and civil servants have already by and large made up their minds, before the citizens are possibly involved – if they are involved at all – and where the citizens concerned can then do little except trying to stop the decision.

The DSV-DECIDE model also enhances traditional decision models used by governmental bodies and public agencies by enabling the people involved in the decision-making process to get a multi-faceted and nuanced understanding of all factors affecting and being affected by the decision, both more or less objective, fact-oriented factors, and more subjective and value-oriented factors. Stakeholders and decision-makers could vary the assumptions concerning different factors, and relationships between factor, thus increasing the transparency of the decision-making process, and getting a good feeling for the sensitivity or robustness of the optimal outcome of the decision to variations of different assumptions in the decision model. The model has been applied and evaluated in a smaller number of public decision processes reported in Danielson et al. (2005, 2008, 2009a, 2009b).

The DSV-DECIDE model is not the only model of its kind. There are similar models proposed or investigated in, e.g., Hämäläinen et al. (2001), Bollinger and Pictet (2003) and others. An excellent overview of models and various tools in this area is given by Rios Insua et al. (2007) in their paper “Towards decision support for participatory democracy”.

Typical characteristics of the DSV-DECIDE model are:

- The decision process model is closely associated with a tool, or rather a tool box, the DECIDE tool box.

- The decision process model is structured into three layers:
  - The stakeholder layer, containing the political process and the interaction with the citizens.
  - The investigation layer, consisting of the local government’s internal administrative process, where decision makers and civil servants are stimulated in order to arrive at reasonable sets of alternatives and civil servants make investigations and assessments necessary for taking the process further. External consultancy firms may also be utilised.
  - The analysis layer, or inner decision layer, into which the data from the other two layers are entered and modelled by using techniques and tools from the area of multi-criteria decision analysis; the values and views of the decision makers (and possibly stakeholders) are incorporated as weights or rankings of the criteria together with assessments of the different decision alternatives score (or fulfilment) with respect of each criterion.
Great emphasis is put on sensitivity analysis, that is, the sensitivity of the outcome of the decision to changes in preferences, priority weights or rankings of criteria, taking into account that different stakeholders may very well differ in their values and views. Among other things, the sensitivity analysis may help to find solutions that will be more satisfactory to some stakeholders than other alternatives, without really “hurting” the interests of other stakeholders. Thus, it can be viewed as a tool for search of a perceived Pareto optimality.

So far, most of the development and practical use of the DSV-DECIDE model has been internal part of the decision process (the investigation layer and the analysis layer), involving politicians (decision makers) and civil servants (experts). A natural next step is to expand the involvement of external stakeholders in a structured way, that is, citizens, businesses, and others, affected one way or the other by the decision under consideration. This step will involve development and deployment of tools as well as new and adequate decision process models, including testing and theoretical development of decision process models, methods, and tools in practical applications. Naturally, this step requires access to ‘real’ decision makers and decision problems or opportunities.

References


