Innovative Applications of O.R.

From stakeholders analysis to cognitive mapping and Multi-Attribute Value Theory: An integrated approach for policy support

Valentina Ferretti*

Department of Management, London School of Economics and Political Science, United Kingdom

ABSTRACT

One of the fundamental features of policy processes in contemporary societies is complexity. It follows from the plurality of points of view actors adopt in their interventions, and from the plurality of criteria upon which they base their decisions. In this context, collaborative multicriteria decision processes seem to be appropriate to address part of the complexity challenge. This study discusses a decision support framework that guides policy makers in their strategic decisions by using a multi-method approach based on the integration of three tools, i.e., (i) stakeholders analysis, to identify the multiple interests involved in the process, (ii) cognitive mapping, to define the shared set of objectives for the analysis, and (iii) Multi-Attribute Value Theory, to measure the level of achievement of the previously defined objectives by the policy options under investigation. The integrated decision support framework has been tested on a real world project concerning the location of new parking areas in a UNESCO site in Southern Italy. The purpose of this study was to test the operability of an integrated analytical approach to support policy decisions by investigating the combined and synergistic effect of the three aforementioned tools. The ultimate objective was to propose policy recommendations for a sustainable parking area development strategy in the region under consideration. The obtained results illustrate the importance of integrated approaches for the development of accountable public decision processes and consensus policy alternatives. The proposed integrated methodological framework will, hopefully, stimulate the application of other collaborative decision processes in public policy making.

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1. Introduction

Public policy making is an inherent multi-attribute problem: it is simultaneously characterized by many different dimensions pursuing heterogeneous and often conflicting objectives. Moreover, decision-making in this context is often complicated by (i) multiple stakeholder views calling for a participative decision process able to include different perspectives and to facilitate the discussion, (ii) long time horizons which add further structural uncertainty to the policy cycle; (iii) the irreversible allocation of scarce public resources, and (iv) the need for legitimation and accountability of results and processes (Tsoukiàs, Montibeller, Lucertini, & Belton, 2013).

Public policies can thus be considered as complex systems and as such present multiple possible descriptions, all of them correct. As a consequence, any model is the representation of reality resulting from a number of arbitrary assumptions, implying the existence of two or more different correct representations of the same

real-world system (Munda, 2004). Therefore, the specification of the objectives and alternatives should be the result of a collective effort in order to construct a realistic and appropriate model of the problem.

To help addressing these complexities in a structured way, the use of policy analytics (Tsoukiàs et al., 2013), which represent a framework for the use of analytics in supporting the policy cycle, has gained attention in recent years. Within this context, Multicriteria Analysis (Figueira, Greco, & Ehrgott, 2005) can play a fundamental role in structuring and supporting complex policy problems with multiple and often conflicting objectives, although empirical research indicates systematic deviations of individuals from rational behaviour in actual intuitive decision making (Kahneman, 2011).

The purpose of this study is to provide an operational decision support framework that guides policy makers in their future strategic decisions by using a mixed method approach, that allows to justify with rational arguments the allocation of public resources by integrating different approaches in order to better handle critical steps and avoid biases. Mixed-method approaches (e.g. Creswell & Plano Clark, 2011; Morse & Niehaus, 2009) allow

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to cope with multi-dimensional systems, the need for multi-level perspectives as well as multi-actors evaluation using both qualitative approaches, for exploring the general problem, and quantitative approaches, for better investigating alternative options and performances.

As observed by Myllyviita et al. (2014), although there is a wide scholarly discussion on mixing methods, successful real examples in environmental decision and policy making are still scarce. Moreover, so far the assumed benefits of using mixed methods have not been systematically tested (Myllyviita et al., 2014). There is thus an evident need to pursue and to better communicate the benefits of mixing (Myllyviita et al., 2014) and the research presented in this paper is an attempt to fill in this gap.

In particular, this paper proposes a group-learning process under a decision support methodological framework evolving through three main methods, i.e. stakeholders analysis, cognitive mapping and multicriteria analysis.

The integrated decision support framework was tested on a real world case study concerning the location of new parking areas in a UNESCO site in Southern Italy. Locating new parking areas can be perceived at the same time as a desirable and undesirable facility location problem.

In this context, the use of multi-criteria methodological frameworks started gaining attention in recent years. Nevertheless, very few applications can be found in this field. For example, an interesting study developed by Jelokhani-Niaraki and Malczewski (2015) dealt with the complexity of parking site selection by combining Multicriteria Decision Aiding (MCDA) with Geographic Information Systems (GIS) through a web-based application designed to support participation and testing the method with students. Another related study is the one by Yuejun et al. (2012) who dealt with the parking site selection problem by combining MCDA and GIS, using the AHP method (Saaty, 2013) and focusing on the comparison of alternatives' phase.

As highlighted in the literature review by Myllyviita et al. (2014), different mixes of methods have been tested and, in particular, cognitive mapping and stakeholders analysis have respectively already been used in combination with Multicriteria Analysis (e.g. Stewart, Joubert, & Janssen, 2010) but, so far, there are no applications testing in a real setting the joint use of the 3 methods proposed in this study, i.e. stakeholders analysis (in the form of a power interest matrix; Dente, 2014), cognitive maps (Eden, 1988), and the specific Multicriteria technique named Multi-Attribute Value Theory (Keeney & Raiffa, 1976). The reasons for the choice of this specific mix of methods can be summarized as follows: (i) cognitive maps seem one of the most promising tools for problem structuring prior to the application of Multicriteria Decision Aiding (e.g. Belton & Stewart, 2002; Stewart et al., 2010), as detailed in Section 2.2, (ii) stakeholders analysis in the form of a power interest matrix is particularly suitable for complementing the Multi-Attribute Value Theory technique given that the latter in a collaborative decision process context does not efficiently support the achievement of a consensus in the preference elicitation phase (e.g. Ferretti & Comino, 2016), thus calling for the need to aggregate different viewpoints according to their different levels of importance, as discussed in Section 2.3 and in the conclusions, and, finally, (iii) stakeholders analysis has shown to be a very important preliminary step in multi-attribute decision making processes (Dente, 2014), as detailed in Section 2.1. The approach proposed in the present paper has thus an innovative value, which stems not only from the experimentation of the mix of the above mentioned specific techniques to support a policy making process with a participatory approach, but also from their testing in the context of public policy making and cultural heritage management, where the combination of qualitative and quantitative methods seems to yield greater benefits (Myllyviita et al., 2014).

Another interesting aspect of the work is linked to the use and demonstration of how prescriptive decision analysis and participatory problem structuring can lead to the generation of new consensus alternatives in a real decision making process. Indeed, the design of alternatives has recently gained attention in the scientific literature (Colorni & Tsoukiàs, 2013; Raiffa, 2007, 1990) and there is a need for testing different tools in order to support innovative design of better alternatives. As highlighted in Section 3.2.4, the mixed method approach proposed in this paper helped the participants to generate a new consensus alternative at the end of the process.

The proposed integrated decision aid is thus expected to constitute a transferable framework to support policy makers in their strategic decisions.

The remainder of the paper is organized as follows: Section 2 presents the overall methodological background, Section 3 illustrates the real world case study on which the mixed method approach has been tested and, finally, Section 4 proposes a detailed discussion of the results obtained from the integrated decision support process and some conclusions for further developments of the research.

2. Methodological background: integrating stakeholders analysis, cognitive mapping and Multi-Attribute Value Theory

This paper proposes an integration of three different tools in order to provide an operational framework able to support strategic choices and public policies.

In particular, the mixed-method approach combines stakeholders analysis (Dente, 2014), cognitive mapping (Eden, 1988) and Multi-Attribute Value Theory (Keeney & Raiffa, 1976) which are powerful methods of analysis and evaluation and that can inform each other and foster synergies, as will be presented in the following paragraphs. Among the different possibilities for designing mixed methods research, the sequential design (Creswell & Plano Clark, 2011) has been chosen, as it seems particularly appropriate in the context of policy making, where the planning process should follow since the very beginning the subsequent phases of policy formulation. Mixing in this study means that methods have progressively been linked to complement each other or to cover a larger proportion of the different tasks in the planning process. As will be shown in Section 3, the sequential design applied in this study allowed to begin with the identification of the problem and objectives to be reached by a qualitative investigation, which is followed by a quantitative analysis to define the best performing alternative option.

2.1. Stakeholders analysis

In public policy making the actors and their behaviors represent the core of any possible theoretical model (Boerboom & Ferretti, 2014; Dente, 2014). The actors are those individuals or organizations that make the actions able to influence the decisional outcomes and that do it because they pursue goals regarding the problem and its possible solution, or regarding their relations with other actors (Dente, 2014). In particular, any actor having a vested interest in the decision process, either directly affecting or being affected by its resolution, including experts and the public, is named stakeholder. The first, essential, step of a decision process to support public policies formulation thus consists in the identification of the stakeholders and of their objectives (Dente, 2014).

Stakeholders have access to and can mobilize different types of resources (i.e. political, economic, legal and cognitive resources), they can be grouped into different categories (i.e. political actors, bureaucratic actors, special interests, general interests and experts) and they can have different roles (i.e. promoter, director,