CHAPTER 19

Supporting Decision-Making within the Policy Cycle: Techniques and Tools

Irene Pluchinotta i.pluchinotta@ucl.ac.uk

UCL Institute for Environmental Design and Engineering, The Bartlett Faculty of the Built Environment, University College London

Katherine A. Daniell katherine.daniell@anu.edu.au

Australian National University

Alexis Tsoukiàs tsoukias@lamsade.dauphine.fr

LAMSADE – CNRS, PSL-Université Paris-Dauphine

ABSTRACT

The policy cycle is a model of interactive stages for structuring policy problems and making decisions to deal with them. The model encourages cycling through discrete activities, using different policy tools. In order to support decision-making within a policy cycle, a decision-aiding perspective is needed; namely formal tools and methods introduced to help decision-makers develop reasoned decisions during the different phases of the policy-making process.

The intention of this chapter is firstly, to introduce existing Decision Analysis analytic methods and tools that can be used to support the different phase of the policy cycle, using concepts from Decision Analysis and Policy Analytics. Secondly, the decision-aiding perspective for the design and evaluation of policies is introduced and discussed. Lastly, the chapter focuses on the importance of the policy design phase, introducing an innovative participatory tool to support policy makers and relevant stakeholders during the design of policy alternatives

1. Introduction

The process of designing, implementing and assessing public policies is a major challenge for policy-makers (De Marchi, Lucertini, and Tsoukiàs 2016) and having strong knowledge of a range of policy tools that could be deployed is a prerequisite for achieving the policy goals (Howlett 2018). Policy-making involves the deliberate and conscious attempt to define policy goals and connect them to instruments or tools expected to realise those objectives (Howlett, Mukherjee, and Woo 2015).

Policy-making is a non-linear process and has been conceptualised in a myriad of ways that express this complexity. Some models have great explanatory power for understanding the interrelationships of politics, values, issues and decisions (e.g., Lindblom and Woodhouse 1968; Cohen, March, and Olsen 1972; Kingdon 1984; Dunn 1981; Sabatier 2007); however,

have proven less helpful for understanding where decision support tools can help policy-makers. Other models are criticised for over-simplification of processes (e.g., Jann and Wegrich 2007 on Lasswell's policy cycle) but have stood the test of time as practice-focussed aids, particularly for public servants supporting a range of policy activities. Indeed, the cyclical approach introduced by the policy cycle (Lasswell 1956) enables intricate phenomenon of policy-making to be disaggregated into manageable steps allowing policy analysts to focus on the different issues of each phase (Bridgman and Davis 1998) using specific tools. Such models of the policy cycle have been used in many countries, including Australia for decades.

Policy decisions are often supported by incorporating appropriate literature, traditional forms of policy analysis and key lessons from policy-making studies at the relevant steps of the policy cycle. However, to support decision-making within the policy cycle a decision-aiding perspective is needed (De Marchi, Lucertini, and Tsoukiàs 2016); namely formal tools and methods introduced to help policy-makers to improve their decisions during the different phases of the policy-making process. A decision-aiding process supports the construction of artefacts using formal and abstract languages, with shared and consensual rationality models (see Tsoukiàs 2007).

For instance, few government departments and public organizations have yet managed to make systematic use of the broad range of data, evidence, decision analysis, operational research methods, cutting-edge statistical, machine learning modelling techniques and also participatory approaches to inform their work (Daniell, Morton, and Ríos Insua 2016), even though data analytics groups are being set up in governments across the world to start to wrangle what Government departments and partners are collecting and storing[i].

Within this context, the concept of "Policy Analytics" was introduced in 2013 as an attempt to develop a framework, tools, and methods to address the challenges related to policy-making (De Marchi, Lucertini, and Tsoukiàs 2016). Policy Analytics is defined by Tsoukiàs et al. (2013) as a project to "support policy-makers in a way that is meaningful (in a sense of being relevant and adding value to the process), operational (in a sense of being practically feasible) and legitimating (in the sense of ensuring transparency and accountability), [by drawing] on a wide range of existing data and knowledge (including scientific knowledge, and expert knowledge in its many forms) and [combining] this with a constructive approach to surfacing, modelling and understanding the opinions, values and judgments of the range of relevant stakeholders". This conceptual initiative prompted numerous research teams to develop empirical applications of this framework and to reflect on their own decision support practice at the science-policy interface (see Meinard et al. 2021).

Furthermore, as discussed by Ferretti, Pluchinotta, and Tsoukiàs (2019), when it comes to policy-making, Decision Analysis have developed, among others, methods which aim at supporting different phases of the policy cycle (Larson and Odoni 1981; Larson 2002; Sinuany-Stern and Sherman 2014). However, most emphasis in this stream has been on problem structuring and on the rational selection among given alternatives, resulting in the development of guidelines for public policy evaluation at different levels (e.g., the Green and Magenta Books of the UK Government, the Public Policy Assessment Book of the UK

Government, the European Social Fund Manual[ii]), but with limited consideration to support the specific policy design phase.

The aim of this chapter is to introduce existing Decision Analysis analytic methods and tools that can be used to support the different phase of the policy cycle, using concepts from Decision Analysis and Policy Analytics. Secondly, the decision-aiding perspective for the design and evaluation of policies is introduced and discussed. Lastly, the chapter focuses on the importance of the policy design phase, introducing an innovative participatory tool to support policy makers and relevant stakeholders during the design of policy alternatives.

The reminder of the chapter is organized as follows: the decision-aiding perspective is discussed in section 2, the policy cycle analytics tools are presented in section 3, while section 4 introduces a tool for the generation of policy alternatives. Section 5 concludes this chapter.

2. A decision-aiding perspective

From a decision-aiding perspective, what we can observe and model is the existence of nested decision-aiding processes within the policy cycle. We can distinguish at least two levels. The first one is the policy cycle itself. Considering any stakeholder involved in the policy cycle asking some advice on how to conduct within it. This will generate a decision-aiding process of a more strategic nature on how to structure the inter-organisational decision process characterising the policy making process (Ostanello and Tsoukiàs 1993; Chisholm 1972; Holmqvist 2003; Majchrzak, Jarvenpaa, and Bagherzadeh 2015). The second level concerns each single phase of the policy cycle. For any of these, any stakeholder involved in the policy cycle might request the support of a team of analysts, these using formal decision support tools.

A more formal definition of what a decision-aiding process is has been introduced in Tsoukiàs (2007), where the process is characterised through four cognitive artefacts (or deliverables) of the process: (i) a representation of the problem situation (stakeholders, stakes, resources); (ii) a problem formulation (actions, attributes, problem statement); (iii) an evaluation model (alternatives, measures, preferences, protocols and algorithms); (iv) a final recommendation. Mazri, Tsoukias, and Daniell (2019) extended this definition to the case of participative decision processes (more relevant in the policy-making context), since defining the participation structure is on its turn a decision problem, once again to be supported through formal decision support tools.

Colorni and Tsoukiàs (2013; 2018; 2020) introduced a formal structure of what a decision problem is (a problem formulation) and focussed upon the generation of actions and alternatives. There are two findings which are relevant for the purpose of this chapter. The first is the fact that designing the alternatives of a decision problem is a decision problem itself: this establishes a recursion of decision problems, extending the formal structure of decision aiding processes. The second is the fact that creating the recursion of decision problems can be modelled using design theory concepts (LeMasson et al. 2018).

Designing the set of decision options (upon which get the values of the client) is a neglected topic although as important as evaluating and choosing them (Ferretti, Pluchinotta, and Tsoukiàs 2019). This new perspective allows to consider integrating formal design support tools within formal decision support tools (and vice-versa) a topic yet to be developed in the specialised literature.

3. Policy cycle analytics tools

The policy cycle approach suggests that policy develops through a set of interrelated tasks for structuring policy problems and making choices concerning them, from setting the agenda and developing policy options, to policy evaluation and revision (Daniell, Morton, and Ríos Insua 2016). The model encourages cycling through discrete activities, using different policy tools. Adapted from Althaus, Bridgman, and Davis (1998) and Daniell, Morton, and Ríos Insua (2016), the version of the policy cycle used for this chapter includes:

- Agenda setting and issues identification to define the problems of public concern that require policy action or change and establish priorities.
- Policy formulation to reach a better understanding a public issue on the agenda and the define the boundaries of the policy goals and objectives.
- Policy design to create policy alternatives, representing possible paths for the solution of a policy problem connecting the initial state of the problem (i.e. the undesirable state) to the final state. The problem is formulated in the previous phase and alternative policy options are developed.
- Policy analysis and decision for the selection of the preferred policy option. Based on the analysis of the different policy alternatives, a final decision is made, and the chosen policy proposal is fully specified.
- Policy consultation to test the policy proposal and to gather support for a constructive policy initiative. This phase involves more than one agency and/or non-governmental stakeholders for the improvement and test of the policy and when appropriate, for gathering support.
- Policy implementation to pursuit the goal agreed in the first phase and to put the policy into practice. At this stage, the necessary public resources and regulations are mobilized to make the policy operational.
- Policy monitoring and evaluation to observe and assess, on an ongoing basis, whether the implemented policy is producing the expected results, to identify whether the policy should be changed, or new issues need to be considered in the agenda.
- Policy learning and readjustment to rethink the policy as appropriate after a reconsideration of the implemented instruments and related policy outcomes,

We provide an overview of key tools from the Decision Analysis research community to introduce analytical methods commonly employed in each phase of the policy cycle. Bridging the two research fields (i.e., Operational Research and Policy Science), we aim to introduce a number of Operational Research tools, opening a multidisciplinary dialogue and underlining the need for a systematic mapping of existing tools. Potentially the decision-

aiding perspective could be applied in each phase of the policy cycle, however, there are areas with none or limited Operational Research applications. It is worth clarifying that we do not claim to provide a comprehensive list of all the existing Operational Research methods that have been applied to one or more phases of the policy cycle.

Using the 8-phase policy cycle, we included two types of tools: analyst-driven analytics and stakeholder-driven analytics, since each phase could be carried out via public consultation or more generally using collaborative and participatory approaches. As highlighted by Pluchinotta et al. (2019), public participation is widely documented as being a valuable component of policy making (Beierle and Cayford 2002; Beierle 2002), bringing the need of facilitating stakeholders' contributions (Ackermann and Eden 2011).

Figure 1 summarizes the existing methods and tools that can be used to support the different phases of the policy cycle, using concepts from Decision Analysis and Policy Analytics, showing the lack of formal tools for supporting decisions in all the phases of the policy cycle.

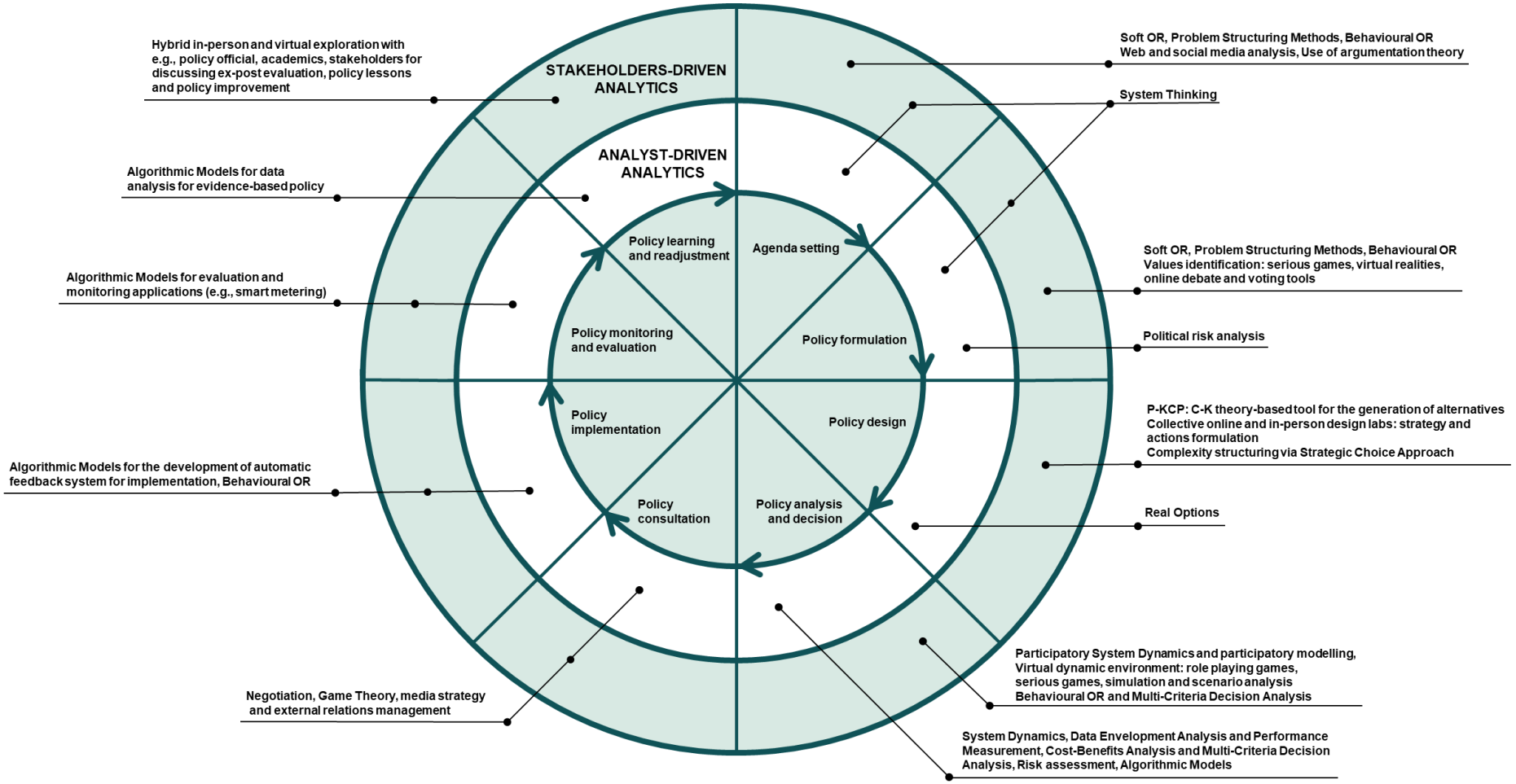

Figure 1. Policy cycle analytics tools (acronym: Operational Research, OR)

There are few phases with a large number of Decision Analysis methodologies successfully adapted and integrated to support participatory policy-making processes. For instance, both phases "agenda setting and "policy formulation" have, namely Soft Operational Research approaches (Checkland 2000; Pollock, Rothkopf, and Barnett 1994), Problem Structuring Methods (Rosenhead 1989), such as Strategic Options Development and Analysis (Eden 2004) and Boundary critique (Midgley and Pinzón 2011), Behavioural Operational Research (Hämäläinen, Luoma, and Saarinen 2013; Franco et al. 2021). Furthermore, System thinking (Sterman 2000) and Group Model Building (Vennix 1996) are often used to carry out policy, governmental and societal system analysis.

In relation to the phase "policy analysis and decision" several Decision Analysis approaches exists, including both analyst- and stakeholder-driven analytics, such as Strategic Choice Approach (Friend and Hickling 1987), System Dynamics (Sterman 2000) and participatory modelling (Voinov and Bousquet 2010; A. Voinov et al. 2016) with simulation and scenario analysis, Behavioural Operational Research, Data Envelopment Analysis and Performance Measurement (Charnes, Cooper, and Rhodes 1979; Cook and Seiford 2009; Emrouznejad and Barnett 2007), Cost-Benefits analysis and Multi-Criteria Decision Analysis (Belton and Stewart 2002).

On the other side, Algorithmic Models can be used to contribute to evidence bases and are increasingly used to inform policy makers (Kolkman 2020). There are two aspects of digital transformation we may cite when we talk about policy analytics tools. The first concerns the active systemic use of data in different phases of the policy cycle, e.g., for issue identification, policy analysis, evaluation (e.g., pay-for-performance approach for energy efficiency programs to evaluate energy efficiency program success) and for designing data-dependent policies (e.g., personalised taxes based upon consumption patterns) (Janssen and Kuk 2016). The second relates to the passive use of algorithms in running utilities and services, introducing the concept of a policy designed by induction. For instance, methods such as Deep Reinforcement Learning are increasingly being used to find optimal policies for a given control task (e.g., Dhebar et al. 2020; Behzadan and Munir 2017).

4. Policy Design: A Tool for the Generation of Alternatives

Within the policy cycle, policy design can be defined as a specific form of knowledge gathering about possible policy alternatives on policy targets and the application of that knowledge to the development of policies aimed at the attainment of specifically desired public policy outcomes and ambitions (e.g., Bobrow 2006; Capano and Howlett 2015).

Therefore, policy design is an intricate challenge for policy-makers as future policy outcomes are inherently uncertain (Nair and Howlett 2016). Evidence suggests that policies often fail due to the lack of formalized policy design methodologies for the innovative generation of alternatives (Howlett 2014). Policy design has long been seen as a component of policy development without any operational characteristic (Howlett 2011). Despite, policy design represents a crucial step since it determines the quality of the alternative policies being

considered, the formalisation of this process has been little investigated (e.g., Ferretti, Pluchinotta, and Tsoukiàs 2019).

Using the lens of a decision-aiding perspective, policy design can be considered the result of a collective decision-making process involving multiple stakeholders for the generation of a set of policy alternatives (Pluchinotta et al. 2019). Alternatives tend to be few and similar when the policy design process is constrained (Alexander 1982). In contrast, a decision-aiding process can bring novelty through the expansion of the set of solutions (see Colorni and Tsoukiàs 2020; 2018).

Ferretti, Pluchinotta, and Tsoukiàs (2019) argue that the mainstream decision analysis literature focuses on tools to support a rational selection among given alternatives. Despite this, policy design represents a crucial step since it determines the quality of the alternative policies being considered, the formalisation of this process has been little investigated.

Within this context, Pluchinotta et al. (2019) underline that there is a demand for methodologies to support policy-makers and relevant stakeholders during the design of policy alternatives, exploring the operational role of Design Theory, and specifically Concept-Knowledge (C-K) theory, to develop a formal tool for the generation of policy alternatives. The tool is based on the integration between Problem Structuring Methods (PSMs) and C-K theory. PSMs, are implemented to elicit and structure individual problem understandings, to detect and analyse differences among different stakeholders' concerns and values (Mingers and Rosenhead 2004). C-K theory framework is then meant to facilitate the alignment of the different problem frames and available knowledge and to enable the creative process for developing innovative and consensual policy alternatives.

C-K theory's underlining idea is that design is a generative process through which something unknown can intentionally emerge from what is known (Hatchuel 2001). Briefly, C–K theory is based on the distinction between two expandable spaces: a space of Concepts (C-space), and a space of Knowledge (K-space) (LeMasson, Dorst, and Subrahmanian 2013). The process of design is therefore defined as the co-evolution of C- and K-spaces through four types of independent operators (C - C, C - K, K – K, K - C): namely, concept generates other concepts or is transformed into knowledge, and knowledge generates more knowledge or helps formulating concepts (Hatchuel and Weil 2002). According to Hatchuel and Weil (2003), the K-space is a space of propositions that have a logical status (i.e., "true" or "false") for a designer in a given time step. Whereas the C-space is a set of propositions describing an object (e.g., our policy), that has no logical status in the current K-space (i.e., when a concept is formulated, it is impossible to prove that it is a proposition of the K-space).

Over the last few years, C–K theory has gained a growing academic and industrial interest (Agogué and Kazakçi 2014). C–K is a theory of reasoning for innovative design situations, overcoming the limits of traditional design theory (Hatchuel et al. 2015) and creativity methods (Kazakçi and Tsoukiàs 2005). It provides researchers and practitioners with a framework to describe and analyse innovative design processes for the generation of alternatives (Pluchinotta et al. 2020). For a detailed discussion on C-K theory-based tool for policy design, namely Policy-KCP (P-KCP), see Pluchinotta et al. (2019).

Briefly, P-KCP consists of 3 main phases: the *K-Space Phase* aims to identify a shared concern, to gather missing information and to build a comprehensive summary of the knowledge about the issue under consideration, by combining individual stakeholders' knowledge in order to support the subsequent generative phase (*C-Space Phase*). Afterwards, the C-Space is built during a one-day stakeholder workshop: stakeholders identify and discuss the traditional policy alternatives and propose innovative ones through the expansion of the C-space. Following the C-K Theory framework, the C-space represents the map of all identified possibilities improving the search for new alternatives. Lastly, the Project Phase uses the K- and C- spaces to shape the policy recommendations.

Conclusions

In this chapter we adopt a general policy cycle approach to represent the complex set of activities occurring when a policy is established: from perceiving the need of a policy to the monitoring and feedback analysis of a policy implementation, through the different steps of agenda setting, policy design, choosing policy tools etc...

We show that, despite Decision Analysis tools have been often suggested and actually, used for supporting the activities within the policy cycle, we lack a comprehensive methodology on how to support the whole cycle and several among the steps characterising it. We nevertheless provide a short survey of methods and models created for such purposes.

Under such a perspective we present in more details how policy design can benefit from formal decision analysis tools as well as from formal design theory and more precisely C-K theory.

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