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Decision aiding in participative contexts : A descriptive model

Ch. Mazri, K. A. Daniell, A. Tsoukiàs

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Chabane MAZRI*[1], Katherine A. Daniell[2], Alexis Tsoukias[3].

e-mail: Chabane.mazri@ineris.fr

Tel : +333 44 55 62 56

Fax : +333 44 55 62 95

**Corresponding author*

[1] *INERIS. Parc Technologique ALATA. BP2. 60550 Verneuil en Halatte, France.*

[2] *Australian National University, Canberra 0200 ACT, Australia.*

[3] *CRNS. Place du Maréchal de Lattre de Tassigny, Paris, France.*

Abstract

Organizing multiple stakeholders' participation in decision processes is now a widespread request, especially in public contexts. Therefore, analysts are expected to provide policy makers (the clients) with scientifically sound and practically realizable approaches. However, there remains a question around the ability of existing decision aiding models to adequately answer challenges raised by stakeholder participation.

Through an exploration of both the decision aiding and participatory process literatures, we demonstrate the existence of a methodological gap making analyst's interventions extremely limited in their ability to respond to participatory challenges. Our hypothesis is that these limits derive from the focus in decision aiding on the analyst-client interactions leaving the other stakeholders with little explicit space to shape decision process evolution. This focus is nothing but an organizational simplification of reality, which is finally something very usual in all management interventions. However, we will see that this simplification brings several limits in participative contexts.

Consequently, we suggest including in the decision aiding process an explicit reflection on the way stakeholders should participate in all steps of the decision process. Through the concept of participation structure, we propose to explicitly consider, in the earliest steps of a decision aiding process, the organizational arrangements through which various stakeholders may interact with the analyst and the client. Finally, we suggest an enhanced model of decision aiding which does not contest existing classic deliverables, but aspires to complement them with new deliverables that will help analysts in more appropriately tackling some of the challenges raised by participative processes.

Keywords

Decision processes, decision aiding, participative processes, cognitive artefacts.

I. Introduction

Participation can be defined as forums for exchange that are organized for the purpose of facilitating communication between government, citizens, stakeholders and interest groups, and businesses related to a specific decision or problem (Webler and Renn, 1995). Our modern democratic societies are showing an increasing interest in participation-based approaches where each and every stakeholder, including the general public, can seek the legitimacy to influence the final outcomes of a decision process. In this new era, both public and private decision makers are increasingly asked to disclose their decision processes and seek, in addition to the classical technical validity requirements, for legitimacy and acceptability. Here again, we acknowledge a need for a shift from legitimacy, considered as inherent to decision power or to natural attributes as defined by Weber (1922), to the need for a legitimating process where a decision maker has to negotiate with stakeholders so to build the normative system required by his action (Laufer, 1996).

From a decision analysis perspective, these transformations may lead to increase the decision process' vulnerability, as well as the types and quantity of resources required for its implementation. Regarding decision vulnerability, the disclosure of complex or uncertain issues may trigger outrage (Sandman, 1993) and conflicts and may deteriorate the relations between stakeholders (Rowe and Frewer, 2000), with potentially catastrophic consequences for the decision process and the decision maker. Furthermore, specific, and likely additional, resources will be required to handle potential conflicting value systems and expertise, as well as dialoging, with non expert stakeholders (Mazri, 2007).

For these reasons, managing stakeholder participation has become a key issue for decision makers, and consequently, has entered the sphere of competencies a provider of decision support, the so-called "analyst", should develop. Regarding the quasi-exclusive relationship between the analyst and the decision maker traditionally fixed by decision aiding approaches, the introduction of participative constraints raises two key methodological issues:

- What kind of relationship should the analyst establish with involved stakeholders other than the client(s)?
- What kind of decision support should the analyst propose to the client(s) regarding participative processes specificities?

Through the analysis of actual descriptive models of decision aiding on the one hand, and methodological challenges raised by the literature on participative approaches on the other hand, this paper aims to demonstrate that a methodological gap exists between these two literatures. More specifically, we will show that existing decision aiding approaches need to be further developed in order to address the challenges faced by clients dealing with participative approaches.

An enhanced descriptive model of decision aiding will be then suggested so to better characterize the way an analyst should organize interventions in participative contexts. However, this descriptive model is to be distinguished from group decision support system (GDSS) approaches, as it does not specifically seek to encompass the use of software or facilitators (Eden and Ackermann, 2013).

II. Descriptive models of the decision aiding process

Decision aiding, rooted in Operational Research (OR) is expected to help with rationalizing how decisions are made (Keller, 1989). OR is embedded in a strong prescriptive tradition where decision makers are expected to systematically search for optimal decisions through mathematical modeling of the decision situation at hand. Such an exclusive approach has been argued in the literature on different grounds (see Simon, 1947, 1954; Allais, 1953; Ackoff, 1979; Checkland, 1981; Mongin, 2000; for an historical perspective the reader can refer to Tsoukiàs, 2008). Here we will focus on those discussions which are of particular interest related to the objectives of our paper.

Most of the traditional problem formulations in OR and Decision Theory are established a-priori and most of the time they focus on a precise method to be used. However, problem statements (and thus formulations) can be very different (see Colorni and Tsoukiàs, 2013); this makes problem formulation an even more complex issue when stakeholder participation needs to be considered.

It is largely acknowledged that decision makers in organizations are usually faced with a stream of intricate and dynamic issues instead of clear and formulated processes (e.g. Dewey, 1929; Simon, 1947; Cohen et al., 1972; Ackoff, 1979; Rosenhead and Mingers, 2004). This situation is amplified in public contexts where several legitimate problem formulations may co-exist (Sfez, 1992; Ostanello and Tsoukias, 1993; Mazri, 2007; Daniell et al., 2010a). Therefore, the definition of the problem to be resolved needs to rely on an explicit and organized approach that addresses this social complexity of decision issues.

In order to deal with these limits and better anchor decision support in reality, a constructivist vision of decision aiding has been suggested (Roy, 1994) in opposition to normative, prescriptive and descriptive visions (Tsoukiàs, 2008). Constructivism in decision aiding relates to the co-construction by the analyst and the client of the rationality on which decision will be based (Bouyssou et al., 2000)[1]. This construction aims at guiding the client through the inherent complexity of decision making (David, 1996) in order to satisfy both his preferences and scientific validity criteria. By doing so, the analyst is not anymore an expert implementing and interpreting optimization models, he becomes a stakeholder influencing the decision process through a set of procedures, models and

[1] Although in this paper we typically refer to just one analyst and client, we note that in real decision-aiding processes, there are often multiple analysts and/or decision-makers (plus sometimes other stakeholders) working on this co-construction or to co-engineer the participative decision-aiding process (Daniell et al. 2010b; Daniell, 2012)

methods he injects in the decision process (David, 1996). A remarkable consequence of this evolution has been the emergence of a problem structuring literature (Eden, 1988; Rosenhead, 1996; Checkland, 2004; Franco et al., 2006; Shaw et al., 2007) dedicated to exploring decision problems' complexity and construction of problem formulations.

A descriptive model of analyst-client interactions has been suggested in Tsoukiàs (2007). Anchored in the constructivist tradition, this model puts the outcomes of this interaction, so called cognitive artefacts, at its heart. Basically, the decision aiding process is here characterized by a number of intellectual products, both models and organizations, built during the analyst-decision maker interactions. Four distinct steps are described:

- *Problem situation*

  This first step aims at building a common understanding of the problem to be managed. To do so, the analyst-client interaction should be focused on the following products:

  - <$\mathcal{A}$>: The set of actors to be considered during the decision process.
  - <$\mathcal{O}$>: The set of stakes believed as important for each of the actors identified above.
  - <$\mathcal{S}$>: The set of resources the actors commit on their own stakes and on other actors' stakes.

- *Problem formulation*

  The objective now is to build a formal and abstract description of the problem described earlier. This abstraction marks the transition in the decision process from the real world to an abstract one considered as representative of both the client's and the analyst's vision of the problem. Based on this abstraction, the analyst will select the type of preexisting approaches or create adapted ones to use.

  The abstraction is performed through the following productions:

  - <A>: The set of actions potentially satisfying regarding the problem formulation.
  - <V>: The set of points of view or dimensions to be considered when evaluating each of the actions described in A. These points of views will be the main material in order to build the decision criteria in the next step.
  - <Π>: The problem statement which transforms the client's concern in a formal decision problem (see Bouyssou et al., 2006; Colorni and Tsoukiàs, 2013).

- *The evaluation model*

  Once the problem to be managed is formulated, the analyst is expected to build an evaluation model satisfying both scientific criteria of validity and the client's "value structure" (Keeney, 1992). Evaluation models used in decision aiding can be described according to the following components:

- $<\mathcal{A}>$: The set of alternatives or decision options.
- $<\mathcal{D}, \mathcal{E}, \mathcal{H}>$: The set of dimensions, evaluation scales and preference structures to be modeled in order for the evaluation model to fit with the client's preferences.
- $<\mathcal{U}>$: Description of the uncertainty structure associated with the decision problem.
- $<\mathcal{R}>$: The aggregation operators combining values, opinions and likelihoods, on various dimensions in order to construct a global assessment fitting the problem statement.

- *Validation of recommendations*

  Recommendations represent the journey back from the abstract world to reality. Interpretations and conclusions inferred from the evaluation model's results are discussed with the client in order to ensure their ability to correctly fit his preferences.

  In addition, Tsoukiàs suggests performing the following validation steps:

  - *Sensitivity and robustness analyses*: Aiming respectively to evaluate the sensitivity of recommendations to variations of input data and the ability of recommendations to remain satisfactory for important variations in operating conditions.
  - *Evaluation of recommendation acceptability or "legitimation"* by the stakeholders with a stake in the decisions made.

Regarding the descriptive model presented above, the question addressed in our paper is the ability of an analyst respecting this methodological framework to appropriately support a client in responding to the great variety of challenges encountered when dealing with stakeholder participation. More particularly, the constructivist posture adopted in this model, and generally in this paper, questions the legitimacy of these various constructions if no reflection is dedicated to the way participants are involved in decision-aiding processes. Practically speaking, who should participate, how and why are questions to be explicitly addressed for each of the products described earlier. The presence or absence of a stakeholder in shaping each product becomes in participative contexts a choice of the analyst and the decision maker, which needs to be justified and which may influence the process outcomes.

Another key issue is the need for the analyst and the decision maker to fully legitimate the rationality behind the adoption of one form of participation over another, including the selection and rejection of certain stakeholders for inclusion in the process. Consequently, the analyst needs to make explicit and transparent the rationality behind the organizational model adopted. Otherwise, there is a significant risk for the decision process to be weakened by participants disappointed by the participation terms or, more generally, by stakeholders with hidden agendas (see also Barreteau et al (2010) on this point).

Therefore, the legitimacy of each decision aiding product relies, at least partially, on the ability to demonstrate the rationality behind the implication or not of each stakeholder for each of the expected results. In other words, participation contexts question the organizational structure adopted by the analyst to build the products of the decision aiding process.

In the next chapter, we will explore in greater depth the main challenges we believe important for a client, and consequently for an analyst, to address related to the question of how multiple stakeholders' participation should be considered for shaping each of the decision aiding artefacts.

III. Challenges raised by participation processes

Following the increasing interest of our societies towards participative processes, there has been an increase of dedicated scientific research around these processes of extremely various natures (Barreteau et al, 2010) and resulting from various research traditions (Von Korff et al, 2010, 2012). Despite the heterogeneous nature of this literature, two main research topics have been distinguished (Webler, 1999; Webler and Tuler, 2001):

- The benefits (Fiorino, 1990; Renn, 1995; Ehrmann and Stinson, 1999; Foster, 2000; Van den Hove, 2003, von Korff et al, 2012) and limits (Coglianese, 1997; Irvin and Stansbury, 2004; Mazri, 2007; Rowe and Frewer, 2000; Barreteau et al. 2010) associated with participation.
- The way 'good' participation should be performed and evaluated (Covello and Allen, 1988; Webler, 1995; Stern and Fineberg, 1996; Creighton, 2005; Von Korff et al, 2010, 2012; Daniell, 2012).

Regarding the paper's objectives, our reflection will focus on the second set of challenges, being the meaning of good participation and mechanisms for applying it in the context of decision aiding.

Without being exhaustive, we believe the following challenges to be particularly important for an analyst providing decision aiding to a client in charge of designing and managing a participative decision process:

1) Variety of participation objectives
2) Variety of participation forms
3) Variety of topics and problems
4) Variety of participation methods or tools
5) Process resourcing
6) Evaluation of participation processes

Each of these challenges will be briefly outlined here.

a. Variety of participation objectives

A set of stakeholders, including the client, involved in a common participative decision process can still highly diverge on the objectives they individually allocate to it. A typology of potential objectives that can be allocated to a participative process based on Bayley and French (2007) and Daniell (2011) is presented in Figure 1.

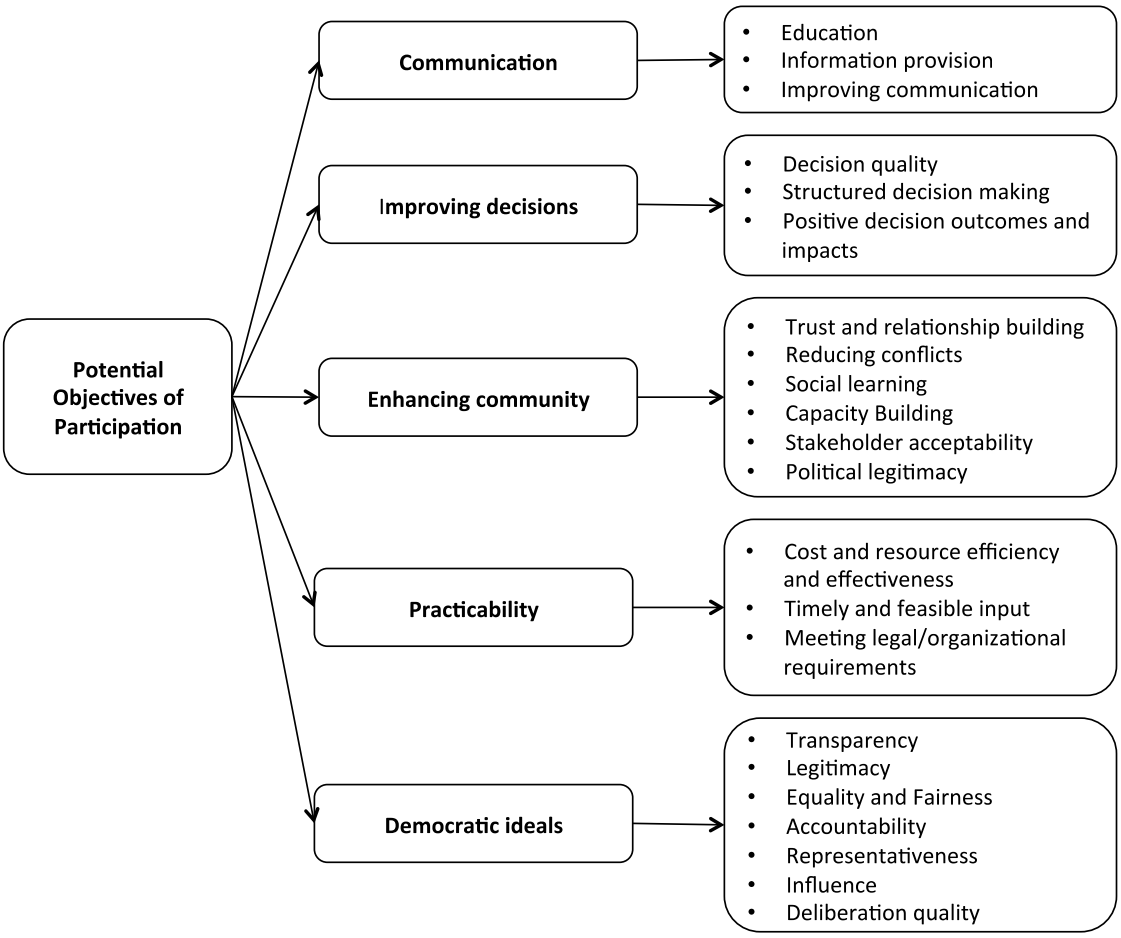


Figure 1 Objectives potentially associated with a participative process (inspired by Bayley and French, 2007; and Daniell, 2011)

The coexistence of all or some of these objectives in a decision process can be a source of difficulty to the client who may require support from the analyst in order to either ensure the decision process satisfies all of them or lowers stakeholder expectations by reducing objectives diversity, especially if they remain incommensurable.

b. Variety of participation forms

The literature has been prolific in distinguishing and characterizing different types or levels of participation according to various criteria. Arnstein's ladder (1969), which is perhaps the best known and most adapted, focuses on the distribution of decision power through participants to distinguish various levels of participation (Fig.2). Lower levels of participation defined as "*therapy*" and

"*manipulation*" reflect a strong preference for higher levels of participation and rather than equally pointing out any positive impacts that could stem from the lower ones.

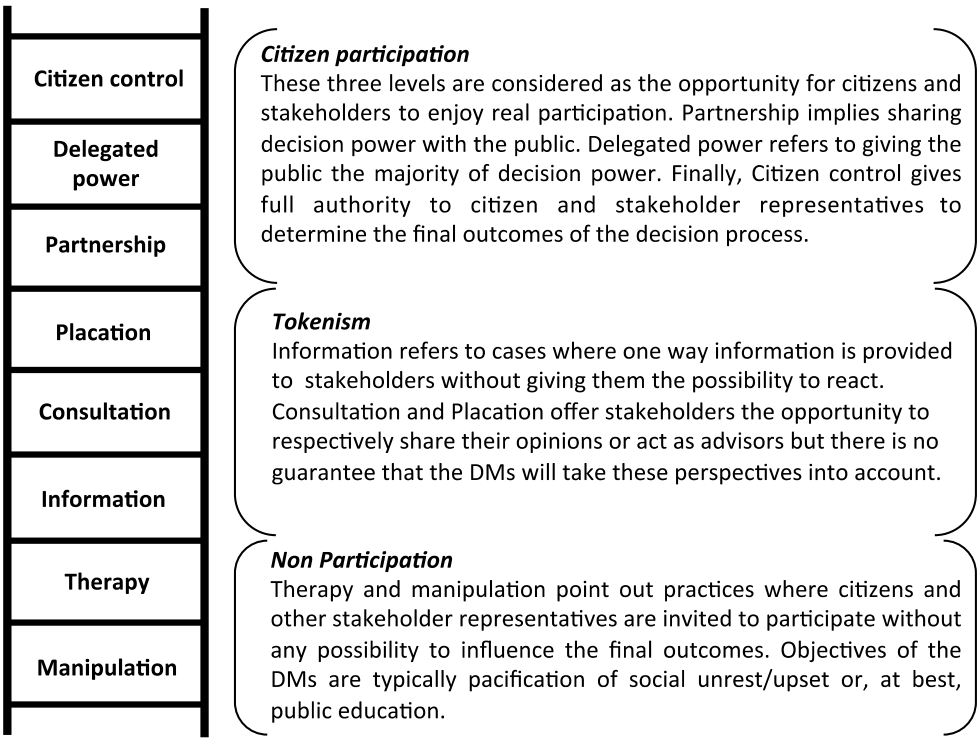
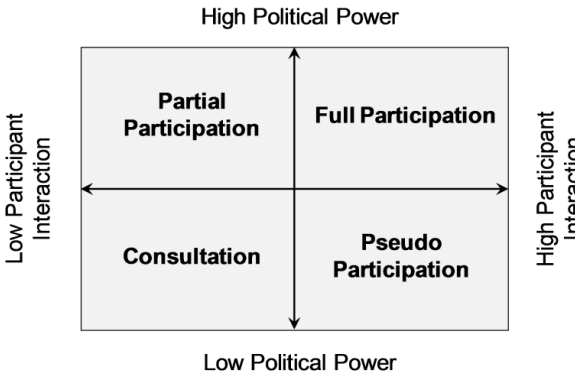
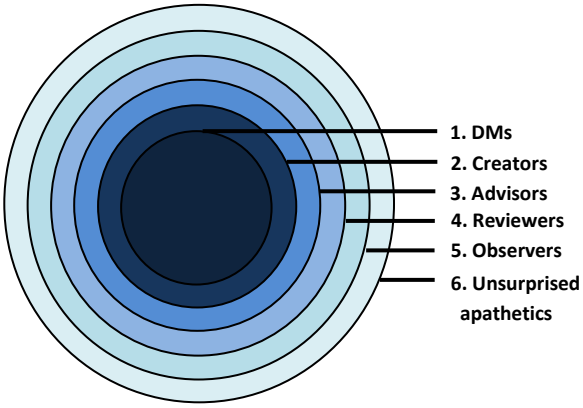


Figure 2 Arnstein's ladder of participation (adapted from Arnstein 1969)

Several other typologies based on various criteria to distinguish participation levels have been since been suggested including Pateman (1970), Aggen (1983), Connor (1988), Wiedemann and Femers (1993). Many more make minor adjustments on these themes, particularly Arnstein's ladder, and for different purposes including OECD (2001), Mostert (2003), Aslin and Brown (2004) and Mazri (2007). Most such typologies acknowledge the relevance of each participation type or of a combination of them depending on application contexts.

Table 1 summarizes a few examples of these typologies and the distinction criteria associated with them.

Table 1 Typologies of participation levels.

Authors	Distinction criteria	Participation levels
Pateman (1970)	Considering the level of interaction that occurs, and level of potential influence on decisions, a matrix of 4 categories of participation is distinguished	
Aggen (1983)	Considering the energy required by each stakeholder to sustain a participation level, 6 levels, represented as orbits more or less distant from a nucleus being the decision making process are distinguished.	
Wiedemann and Femers (1993)	Similar to Arnstein (1969), based on the need to empower individuals and communities, levels of responsibility in decision making, as well as availability of information are considered as criteria to distinguish various participation levels.	▪ Public right to know ▪ Informing the public ▪ Public right to object ▪ Public participation in defining interests and determining the agenda ▪ Public participation in assessing risk and recommending solutions ▪ Public partnership in the final decision.
Connor (1988)	Levels of participation are distinguished according to their ability to deal with various levels of	▪ Education ▪ Information feedback ▪ Consultation ▪ Joint planning

	dispute resolution.	▪ Mediation ▪ Litigation ▪ Resolution/prevention

Of course, there is no ideal type of participation and a decision process may combine different types of participation in order to satisfy different objectives (refer to Figure 1). Therefore, defining participation forms and their combinations regarding a specific decision process is a highly relevant product for an analyst to develop in a decision-aiding role.

c. Variety of topics and problems

A single decision process can raise several issues that interact and contribute to shaping each other creating complexity (Holland, 1992). Each of these issues may present distinct properties leading to different types of debates, and consequently, requiring different forms of participation.

For example, Chess, Dietz and Shannon (1998) suggest characterizing discussion issues according to two distinct criteria

- *State of value agreement:* Deliberations may uncover various value systems between which different levels of divergence would modify the way in which these deliberations should be conducted. When deliberations are focused on values, it requires the expression and combination of a variety of norms and rationalities and leads to the need for preference elicitation (Fürnkranz and Hüllermeier, 2010), problem structuring (Rosenhead and Mingers, 2001), conflict resolution (Janis and Mani, 1976; Renn, 1995) and consensus building (Regan et al, 2005). For instance, the question of "how safe is safe enough?" (Fischhoff et al, 1978) is an old, recurrent and key question in all decision processes involving risks. Even if the answer should be based on scientific arguments, the acceptability frontier is a matter of values and risk appetite level of the involved and affected stakeholders.
- *State of knowledge:* Level of scientific controversies related to an object of debate influence the way deliberations are conducted. The main difficulties here relate to building integrated expertise, dealing with individual and combined uncertainties (Jallen et al., 2001), facing ambiguities in results interpretation (Renn and Klinke, 2002) and installing a constructive dialogue between experts and non-experts. The question of electromagnetic fields impacts on human health is a complex question where various, and sometimes conflicting scientific elements exist today (Repacholi, 2001) and require both expert interactions and popularization efforts towards non-experts.

Another complementary perspective is given by Renn and Klinke (2002), who studied types of deliberations occurring in environmental risk management processes. Complexity, uncertainties and

ambiguities in topics discussed are suggested as key factors leading to shape differently the participatory process by requiring different types of stakeholders to use different types of discourses. Consequently, a continuous scale distinguishing simple, complex, uncertain and ambiguous issues is used to classify various types of discourses, respectively: instrumental; epistemological; reflective; and participative, and consequently, different participation contexts.

The various typologies described above differ in the factors considered to distinguish forms of participation. However, they both agree on the fact that the characteristics of issues may lead to the need to involve different type of stakeholders and, consequently, generate different types of deliberations.

Accordingly, the analyst needs to address the challenge of combining different issues requiring different deliberation contexts within a unique decision process and with the aim of achieving the set of objectives described above.

d. Participation process resourcing

How participation is to be carried out through decision-aiding processes, relates not only to ideal types, but also to what physical resources can be made available for the process. Important resources that will impact on the type of decision-aiding process that can be designed and implemented (including the choice of methods or tools further discussed in the next section) include:

- Time and finance
- Appropriate human resource availability
- Skills in designing and using methods
- Organisational will and leadership
- Existing trust levels and relationships
- Power to make and implement decisions
- Knowledge of the policy area
- Stakeholder interest and capacity in engaging (both agencies and communities)

e. Variety of participation methods or tools

For different levels and issues of participation, a variety of participation methods and tools can be chosen. Many authors have outlined a number of different methods that analysts can choose and learn to use to support decision-aiding processes (e.g. Steyeart and Lisoir, 2005; Creighton, 2005). Some of these methods that can be used in combination through such processes are outlined in Tables 2 and 3. These range from less interactive methods (Table 2) to more interactive methods (Table 3) and have different purposes, constraints, costs and possibilities for numbers of participants.

Table 2: Common less interactive and "more interactive" participation methods with some of their properties (adapted from Daniell, 2011)

Methods	***Ideal use***	***Cost***	***Participant numbers***	***Potential challenges***
Mailouts / press articles / broadcasts	Broadscale information distribution/ awareness raising	Inexpensive to very expensive depending on medium and participant numbers	Few to very large numbers	Tailoring information to audience; finding attractive format
Information stands / roadshows	Providing overview information and/or people to explain information	Inexpensive to very expensive depending on length/ size /location of roadshow	Potentially large numbers	Making information easily understandable to people; finding knowledgeable people able to answer questions
Town hall / public meetings	Providing overview information and/or people to explain information	Relatively inexpensive	Dependent on size of meeting hall. Typically <2000	Can heighten conflict if information is contentious or disputed; difficult to hear many voices
Public presentations / Q & A sessions	Providing information of interest and encouraging some debate	Relatively inexpensive to expensive depending on technology used	Dependent on room size unless televised. Typically <200	Requires a good facilitator to maintain a positive Q&A session
Mail, phone and in-person surveys	Eliciting information from a targeted population	Relatively inexpensive to very expensive based on participant numbers	Dependent on survey design and resources to carry it out. Potentially large numbers	Obtaining expertise to develop and administer a useful and well-constructed survey
Delphi analysis (typically experts)	Developing a structured expert view on a issue	Relatively inexpensive	3 to many (especially web-based Delphis)	Facilitation of method use and choice of experts
Consultation by written submission	Eliciting feedback with a view to considering new information and differing opinions in decision-making	Varies greatly on number of participants and synthesis work/technologies involved	Potentially large numbers	Not being a superficial process; synthesis and treatment of submissions

Table 3 Common more interactive participation methods with some of their properties (adapted from Daniell, 2011)

Methods	***Ideal use***	***Cost***	***Participant numbers***	***Potential challenges***
Citizens' juries / consensus conferences	Developing judgements on controversial or little publicly examined topics	Relatively inexpensive to vary expensive depending on size/technologies involved	Approx 10-150	Organisation of the events; having political buy-in to considering decisions/ recommendations
Participatory modelling	Developing shared representations as a basis for joint-investigations and informing decisions	Inexpensive to expensive depending on scope and technology	Approx 5-50	Managing organising team and participant dynamics / effectively structuring complex information

Facilitated workshops / focus groups	Encouraging dialogue and collaborative work, including making tradeoffs through use of techniques such as multi-criteria decision analysis	Relatively inexpensive	Approx 10-30 per workshop. More can be handled in parallel by multiple facilitators	Establishing agreed workshop aims and finding effective facilitators who can work with participants to achieve them
Games (role-playing, simulation, on-line...)	Developing understanding of a specific situation and impacts of actions	Inexpensive to very expensive depending on game development costs/technology	Variable depending on game and platform	Finding resources for game development; having access to appropriate props/technology
Problem structuring methods	Aiding decision-making in complex, uncertain and conflict-ridden situations	Inexpensive to expensive depending on participant numbers and technology	Approx 5-50	Finding facilitators with a working knowledge of the required methods
Visioning / scenario building/ search conference	Developing and assessing potential futures	Vary variable based on participant numbers and technology	Approx 5-150	Finding facilitators with a working knowledge of the required methods
Participatory planning / GIS	Jointly developing action plans and spatialising information provided by participants	Vary variable based on participant numbers and technology	Variable depending on scope of planning process. Large numbers can participate through online GIS systems	Finding effective facilitators and having access to GIS technology/ maps or spatial models
Participatory evaluation	Encouraging participant reflection and learning with a view to applying lessons in the future	Vary variable based on participant numbers and technology	Variable depending on scope of evaluation	Finding facilitators and evaluation specialists with a working knowledge of the required methods
Discussion forums (online, TV, in person...)	Encouraging dialogue, debate and mutual learning	Vary variable based on participant numbers and technology	Variable depending on media. Effective interaction likely with relatively small numbers.	Finding discussion facilitators and mediators; developing appropriate platforms for interaction if online or on TV
Multi-lateral negotiations	Developing joint agreements or treaties	Inexpensive to extremely expensive depending on level of negotiation/participant types (i.e. security costs for high-level participants)	Variable Typically 3 to 200	Finding effective mediators, chairpersons and information synthesisers/drafters
World cafés	Developing conversations and collective understanding of multiple inter-connected issues	Relatively inexpensive to very expensive depending on participant numbers	Variable depending on aims. Can range from 12 to hundreds or thousands	Organisation of the event; continuing the conversations after the end of the event and acting on knowledge

Advisory panels	Developing and synthesising knowledge and opinions to inform decision-making processes	Inexpensive to very expensive depending on supportive structures	Variable depending on aims. Can range from 5 to hundreds or thousands	Selecting a broad range of advisors who will be able to work effectively together and add value to decision-making

f. *Evaluation of participation processes*

Evaluating participation processes is of particular interest to the analyst, whose legitimacy is based on his ability to improve the way decision processes are conducted. In other words, it is of vital importance for the analyst to demonstrate that his support in dealing with participation increases the quality of the decision process perceived by participants comparatively to any other seldom way of dealing with it.

Therefore, the definition of a set of quality criteria against which the analyst's support can be assessed regarding participatory aspects is required.

Different evaluation criteria or more modestly, good practices, have been suggested in literature (Covello and Allen, 1988; Covello, 1991; Webler, 1995; Stern and Finberg, 1996; Walker et al., 1998; Wiedemann et al., 1998; Bertrand and Martel, 2002; Jones et al., 2009; Daniell, 2012). We will focus in the following on three references that we believe are representative of some of the most important points in this literature both regarding dimensions considered and formalization level.

Fiorino (1990) distinguished four evaluation dimensions to be systematically considered:

- Encouraging non-experts'/citizens'/stakeholders' direct participation.
- Offering these groups the ability to influence decision making.
- Promoting direct (face to face) discussions.
- Ensuring fairness of these groups' access to the debate comparatively to experts and decision makers.

Rowe and Frewer (2005) expanded the set of evaluation criteria and suggested the following dimensions:

- *Representativeness* addresses the ability of the participatory decision process to adequately represent the potentially wide variety of opinions and values regarding the considered topics.
- *Independence* of the authority in charge of managing the participatory decision process. However, the authors note the difficulty in satisfying this criterion when the decision maker is also in charge of the decision process. Moreover, in some cases it will not be practical or desirable to maintain this criterion, but as long as the positions and responsibility structures of those involved in the development of the participation process are understood and

negotiated (i.e. the *transparency* criterion) are upheld, it is unlikely to be problematic (refer to Daniell, 2012 for further discussion).

- *Early involvement* of stakeholders in the decision process, even if the authors do not provide indications on "*How early is early enough*?"
- *Influence on decision making* for those involved in the participation process (i.e. planned decisions have not already been made)
- *Transparency* of how the decision process will be undertaken and stakeholders' input considered or used
- *Access to resources* in order to adequately understand the issues and structure arguments and opinions.
- *Identification of debate topics* in order to ensure that the various dimensions of the issues brought into the process by participants will be effectively treated.
- *Use of decision support approaches* to deal with the inherent difficulty of elaborating multi stakeholder evaluation models (criteria definition and weighting, preferences elicitation…).
- *Efficiency* in resources consumed by the decision process.

Another founding work on evaluation criteria for deliberative situations has been suggested by Habermas (1987; 1992) who proposed a set of conditions to be respected in order to reach what he called an *ideal speech situation*. The term *ideal* here refers to a perfect but theoretical set of conditions to be enforced if one wants to offer a satisfactory framework for a debate.

According to Habermas, offering an ideal speech situation requires the satisfaction of two criteria: **fairness** and **competence**.

Fairness refers to the ability to offer comparable chances to access the debate for all stakeholders. Habermas suggested some clear recommendations on how to implement such a criterion:

- all stakeholders have equal rights to attend the debate;
- all stakeholders have equal rights to express and defend their claims;
- all stakeholders have equal rights to contest claims presented by other participants to the debate; and
- all stakeholders have equal rights to define decision rules and validation procedure in case of lack of consensus.

The criterion of competence imposes some requirements on the stakeholder interested in participating to the debate. Those requirements are (see also Watzlawick 1967):

- *Cognitive competence,* addressing the ability to develop logical reasoning.
- *Linguistic competence,* addressing the ability to formulate logical reasoning in a comprehensive manner.

- *Pragmatic competence,* addressing the ability to use language effectively in order to achieve a specific purpose and to understand language in context.
- *Interactional competence,* addressing the ability to understand and use interaction rules and norms.

The practical recommendations described above are just examples of how such criteria can be translated operationally. The reader may find in Webler (1995) an extensive discussion on their interpretation and operational signification.

Here again, this brief review of quality evaluation models shed lights on the need for the analyst to set the quality criteria he expects to be met regarding the way stakeholders should be involved in delivering the various products described earlier.

The challenges described above offer a global view of the main difficulties each analyst supporting clients in a participative context should acknowledge, understand and tackle in a formal and abstract way according to the definition of decision aiding we suggested previously.

However, the main question is to evaluate the ability of the various artefacts identified and described in section 2 to correctly deal, or at least provide insights, on those various challenges. We will treat this issue further in the next section.

IV. Formalizing analysts' intervention issue in participative contexts.

Decision aiding as one type of scientific intervention in organizations, adopts an "organizational simplification" (Hatchuel and Weil, 1992) by focusing on one specific category of stakeholders being decision makers. Therefore, analysts' interventions have always been centered on a quasi exclusive relationship with a client being the decision maker.

However, in a context where decision makers accept to share their decision power or to consider other rationalities, instead of exclusively rely on their own, analysts need to expand the set of interactions that they organize to all stakeholders considered relevant to build the rationality on which the final decision will be based. This is already partially done through $<\mathscr{A}>$ (set of actors to be considered during the decision process). However, analysts are interested there in identifying stakeholders and not really in defining their respective roles, contributions and interactions with the analysts and the other stakeholders during the decision aiding process. The original model $<\mathscr{A}>$ may register the existence of "de facto participation", but neither defines it nor helps to design it. This lack of definition of participation terms within the decision process may lead to different types of interactions and thus, shape differently the various artefacts of the decision aiding process.

In other words, lacking a definition of participation terms within a decision process leaves analysts incapable of:

- demonstrating that the artefact construction they organize in the decision process is done in the best possible way;
- ensuring the clients that they have correctly anticipated the various participation difficulties and challenges that may threaten the decision process.

To further illustrate this, let us take an example.

Consider a wedding planner (the analyst providing decision support) hired by the bride and the groom (the decision makers) to support their choices and to help satisfy a set of expectations regarding the wedding ceremony. A first exploration of those expectations by the analyst shows up the following key problem dimensions:

- *In addition to their own vision of what the ceremony should be, the decision makers are also strongly attached to satisfying their respective family traditions and ensuring their friends are having fun.*
- *Both decision makers are not very familiar with all the traditional constraints imposed by their respective families as they have never been interested in such aspects before the ceremony. An important part of knowledge needed to carry out the decision process is thus to be obtained from both families representatives, especially the parents.*
- *Friends from both sides may have different definitions of the notion of "fun". The decision makers expect the analyst to understand this variety of representations and suggest satisfactory alternatives. Furthermore, the decision makers know that some of their friends would like to prepare a surprise during the ceremony. They would like the analyst to ensure that room is left in the organization for such a surprise.*
- *Finally, decision makers fix a budget limit they do not want to exceed.*

This short example, on which we will rely also to illustrate some of our reflections in the next sections, shows that the analyst cannot rely exclusively on the decision makers' rationality. Part of it has to be constructed and shaped during the decision process with respect to various stakeholders contributions (their respective parents and friends in this case).

The organizational simplification usually adopted in decision support is thus of little help as the analyst here needs to structure the participation of at least three different categories of stakeholders. Therefore, in addition to the clear status given to the analyst and the clients, it is necessary to clearly specify roles and statuses of the other stakeholders in <$\mathscr{A}$>.

Accordingly, we suggest enriching the organizational simplification classically adopted in decision aiding by inviting analysts to explicitly consider the following issues:

i. Definition of the participation process objectives

As stated previously, stakeholders may seek various objectives when entering a participative process: information sharing, decision making, conflict resolution, etc.. These objectives may be equivalent, complementary or in contradiction with the clients'.

Achieving such a variety of objectives through a unique process may be hard or even impossible. It is then necessary for the analyst to acknowledge this variety very early so to calibrate the decision process and either answer these various expectations or facilitate the exclusion of some objectives considered as incompatible or impossible to achieve.

In addition, by informing the stakeholders before they invest resources in the decision process about objectives adopted and potentially rejected, the analyst can provide more transparency and legitimacy to the decision process.

Going back to our example, if the decision makers want their parents to participate in the decision process as consultants regarding their respective expertise in traditional ceremonies; it seems that the parents expect more of the participation process as they see themselves as the guardians of traditions and values to be preserved. Therefore, they ask for a share in decision power. To ensure that these traditions and values are fully respected, they also offer the possibility of investing additional resources to relax the financial constraints defined by the decision makers.

Finally, the analyst foresees potential conflicts between the two families as the traditions are not always compatible. In addition, the analyst starts getting worried about the compatibility of the friends' surprise and both families' traditions.

This example shows how the analyst asked by the decision makers to consult families and friends about their expectations regarding the ceremony ends up with:

- some of the stakeholders not interested in limiting their participation to consultancy but expecting a share of decision power;
- the possibility of relaxing the financial constraints of the decision makers; and
- the possible emergence of future conflicts;

Consequently, the first objective of the participation process being the collection of families' and friends' expectations is now challenged by new objectives either introduced by participants (now considering parents as decision makers) or by the problem configuration (conflict resolution in case of incompatible traditions).

ii. Definition of the participation level or form each stakeholder should be given within the decision aiding process.

Table 1 in this document has provided a summary of the various scales existing in literature to discriminate participation levels or forms. The point here is not to recommend one scale

over another; it is rather to state that participation can be performed through various means, at different moments and with various levels of impact on the final decision.

Within a decision process, the issue of how stakeholders should participate can be divided into two sub questions:

- *How to participate?*

  From information sharing to decision power sharing, there is a continuum of participation forms that provides stakeholders with various power levels to impact the decision process. Furthermore, literature review presented earlier demonstrated that various types of topics and issues may require different types of deliberations to be correctly considered. The analyst should thus acknowledge that various forms of participation could cohabit within the same decision process.

- *When to participate?*

  Each artefact described in the decision aiding model can be co-constructed participatively. For instance, various rationalities and problems definitions can be considered when setting up the problem formulation. Various value systems and preferences can also be considered when elaborating the evaluation model.

If the fact that different stakeholders may experience different forms and levels of participation is already well acknowledged by the literature as described earlier, we believe it more difficult and sensitive to acknowledge that one single stakeholder may experience different levels of participation within the same decision process, depending on, for example, his or her resources, stakes and values.

For instance, if the decision makers in our example accept a share of decision power with their parents to ensure that traditions are fully respected, should this mean that parents are given the possibility of also deciding on other aspects of the wedding such as the type of flowers, table settings, ceremony location and menu?

Depending on the participation objectives and individual resources and stakes, the analyst needs to calibrate the types and levels of participation of each stakeholder for each artefact. From the stakeholders' points of view, this means that their participation will take different forms depending on the artefact considered, ranging from no participation to a share in decision power regarding the validation of the considered artefact.

However, the construction and justification of such an organization model and the associated choices need to rely on a rationality which is both scientifically sound and perceived as legitimate by the various participants. Otherwise, there is a risk that the stakeholders will reject the organizational model and, consequently, the decision process.

The need to construct the legitimacy of the organizational simplification leads us naturally to the third issue being the quality criteria to be adopted when defining participation terms.

iii. Definition of quality criteria to evaluate the participative orientations adopted in the decision process

In the decision aiding context, the definition of quality criteria against which the participation structure is evaluated aims firstly at building its legitimacy not only for the decision maker, but also for all the other stakeholders, whether they are identified as participants or not.

We have seen earlier that various quality criteria have been suggested by the participation literature. A first level of difficulty for the analyst is thus to select one or several of these evaluation criteria to answer contextual needs and still keep the decision process manageable.

However, we foresee a higher level of difficulty when it comes to confronting these evaluation criteria with the decision makers' rationality and personal objectives. For instance, the short literature review presented earlier suggests a set of criteria to ensure the best possible deliberations through for example, fairness, competence, efficiency, representativeness. This may clearly come up against the decision makers' expectations, being for instance the limitation of participant numbers or the manipulation of the participation process to validate predefined solutions.

For instance, Ostanello and Tsoukias (1993) in their analysis of the dynamics of interorganisational decision processes suggest different possible states towards which a decision-maker may like to see an interaction space (IS) established for a given decision process evolve:

- <CE>: *controlled expansion*, expanding the set of stakeholders allowed to enter the IS through explicit or implicit participation filtering,
- <NCE>: *non controlled expansion*, expanding the set of stakeholders entering the IS without any control or participation filtering;
- <CC>: *controlled contraction*, reducing the set of stakeholders within the IS, through appropriate convincing or enforcing actions;
- <ST>: *stalemate*, the IS remains idle and nothing occurs in any direction;
- <IN>: *institutionalization*, the IS is transformed in a formal structure with explicit participation rules and power sharing;
- <D>: *dissolution*, the IS is dissolved, all stakeholders leave it.

In assessing participation we need to show whether this is consistent with some strategy about the dynamics of the IS.

Whatever the agreement level between the decision makers' own objectives and the quality criteria described earlier, the construction of an evaluation model of the "organizational simplification" is a crucial issue of the decision aiding process and should thus be treated explicitly by the analyst. The paper's objective is not to plead for greater attention to be paid to the decision maker's rationality or the criteria for the best possible deliberation; it is to warn the analyst that this issue should be explicitly treated and the risks associated to each evaluation model assessed, not only with regards to the decision maker's expectations, but also with respect to possible stakeholder reactions and their impacts on the decision process.

iv. Definition of the resources and methods to be used for the participation process

The previous section (including Table 3) highlighted some of the resources and methods that an analyst can consider in the choice of how to design and implement the required participation process.

In our example the analyst will likely have to rely on the trust and relationships between the clients and the stakeholders (their parents) to bring them into the participation process. The clients will also likely not want to dedicate scarce financial resources to the participation process, so the analyst will have to find inexpensive methods of including them in the process. This could include the decision-makers undertaking individual interviews with their parents (less interactive) or the analyst convening a wedding planning "workshop" where the expectations, traditions, clients' objectives and compatibilities can be explored in an interactive fashion. With such a latter process there will be greater risks to manage in terms of inter-family and client-stakeholder conflict, but potentially greater benefits in the stakeholders feeling greater appropriation of the process and likely to dedicate greater financial resources. The analyst therefore needs to determine if he or she has the required facilitation skills to manage this group and/or capacity to find a colleague with the skills to do so.

The four working axes described here address issues that have been identified as important in the participation literature outlined earlier, but not explicitly considered in the decision aiding processes literature. These axes do not constitute an exhaustive answer to all challenges raised by participation issues, especially those related to extreme sensitivity of local conditions described earlier. However, by ensuring analysts' systematic consideration of these issues, we believe they should bring more validity and operability to decision aiding interventions within participative contexts.

Operationally speaking, the enrichment of the "organizational simplification" suggested here requires a revision of the set of artefacts used to describe the decision aiding process. In the following section we therefore suggest an enhanced descriptive model of the decision aiding process.

V. An enhanced model of decision aiding process in participatory contexts

In order to suggest an enhanced descriptive model of decision aiding that acknowledges the participative dimension of decision making, we will rely on the model described in chapter 2 of this paper. Regarding the set of already defined artefacts in this model, we will either:

- suggest additional artefacts, if we believe them necessary to enrich the organizational simplification used in decision aiding;
- Provide complementary comments to ensure that existing artefacts correctly address the participation issue.

The suggested steps and artefacts composing the enhanced model of decision aiding are the following:

Step 1: Problem situation

As described earlier, the main objective of this first step is to build a common understanding of the problem to be resolved. Several problem situations may co-exist and reflect various rationalities interested in a common object. Therefore, the aim of this first step should be a description as exhaustive as possible of this variety of problem descriptions and associated rationalities.

To do so, the analyst's actions should be organized according to the following productions:

- <$\mathscr{A}$>: The set of actors to be considered during the decision process.
- <D>: Description of the actors identified according to the following dimensions:
  - The set of stakes each actor wants to bring within the decision process.
  - The set of resources each stakeholder is committed to invest on his stakes and on other participants stakes including the methods to shape interactions between actors in <$\mathscr{A}$>.
  - The set of participation objectives motivating the actor to enter the decision process.
- <Θ>: The set of objects each actor wants to be treated within the decision process. We define here the concept of object as *a formulation of an issue, problem or topic considered by at least one actor as related to one of his stakes, resources or participation objectives.*

Step 2: Participative structure.

Comparatively to the previous model described in chapter 2, this is a new step aiming at designing a context adapted organizational simplification. More precisely, instead of a systematic simplification focused on the client-analyst interaction, this step opens the possibility to adapt the organizational simplification to the specificities of the decision process.

It is proposed that the design of this organizational simplification be performed through a participative structure that defines the participation levels associated with each participant related to each artefact of the decision process.

We define a participative structure according to the following items:

- <Ω>: Set of quality criteria to be respected by the participation structure. One can rely on the criteria described earlier in our literature review.
- <$\mathscr{A}$>: The set of actors to be considered during the decision process. An extension of this component of the model for more complex multiple analyst and inter-organisational decision-aiding processes is provided in Daniell (2012), which considers that the set of actors, A, can be further specified to include:
    - a subset of 'core participants', C, who interact in the decision-aiding 'interaction space' (see Ostanello and Tsoukias, 1993) → C ⊆ $\mathscr{A}$;
    - a subset of 'associated stakeholders' , K, who may be either directly related to the core participants through organisational or personal affiliation, or unrelated to the core participants, where their stake in the problem situation may be known or unknown to core participants → K ⊆ $\mathscr{A}$; and
    - a subset of 'decision aiding team members', T, such as the analysts who may responsible for facilitating, organizing and managing the participative process, or carrying our more traditional OR decision analysis activities. Members of this subset may either also be 'core participants' or 'associated stakeholders' at any point in the decision-aiding process → T ⊆ $\mathscr{A}$, $\mathscr{A}$ = C ∪ K .
- <Γ>: Set of participation levels of each actor. Although there is no unique scale of participation levels, the reader may find in table 1 a summary of some scales used.
- <Θ>: Set of objects to be dealt with during the decision process. This set is an aggregation of the various objects brought by each actor in the previous phase. Redundancies, complementarities or wrong formulations are here to be considered by the analyst to reformulate and propose to participants a set of coherent and well structured objects.
- <Ψ>: Set of objectives associated with the participative structure.

All these productions need to be validated by the client(s). However, we suggest elaborating them according to the following guidelines:

- Satisfy any regulatory requirements, if they exist, related to participation in the decision process.
- Acknowledge the openness of the client to participatory processes.

- Ensure that quality criteria defined in Ω are respected when defining the five other artefacts.
- Match the objectives associated with the participative structure with available resources to conduct the decision process.
- Match the participation levels of each actor with the objects' properties and resources available for the participative structure. We have seen earlier in this paper that various types of topics may require various types of deliberations, and thus, various types or methods of participation.
- Acknowledge the opinions and requests of the actors in $<\mathscr{A}>$ for each of those artefacts. More precisely, the analyst(s) should remember that each actor's request be considered when defining those artefacts as this will likely increase the legitimacy of the participation structure, and finally, of the decision process.
- The six products are mutually interrelated as none of them can be shaped independently from the five others. Basically, the set of actors influence and is influenced by the set of objects; the participation types affected to each actor depend on his contributions to every object and the resources available; the set of objectives will depend on the stakeholders and objects to be discussed…
- The six products can evolve during the decision process in accordance with the evolution of ideas, positions and knowledge of actors. Consequently, the analyst(s) will pay attention to constantly acknowledge the dynamic character of those products.

The participative structure designed here describes a context of an adapted organizational simplification that should frame the interactions of the analyst(s) and the client(s) with all actors in $<\mathscr{A}>$ during the next steps of the decision process. The guidelines described above should ensure that this participative structure represents an appropriate answer to the problem specificities in one hand (defined within step 1) and quality criteria defined in Ω .

Steps 3 and 4: Problem formulation and Evaluation model

As described in section 2 there are a number of steps that represent a journey from the real world to an abstract one when the analysts will deploy their abstract and formal knowledge to elaborate problem formulation and evaluation models.

Comparatively to the previous model, no new artefacts are required. However, each artefact in these steps needs to be organizationally performed accordingly to the participative structure defined in step 2. For example, the set of dimensions $<\tilde{\mathscr{V}}>$ has to be performed with respect to the organizational terms defined in the participative structure which implies reflecting on and deciding on issues such as:

- Who should participate in the definition of those dimensions?
- How each of those actors will contribute to the definition of those dimensions: information, information with feedback, consultation, co-elaboration...?
- Which participation objectives are satisfied through those participation terms?
- How the way those dimensions have been defined satisfies the quality criteria of the participation structure?

Further such questions and the ethical dimensions of these that an analyst is likely to grapple with are outlined in Daniell et al. (2009).

Step 5: Validation of recommendations

The original decision aiding model focuses the validation phase on the ability to demonstrate the robustness and acceptability of the final outcomes. Although these aspects are important, we believe that validation should also be expanded to the organizational terms that framed the way the decision process has been conducted.

There are two key arguments that underline the need for such an extension:

i. The constructivist perspective of decision aiding adopted in this paper places the process of stakeholder selection and participation at the center of the various intellectual constructions stemming from the decision process. Forgetting or marginalizing stakeholders, which included preventing them from expressing and sharing their representation(s) at the right time with the right participants may lower the quality of the decision process outcomes. In other words, an unfitted organizational simplification may lead to a deterioration of the quality of the decision aiding process.

ii. With a limited number of resources, analysts and decision makers will have to make some difficult choices leading to a limited integration of some stakeholders and objects within the participative structure or even their total exclusion. As trust in both private and public institutions is a rare commodity in our modern societies, the legitimacy and relevance of these choices have to be strongly reasoned and able to be defended if either suspicious or even adversarial observers attack the participative structure. Here again, the legitimacy of the organizational simplification will benefit the legitimacy of the whole decision process.

To do so, the analysts can be invited to evaluate, with the clients and the participants, the way the decision process has been conducted regarding the quality criteria defined in Ω. Actually, several practical recommendations (Rowe and Frewer, 2000; Etienne 2010, Daniell, 2012) as well as regulatory frameworks (Mazri et al, 2010) recommend a global assessment of the participation process at its conclusion.

Finally, the technical validation of the outcomes and the organizational validation of the process leading to those outcomes should offer the analyst the opportunity to either demonstrate the

legitimacy and high quality of his decision support or identify weaknesses to be revised and corrected.

VI- Conclusions

By reviewing the decision aiding models on the one hand and participation challenges on the other hand, we tried to show that:

- Decision aiding models do not sufficiently address the challenges related to supporting a client dealing with participative processes. Although the existing literature (i.e. Rosenhead, 1981, Munda, 2004, Tsoukias, 2007, Daniell, 2012) has shed light on the need for more inclusiveness, especially in problem situation and formulation phases, it does not specify how those additional inputs should be considered during the various stages of decision aiding process and which status should be given to those inputs comparatively to the classic exclusive relationship between the analyst and the client.
- To overcome these limits, this paper suggests considering the organizational simplification to be adopted by analysts as a specific artefact of the decision aiding process. This artefact is both *necessary* and *challenging*. *Challenging* since it requires the consideration of several interrelated issues: the set of participation levels, the set of quality criteria to be respected, the set of objects open to participation, the objectives of the participation, the resources dedicated to participation, and the set of actors. Dedicated reflection needs to occur around those issues and especially related to their mutual interdependencies. *Necessary* because there is no standard model of organizational simplification as it remains a context dependant artefact requiring a subtle balance between resources available, client preferences and stakeholder expectations.
- Consequently, in addition to the classic technical validation of the evaluation model and of the recommendations, this paper suggests that decision aiding interventions should also be validated related to the legitimacy of the organizational simplification established, whether it be explicitly or implicitly.

  In simple words, we suggest that the constructivist perspective imposes not only a technical validation, but also an organizational one as an “unfitted” organizational simplification may well alter the decision process outcomes.

Shedding light on the organizational simplification underlying every outcome of the decision aiding process does not seek to discount the whole model of decision aiding. Rather, it invites an enrichment of this model through an additional artefact: the participative structure. Basically, a participative structure defines an organization linking a set of stakeholders with a set of objects through participation levels that, finally, should respect a set of given quality criteria.

This structure is dynamic from several perspectives. It may evolve as the deliberation process identifies new objects requiring new pieces of knowledge or values, and consequently, new stakeholders. It may also evolve as the individual or collective objectives change requiring new expectations to be achieved, or resources available to the structure change. For example, stakeholders may gain resources (competence, knowledge, representativeness, financial resources…) making them candidates for higher levels of participation.

Of course, developing such an organizational simplification does not resolve all the issues and challenges related to participation. As Martin and Sherington (1997) noted, participation processes are extremely context sensitive. More generally, it seems that participatory dynamics are shaped by an extreme range of parameters and determinants making each situation unique (Mac Kinnon, 1994). Therefore, the expression "the devil is in the details" applies perfectly when it comes to the management of participatory processes (Barreteau et al, 2010).

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