

Decision support in participatory contexts: The organisational design dimension.

Chabane MAZRI^{*1}, Katherine A. Daniell², Alexis Tsoukias³.

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 CNRS. 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 to deal with the complexity induced by inclusiveness requirements. Operational Research and Management Science (OR/MS) literature has been addressing these issues for a number of decades now, with a visible consequence being the expansion of analyst's role from problem solver to facilitator of stakeholder interactions.

Within this evolutionary movement of the role of an analyst, this paper develops a literature analysis that goes beyond OR/MS to highlight an additional but complementary and vital role for today's analysts: that of an 'organisational designer'. Specifically, we claim that an analyst creates—consciously or otherwise—the organisation through which the set of stakeholders involved in the decision process interact, which in turn shapes the final decision recommendations and outcomes. We also claim that the ability of this organisation to fit contextual requirements is of utmost importance for the success of an analyst's intervention. Therefore, organisational design of stakeholder participation becomes a key issue to be explicitly addressed within OR interventions.

This paper is organised to support these two claims. Firstly, it describes the terms of organisational design and the mechanisms through which it may influence the outcomes of decision processes. Secondly, we review how these aspects are already discussed within OR/MS literature in order to highlight current limitations and future possibilities for greater investigation of the place and role of organizational design in OR/MS research and practice.

Keywords

Decision processes, analyst role, organisational design, stakeholder participation.

Introduction

Participation can be defined as forums for exchange that are organized for the purpose of facilitating communication between government, citizens, stakeholders, interest groups and businesses related to a specific decision or problem (Webler & Renn, 1995). Our modern democratic societies are showing an increasing interest in participation-based approaches where each and every stakeholder, including members of the general public, can seek the legitimacy to influence policy elaboration and decisions that affect their lives. In this new era, public policy makers are expected to disclose their decision processes and seek, in addition to the classical technical validity requirements, legitimacy and acceptability of their decisions. 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 legitimisation process where decision makers have to negotiate with stakeholders to build the normative system required to support their action (Laufer, 1996).

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 or practitioner, should develop.

Stakeholder participation is an already deeply rooted issue in OR/MS literature. Problem structuring methodologies (Rosenhead & Mingers, 2001), strategic stakeholder management (Freeman & McVea, 2001) (Ackermann & Eden, 2011) or group decision Support Systems (Gray, 1987) and community operations research or systemic intervention (e.g. Midgley, 2000) are examples of distinct research strands within the OR domain where more attention is given to issues of stakeholder inclusiveness and problem structuring than to mathematical modelling of reality. Within these approaches, the role of analysts is not limited to problem modelling and solving, instead they need to also be the facilitators of multi stakeholders contributions (Keys, 2006) (Franco & Montibeller, 2010) so as to build a collective commitment for action (White, 2005); (Rosenhead and Mingers, 2001).

In this multifaceted vision of analysts' activities and associated competencies, we believe that one additional role should be brought to light due to its implications for the decision process. Specifically, we claim that each analyst's intervention in participatory contexts encompasses a large component of organisational design (OD) where the roles and terms of interactions between all the participants are set. Simply defined, organisations can be viewed as *collectivities oriented to the pursuit of relatively specific goals and exhibiting relatively highly formalised social structures* (Blau & Scott, 1962). The group of stakeholders engaged in the decision process, including the analyst and the client(s), can be seen as a collectively pursuing, amongst other objectives, the formulation and resolution of one or several problems. Accordingly, analysts must define a set of roles and interaction norms within the decision process that will constitute a more or less formalised social structure. For that reason, one can argue that analyst interventions, especially in participatory contexts, encompass a role of organisational design. For instance, a workshop facilitated by an analyst using decision support systems (DSS) can be seen as a quite simple organisation, where all participants are connected through the DSS and have similar possibilities for submitting views and discussing their relevance.

This paper has a twofold purpose. First, we ambition to raise awareness amongst the OR community on the relevance of paying attention to the organisational structure underlying analysts' interventions in order to strengthen their validity. Second, we will rely on the developments in social sciences pertaining to OD to identify the key variables each analyst should consider when planning and deploying its intervention. We will then demonstrate that, despite the attention paid to participatory aspects by various OR traditions, there is still a lack of methodological structure allowing analysts to

address in a systematic and organised way all of these variables. However, it goes beyond this paper's objectives to provide the reader with prescriptive recommendations on how to address this crucial issue. This will be the subject of a distinct forthcoming paper.

Accordingly, this paper will be structured as the followings. We will firstly strengthen the rationale for why Organisational Design needs to be explicitly addressed when planning and deploying OR interventions. The second section will be dedicated to the exploration of the concept of Organisational Design through the identification of the key variables to be considered when shaping a set of social interactions within a given decision process. To do so, we will rely on a vast array of developments in social sciences before coming back to OR literature in section 3 to question the way these variables are considered by OR intervention frameworks. Our objective is to sketch a hopefully representative vision of the strengths and limits of OR frameworks and practices when it comes to the Organisational Design dimension. Finally, we will discuss the implications of such limits and strengths for OR practices and suggest some areas of investigation for both academic and practitioner communities.

I. Organizational design: Definition and rationality in OR/MS

Organisational Design is the branch of Organisation theory (McAuley, Duberley, & Johnson, 2007) interested in fitting organisational structures to the requirements of their environments. It builds upon the theory of contingency (Galbraith, 1973) (Pfeffer, 1982) (Daft, 1992) which, reduced to its simplest meaning, holds that the most effective organisational structure is the one that fits its internal and external contingencies (Donaldson, 2006). Technology evolutions or changes in competitive environments are very often the type of contingent factors considered in designing or redesigning organisations.

Formally, designing organisations is the process of defining and implementing models of interactions and coordination that links the technology, tasks and human components of the organisation to ensure it accomplishes its purpose (Duncan, 1979). Mainly developed in the domain of business performance, Organisational Design is seen as an important leverage point of performance improvement for managers dealing with turbulent environments. Power distribution, specialization or centralisation levels are examples of variables on which Organisational Design may act to improve organisational performance.

Although these factors may seem a bit far from OR practitioners' main concerns, Organisational Design, as a research question, is interested in to what extent organisational patterns adopted by interacting individuals may influence these individuals' ability to reach what they believe are common objectives. In doing so, it questions OR practitioners and academics on the way they handle the social interaction aspects of their methodology deployment. Put in other words, and if one recognises OR interventions as a hybrid of new knowledge and new social relations (White, 2009), the question raised here is whether the set of social interactions occurring during OR interventions are nothing but a consequence of the intervention methodology(ies) adopted or whether Organisational Design is also an aspect that deserves full attention at the early stages of intervention design.

From the terminology adopted in this paper, one can already guess that our position favours the second hypothesis. More precisely, we see Organisational Design in the context of OR as the set of social arrangements, including the identification of participants and of their interaction norms, which need to be carefully defined by the analyst and/or others in order to fit both contextual situation and the intervention methodologies to be used. In doing so, the "who should participate how and when" should enter the set of questions explicitly addressed by analysts when designing their interventions.

We provide the following set of arguments supporting this claim.

An epistemological perspective: the social dimension of knowledge production

The epistemological identity of OR has been the subject of intense past and ongoing debates that go beyond the limits and objectives of this paper. Whether OR is about techniques or science (Keys, 1998), the objective vs subjective status of analysts (Mingers, 2000), the status of knowledge produced or the evaluation terms of OR interventions (White, 2006) (Midgley, Brocklesby, Wood, & Ahuriri-Driscoll, 2013) are just few examples of some of the key discussions that have not yet reached satisfactory closure.

With regard to this paper's objectives, let us pick one issue: the influence of social interactions on knowledge production in general and in OR practices in particular. Several philosophical currents recognise, to different extents (Mingers, 2000), the influential role of social structures and networks in scientific knowledge production. Sociology of scientific knowledge (Woolgar, 1988) or critical realism (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998) (Mingers, 2000) stands behind the socially grounded character of scientific productions making them neither objective nor absolute. The spectrum of social mechanisms exerting an influence on knowledge production is broad. It ranges from the impact of personal influences and backgrounds of scientists (Ravetz, 1971) to the consideration of conversational processes through which they exchange and communicate (Holquist, 1997) (Tsoukas, 2009) and, more widely, to the political and cultural backgrounds in which the research is conducted (Webster, 1991). The echoes of these paradigms have been fundamental in moving the status of OR interventions from objective and neutral (Ackoff, 1979) to a subtle and complex set of interactions involving social and technical dimensions (Keys, 1998) (Mingers, 2000) (White, 2009). Specifically, the influential character of various social mechanisms are already highlighted and discussed within OR literature. Jackson (1993) stressed the varying character of ontological and epistemological presuppositions that remain hidden in what is considered analyst common sense or 'craft knowledge' whereas Cropper (1990) shows how an analyst's personality may influence upon the way an OR intervention is conducted. At a more social level, Keys (2007) adopted the lens of design science to shed light on the way OR knowledge is produced through continuous negotiations, which makes such knowledge tightly bound to its context of development. Furthermore, theoretical frameworks have also been suggested to describe and analyse these mechanisms. Through the lens of critical pluralism (Mingers & Brocklesby, 1997) (Mingers & Gill, 1997) each OR context is described as a combination of a problem content, intellectual resources and intervention systems. Whereas the actor network framework (Keys, 1998) focuses on the network of participants in which interactions are organized and maintained through facilitation capabilities.

Thus, it can be established that focusing on the technological aspects of interventions is not enough anymore; it is necessary to pay attention to the relational aspects as well (Keys, 1998) (White, 2006) (White, 2009).

With the framing and organizing of participants' interactions being at the centre of OR knowledge creation, the shape of social structures built by analysts to support their interventions becomes an important aspect of knowledge validation and legitimization. More specifically, analysts' capacities to demonstrate the way that they organised participants' interventions is crucial, so that they can show, for example, that their organisational design has not restrained knowledge production by, for instance, leaving some key stakeholders out of the process or by hindering their abilities to promote their own representations of the problem situation.

Organisational Design thus aims at systematically questioning the very properties of the social structures underlying OR interventions in order to ensure that they display a set of key properties

believed necessary to prompt knowledge production. In doing so, the knowledge produced is expected to inherit the legitimacy of the social structure within which participants' interactions occurred.

A methodological perspective: no unique organisation can fit all decisional contexts

Here we distinguish two main methodological arguments.

Firstly, as skilled as they may be, managing the set of complex interactions in real time that occur between stakeholders involved in an intervention can quickly exceed analysts' cognitive capabilities (Brocklesby, 2009). Accordingly, putting aside the "heroic image" of analysts based on their personal skills requires additional methodological developments such as either improving real time facilitation capabilities or decreasing interaction complexity through improved organisational architecture. For instance, limiting interactions on a given issue to those who are either providers of relevant knowledge, or value systems can reduce interaction complexity and allocate other stakeholders' resources to topics of higher interest for them. Accordingly, Organisational Design can be seen as a means of handling interaction complexity through better planning. The second argument relates to the increasing complexity of intervention methodologies analyst may experience, especially if they anchor their practice in a multimethodology framework (Flood, 1996) (Mingers & Brocklesby, 1997) or other pluralist framework. Combining different methodologies, possibly grounded in different paradigms or epistemologies, is likely to combine multiple organisational architectures in order to encourage better fit with individual methodology requirements. In their account of a case study on Health services in UK, Taket and White (1998) describe how multiple workshops and spin offs of subgroups had to be organised to match with their multimethodology framework (PANDA). Sibbesen and Leleur (2006) have on their side detailed the multi level organisational arrangements required by the combination of soft and hard methodologies in supporting a large transportation company in selecting optimal locations of distribution terminals in Denmark. Accordingly, Organisational Design can offer a systematic framework to support analysts in developing the sophisticated organisational arrangements required by multimethodology applications.

An ethical perspective: procedural ethics of OR interventions

Analysts undertaking OR interventions as organisers of social interactions and providers of models and tools are highly influential on the way clients' representations and decisions are shaped. Accordingly, practice carries important ethical dimensions with which the OR community has been struggling for a long time (Walker, 1994) (Rauschmayer, Kavathazopoulos, Kunsch, & Le menestrel, 2009). Le Menestrel and Van Wassenhove (2004) distinguish three methodological approaches for dealing with ethics in OR practices. *Ethics outside OR models* carries an objective vision of OR interventions and rejects any subjective influence of analysts. If ethical issues are to be considered here, they occur in the domain of a knowledge user and not in the domain of knowledge provider. *Ethics within OR models* assume the subjective character of OR practices and fully integrates them within the models developed. Multi Criteria Decision Making (MCDM) (Roy & Bouyssou, 1993) is for instance interested in modelling decision makers' preferences and ensuring the final outcomes are faithful to this specific expression of subjectivity. The third approach, favoured by the authors, considers that ethical issues should not be only considered in the models, instead highlighting the importance of the *OR process* being the way models are implemented in the real world. *Ethics beyond OR models* is thus interested in discussing ethical consideration at the procedural level of OR interventions so to consider the social context that surrounds a model's use (Brocklesby, 2009). Ethical questions addressed at this level may

be of various natures: who is involved in framing the problem? How are expert opinions legitimate? Have alternative modelling approaches been envisaged and discussed?

Brocklesby's (2009) discussion of ethics beyond the modelling approach further elaborates on the importance of considering social dynamics when it comes to ethics. In doing so, he supports the work of Le Menestrel and Van Wassenhove (2004) although he points to some serious challenge for an analyst dealing with interpersonal complexity on a real time basis. It is here we believe Organisational Design has an important role to play. By inviting analysts to fully address, at the early stages of their interventions, the terms through which they will manage the social dimensions of the OR process, we expect to provide them with the means to ensure that the forthcoming interactions adequately embody a set of ethical requirements that they define. We will discuss in the next sections some proposals of ethical requirements that can be tackled through OD. These proposals do not have any normative purpose; they should rather be seen as inspiring suggestions to be completed or adapted to the local context, or indeed negotiated for it (Daniell, White, & Rollin, 2009).

Practical perspective: Dealing with contextual constraints

As already spotted by several contributions in OR literature (Checkland & Scholes, 1990) (Margerum, 2002) (Midgley, Brocklesby, Wood, & Ahuriri-Driscoll, 2013), analysts need to make the best of the contextual constraints in which they are embedded. Specifically, the "success" or "failure" of an intervention does not rely only on the relevance of the adopted technique; it is the result of the way the technique has been deployed given the local context. Practically, analysts may be confronted with extremely various contexts making it necessary to (re)invent the organisational terms through which they will carry their intervention. For instance, Brocklesby (2009) describes how time constraints and pressure for quick results heavily reduced inclusiveness possibilities whereas White and Taket (1997) discuss how illiteracy in developing countries modified techniques selection and associated terms of stakeholders' participation.

Accordingly, and at a pure practical level, Organisational Design may constitute a necessary issue to be considered by analysts in shaping their intervention terms so to fit local contexts.

In our case, we were involved in an intervention for the French Ministry of Environment with the aim of supporting its decentralised services that were undertaking local participatory processes for land use planning around hazardous industrial sites. After the Toulouse catastrophe in 2001 (30 fatalities), tighter regulation came to force in 2003 to reflect societal needs of increasing participation of local stakeholders and decreasing risk acceptability through stronger land use planning constraints.

Compulsory expropriation of inhabitants in high risk zones, heavy investments for industries to reduce risks or the reinforcement of buildings to cope with accident consequences were a few of the examples of decision alternatives made available by the regulator. There were high stakes for all participants, either financially because of required investments or emotionally for people attached to their social networks and asked to move away.

The regulator invited local governors, namely the Prefets, to design the participation structures that fit their local contexts. There were however a minimal set of requirements to be respected:

- i. *The Prefet remains the only and final decision maker;*
- ii. *The participation of the following representatives at a consultancy level is mandatory: Industry operators at the origin of the risk, mayors and their services impacted by the hazards, representatives of local workforce and representatives of local stakeholders impacted by the risks (including the population and other industries at the vicinity).*

iii. In addition to these representatives, deliberations should involve direct interactions with the citizen; at least one public hearing is to be carried before final decisions are taken.

This system of constraints made it difficult for our intervention to impose a predefined set of techniques or organisational arrangements. Specifically, with eight distinct interventions realised in different regions in France, technical and organisational arrangements were to be reinvented depending on various local conditions:

- *The complexity of problems at hand were highly variable depending on land use occupation specificities that could range from rural with very few stakes to dense urban areas with thousands of inhabitants to protect.*
- *Prefets attitudes towards inclusiveness in decision making were highly heterogeneous from one case to the other. They ranged from preferences for high engagement in ensuring full stakeholders and public participation to a minimalist approach with an emphasis on reducing process duration and risks of panic among population.*
- *Local awareness and knowledge about risk issues were also decisive in defining intervention terms. For example, low levels of awareness necessitated additional engagement work to increase knowledge and understanding levels among local stakeholders so as to ensure adequate understanding on highly technical matters.*

We will go back to this empirical example at various sections of this paper to comment or exemplify our statements.

With Organisational Design now having been defined and its relevance for analysts' practices established at epistemic, methodological ethical and practical levels, we will discuss in the next sections how Organisational Design has been discussed in the participatory literature beyond OR/MS.

II. Exploring the issue of organisational design in participatory processes: A literature review.

Stakeholders' participation has been embraced by extremely various research traditions (Barreteau, Bots, & Daniell, 2010) (Von Korff, Daniell, Moellenkamp, Bots, & Bijlsma, 2012). Despite the heterogeneous nature of this literature, two main research topics have been distinguished (Webler, 1999) (Webler, Tuler, & Kruger, 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, and
- The way 'good' participation should be performed and evaluated (Covello and Allen, 1988; Webler, 1995; Stern and Fineberg, 1996; Von Korff et al, 2010, 2012; Daniell, 2012).

Regarding the paper's objectives, our reflection will focus on the second set of challenges, and more especially on the way one should design the organisation that will form the medium through which stakeholders will interact. Accordingly, we will review in this chapter the developments in literature ranging from 1986 to 2016 and covering mostly environmental public decision making as addressed by social sciences. In doing so, we identified three categories of contributions which we differentiated in the following by their level of abstraction and reproducibility.

The first category is limited to a set of high level recommendations and values shaping the global contours of the participatory process without providing further details on how to practically design it. Table 1 in below provides a synthesis of two representative contributions of this category (Covello and Allen, 1988) (Stern and Fineberg, 1996).

Table 1 Examples of high level recommendations associated to organisational design.

Participative rules developed by Covello and Allen (1988) for the EPA¹	Standards for deliberation as defined by Stern and Fineberg (1996) for the NRC²
<ul style="list-style-type: none"> 1- Accept and involve the public as a partner 2- Plan carefully and evaluate your effort 3- Listen to the public specific concerns 4- Be honest, frank and open. 5- Work with other credible sources. 6- Meet the needs of the media. 7- Speak clearly and with compassion. 	<ul style="list-style-type: none"> 1- Involve the interested and affected parties. 2- Combine direct and representative democracy. 3- Ensure fairness and transparency in participants' selection. 4- Participation is needed "early" in the decision process. 5- Explicitly address external constraints, more particularly regarding legal limits. 6- Strive for fairness in the process. 7- Plan participation as a project with limited resources.
Analysis	
<p>Despite their general character, the reader may distinguish some requirements that pertain to personal qualities (be honest, speak with compassion...) whilst others refer to methodological challenges being: (i) the need to carefully identify the process' stakeholders (both direct participants and those informed through various medias); (ii) the general set of values to be respected and against which each participatory process should be assessed: fairness, transparency, honesty...; (iii) the need to adopt a project planning approach especially regarding prevision of topics to be addressed and legal requirements.</p>	

A second category of contributions has been beyond general recommendations to suggest predefined models of organisations framing participation. These models range from very simple to quite sophisticated depending on the number of participants, variability in levels of knowledge or decision power amongst participants. For instance, simple models, like *consensus conferences*, consider a set of representative citizens (from 10 to 15) for which discussions are supported by a facilitator and a set of independent experts. The *cooperative discourse model* suggests a more sophisticated organisation adapted to a larger set of stakeholders' categories interested in complex and ambiguous problems (Renn, 1995).

Table 2 in below synthesises three key and representative contributions of this category being the consensus conferences, negotiated rule making and the cooperative discourse model.

Table 2 Examples of predesigned organisations for stakeholders participation.

<i>Consensus conferences</i> (Joss & Durant, 1995) (Rowe & Frewer, 2000)	<i>Negotiated rule making</i> (US administrative conference, 2017)	<i>Cooperative discourse model</i> (Renn, 1995)
The standard organisation adopted in this model consists of a representative panel of citizens (10 to 15) which expertise will be gradually increased through dedicated trainings and interactions with selected experts. The group is expected to explore the complexity of a topic (political, scientific, ethical...) and reach a conclusion which is representative of the public opinion.	Enacted by the negotiated rule making act (1990), this second process defines the steps through which federal agencies should organize the participation of various stakeholders, including the public. The process involves the creation of a dedicated committee which missions include: (i) the identification of relevant stakeholders and associated representatives, (ii) the list of the issues to be negotiated and (iii) the appointment of a facilitator.	This last model aims at organizing interactions between three categories of participants. The first are the stakeholders directly interested in the topic(s) of concern, the second is the general public being the bearer of legitimate values and finally scientific experts. The organization designed to structure their interactions implies the following steps: <ul style="list-style-type: none"> - A first interaction is carried with the stakeholders who are asked to identify the topics of concerns and formulate associated evaluation criteria. - The various decision alternatives available are assessed with respect to these criteria thanks to the contribution of scientific experts. - Given this multicriteria evaluation, a panel of representative citizens is asked to elaborate the tradeoffs between criteria in a way that respects societal values.
Analysis In their effort to predefine the organisational structures through which participants interact, we may note that the following aspects are systematically addressed: identification of participants, determination of their level and moment of participation and the definition of topics to be addressed. In addition, a recurrent concern appears to be the structuration of interactions in a way that balances two key constraints being the respect of democratic values and scientific accuracy. These aspects refer to the ideals these structure ambition to reach.		

A third and last category of contributions addresses the issue of designing context adapted organisations framing stakeholders' interactions. In this category, we switch from selecting amongst pre-existing organisations to developing a methodology aiming at designing a one-shot organisation that fits the context specificities. It is therefore much easier to describe in the followings the list of parameters considered in deploying the various design approaches suggested.

Developments in this category are far scarcer. Table 3 in below synthesizes three key contributions representative of this level of conceptualisation.

Table 3 Examples of conceptual frameworks aiming at organisational design.

<i>Deliberation typology (Chess, Dietz, & Shannon, 1998)</i>	<i>Risk management Escalator (Renn & Klinke, 2002)</i>	<i>Criteria for evaluating the quality of public participation (Schroeter, Scheel, Renn, & Schweitzer, 2016)</i>
Authors distinguish two key variables to be considered when designing stakeholders involvement being the levels of agreement on values and on knowledge. By varying each of these two parameters, authors distinguish four contexts where organisational design should be deployed differently (Fig.1)	This second approach is quite similar to the work of Chess et al (1998) as it relies on the properties of topics being discussed to infer the type of deliberation that will take place. Developed in the area of risk management, this typology characterizes topics as either simple, complex, uncertain or ambiguous. Each of these categories is expected to generate a specific type of discourse between participants being respectively internal, cognitive, reflective and participative.	This third contribution is representative of the efforts existing in literature to define a set of criteria against which various organization designs can be compared and evaluated. In this work, authors acknowledge the relevance of the following criteria: - <i>Inclusiveness</i> or the ability for an OD to associate a large variety of relevant stakeholders including citizens. - <i>Information exchange and learning</i> or the ability of the OD to trigger high value debates and learning amongst participants. - <i>Influence on political decisions</i> or the ability given to participants to influence final outcomes.
Analysis The developments presented above are representative of various attempts in literature to sketch a set of systematic variables to be considered in OD. The two first contributions discuss, in different terms, how different types of topics lead to different categories of deliberations or discourses, requiring in consequence calibrated OD. The third contribution is representative of the efforts ¹ deployed to achieve a consensual and accepted set of criteria assessing the relevance and adequacy of the organisations designed to frame participatory processes. Despite their high level of conceptualisation, none of these contributions can be considered as a complete methodology in the sense that they fail to define all the key variables entering in OD. However, given the paper objectives, they appear as very helpful to highlight some or all of the key variables entering in OD.		

Figure 1 Deliberation typology according to Chess, Dietz and Shannon

Out of this vast literature, we have identified five recurrent variables that appear to act as the determinants of Organisational Design in participatory contexts:

- a. Identifying relevant stakeholders and discussing the rationale behind involving them in the decision process.
- b. Managing a possibly large variety of participation objectives that may cohabit within one participatory process.
- c. Defining the level of participation for each stakeholder.
- d. Technical and value laden deliberations being fundamentally different, organisation design must be flexible enough to adapt the requirements of these various types of debates.
- e. Define and agree on the yardstick against which various organisation designs should be evaluated and compared.

We will go more in depth into each of these variables with the aims of describing the mechanisms through which they contribute in shaping the complex equation of successful participation.

Stakeholder analysis

A stakeholder is any group or individual who can affect or is affected by the achievement of the organisation's objectives (Freeman, 1984). Those affected are usually referred to as the claimants whereas those who affect are the influencers (Mitchell, Agle, & Wood, 1997) (Kaler, 2002). Stakeholder analysis, especially in public related matters, acknowledges the importance of empowering claimants, especially where they lack power to influence final outcomes.

On a practical level, stakeholder analysis encompasses the three main following activities (Reed, et al., 2009):

- i. Identify aspects of a social and natural phenomenon affected by a decision or action;
- ii. Map influencers and claimants;
- iii. Prioritise identified stakeholders for involvement in the decision-making process.

More widely, a careful stakeholder analysis is fundamental for the design of adapted participatory processes for two key reasons. Firstly, each stakeholder can be seen as an asset or resource that may benefit the whole process. Either as a holder of relevant knowledge, of legitimate and representative value systems or of a new and innovative representation of the problem situation, a stakeholder is fuel for reflection and in-depth exploration of issues to be considered. Secondly, putting aside, voluntarily or not, a stakeholder may lead to decrease the legitimacy of a process and generate outrage and suspicion both among participants and external observers.

Accordingly, careful identification of stakeholders, both influencers and claimants, is of high importance when planning for social interactions.

Managing a possibly large variety of objectives

A set of stakeholders involved in a common participatory decision process can still diverge strongly on the objectives they individually allocate to it. For instance, public decision makers seeking to improve legitimacy and acceptability of their policies through public participation can end up with additional objectives of public education if the topics are complex, or of conflict resolution if discussions reveal deep disagreements amongst participants. They will also have to pay attention to individual objectives stakeholders may bring to the decision process.

The range of participation objectives can actually be extremely vast. Van den Hove (2003) distinguishes substantive purposes (e.g. improving the quality of decision making) from procedural ones (improving representativeness of society, legitimacy and acceptance of decisions, conflict management, valuing contextual knowledge as well as scientific one). Figure 2 describes a synthesis of the set of objectives for which participatory processes can be developed.

Figure 2 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 is a threat to the very identity of the participatory process for mainly two reasons.

- Firstly, some of these objectives can be incommensurable. A client interested in one-way communication to inform and educate (i.e. communication objectives) participants about

decisions already taken is likely to generate outrage among stakeholders interested in actually shaping these decisions (I;e; Democratic ideals).

We encountered this pattern pretty regularly during our work on land use planning in France especially where Prefets where viewing the whole process as a gift wrapping exercise of barely acceptable decisions whereas locals expected more transparency and early inclusiveness in the process. Mayors, on their side, were more concerned with long term perspectives and the building of communities that would continue to work together on these topics long after the closure of the ongoing decision process. This made the issue of institutionalising the participatory structure of primary importance for them.

This mix of objectives was far from being explicit at the beginning of the process and we felt it was an important part of our contribution as analysts to reconcile these various objectives in a way that makes explicit what should be in and what should be out of the collective agenda of participants.

- Secondly, it is fundamental to ensure adequacy between the set of objectives adopted in one hand and the set of available resources, in terms of competence, time and money on the other hand. Otherwise, it is likely that the whole process will collapse and fail.

In some cases, participants may agree on the process objectives but under estimate the required investments to achieve them.

Confronted with the highly technical nature of issues to be discussed, local actors and the Prefet for instance agreed at several occasions to further invest in trainings and information popularisation to ensure that everyone stayed on board throughout the deliberations.

This is why the set of objectives of a participation process should not be determined only by the decision maker. It is a construction that results from a subtle combination of the decision maker's objectives, participants' expectations, available resources, and the very properties of the topics to be considered. If these topics are too complex for instance, it might be necessary to consider information and education objectives in addition to reaching an agreement. If participants' expectations are too vast and conflicting, it becomes the responsibility of the analyst to reveal and discuss these issue with decision maker(s) before launching the participatory process. Finally, continually ensuring coherence between the decision process objectives and available resources to achieve them should form part of analysts' concerns at every stage of their intervention.

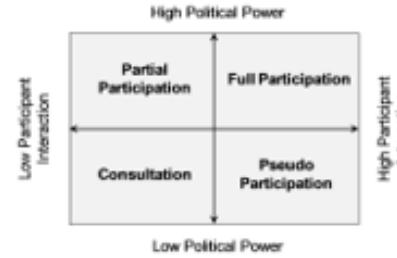
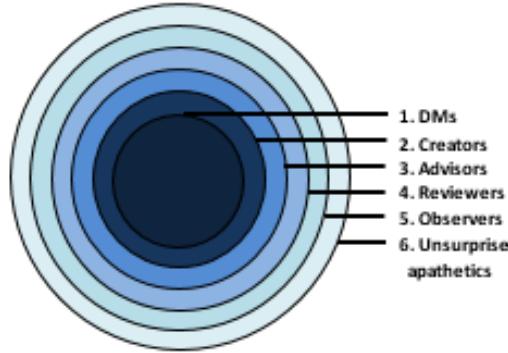
Defining the right level of participation for each stakeholder

The participation level defines the set of opportunities an actor is offered to enter into a debate. It can range from simple provision of information to the right to submit, discuss and criticise claims made by others. Actually, it is very likely, and sometimes recommended, for a participatory process to attribute various participation levels to various stakeholders.

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, focuses on the distribution of decision power through participants to distinguish various levels of participation. 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.

The reader may find in table 4 below several examples of participation levels typologies.

Table 4 Typologies of participation levels.

Authors	Distinction criteria	Participation levels
<u>Pateman (1970)</u>	Considering the level of interaction that occurs, and of potential influence on final outcomes, a matrix of 4 categories of participation levels is distinguished	
<u>Aggen (1983)</u>	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 <u>decision making</u> process are distinguished.	
<u>Connor (1988)</u>	Levels of participation are distinguished according to their ability to deal with various levels of dispute resolution.	<ul style="list-style-type: none"> ▪ Education ▪ Information feedback ▪ Consultation ▪ Joint planning ▪ Mediation ▪ Litigation ▪ Resolution/prevention

Discussing participation levels is about determining distributions of decision power within a group of participants. It also determines the extent to which interactions are more or less inclusive, and thus, the possibilities of exploring additional aspects of a given topic.

Implications of a specific distribution of participation levels in the network of actors built by the analyst to perform his or her intervention have both epistemic and ethical dimensions. Building upon the vision of knowledge as a social construction we already discussed in the first section, participants' terms of access to debate determine the extent to which new representations can be submitted, criticised and influential on the final outcomes. In other words, knowledge produced by OR interventions rely, at least partly, on the participation levels attributed to each and every actor.

At the ethical level, analysts need to build the legitimacy of their intervention so to be accepted both by those who were involved and the external observers. This legitimacy cannot only rely on satisfaction and acceptance of participants, especially in the public sphere, as the final outcomes may draw upon compromises and concessions that may dissatisfy some or all of the involved parties. It needs thus to rely on explicit and hard to dispute terms of participation. By doing so, the final outcomes will inherit the legitimacy of the process through which they have been elaborated.

Topics variety and associated organisational requirements

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 organisations.

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

- *State of value agreement:* Deliberations may uncover diverging value systems. When deliberations are focused on values, it requires the expression and combination of a variety of norms and rationalities which in consequence requires preference elicitation (Fürnkranz & Hüllermeier, 2010), problem structuring (Rosenhead and Mingers, 2001) (Franco, Shaw, & Westcombe, 2006), conflict resolution (Janis & Manis, 1976) (Renn, 1995) and consensus building (Regan, Colyvan, & Markovchick-Nicholls, 2006). For instance, the question of "how safe is safe enough?" (Fischhoff, Slovic, & Lichtenstein, 1978) is an old, recurrent and key question in all decision processes involving risks. Even if many consider that 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:* the 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 & Klinke, 2002) and installing a constructive dialogue between experts and profanes. We can cite here as an example the question of electromagnetic fields impacts on human health where conflicting scientific elements 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 were suggested as key factors shaping the participatory process since they require different types of stakeholders using different types of discourses.

Accordingly, one should remember that discussing values or uncertainties over scientific conclusions do not lead to the same type of debates. This in consequence requires anticipation of the topics to be addressed as to consequently adapt the terms of interactions.

Coming back to our illustrative example, dealing with land use planning around hazardous sites have led participants to uncover a wide range of topics:

- *Highly technical issues related to modelling of consequences and associated uncertainties, evaluation of inhabitants' evacuation kinetics, assessment of buildings vulnerabilities to explosions, efficiency of risk reduction measures, probabilistic evaluation of accidental scenarios, etc.*
- *Long term perspectives in terms of territorial developments that allow safe cohabitation of industry and other economic and social activities. A recurrent issue at this level was the relevance of heavy and long term investments for the sake of industrial activities highly threatened by economic uncertainties.*
- *Issues of fairness in terms of costs repartition between risk beneficiaries and those bearing negative effects have also been around the corner in almost every case. Discussions here were highly impregnated with interrogations on legitimacy and representativeness of statements made by various participants and the way to steer intermediate pathways fitting the variety of value systems.*

Our experience at this level is that organisations that do not fit the specificities of topics to be discussed may lead to the following pitfalls:

- *Interactions are of poor quality and become difficult to facilitate. Discussions jump from one topic to the other and in depth interactions become harder to sustain over time. Furthermore, as not all participants have equal competencies on the topics, frustration may rapidly take over as competent participants lack expression time and incompetent ones rapidly loose abilities to sustain discussions.*
- *All stakeholders faced with the complexity of issues regularly asked for additional delays for different purposes. The Prefet technical services who were in charge of conducting or coordinating the expertises required by deliberations often needed to conduct complementary studies to answer questions raised by participants or to address new types of uncertainties revealed by the debates. Local authorities and public representatives expressed at several occasions their distrust with regard to expertises conducted by Prefet technical services and counter expertise were required. Finally, several representatives, including local authorities and inhabitants associations, asked for additional delays to discuss the technical matters with their respective communities.*

Actually, by fitting organisation design to topics specificities, we believe the analyst is provided a new lever to ease interactions facilitation. We have discussed in the previous section how this easing can be performed either through improved facilitation techniques or thanks to better organisational design. We do not claim that topics can be fully anticipated as new ones may appear during debates. However, a fair amount of anticipation and continuous adaptation to new topics emergence may provide the analysts with the right organisation shape that will smooth group facilitation.

Terms of evaluation of participatory processes

With respect to the social dimension of OR interventions, it is expected from the analyst to demonstrate a rationality that is both ethical and contextually adapted behind the interaction terms he decides to establish within the network of actors and contributors to the decision process.

In other words, an analyst should be able to provide clear and justified answers to the following two questions:

- Why is the Organisational Design you suggest better than any other random architecture?
- How is the Organisational Design you suggest adapted to the context in which your intervention is embedded?

Clearly, these questions can be both parts of a legitimizing process of OR interventions towards participants and external observers and a reflexive process through which the analyst questions his practices and methodological choices.

However, assessing and demonstrating the relevance of a participatory scheme deployed by an analyst is by no mean an easy issue. Actually, it is not unlikely for participatory process' outcomes to disappoint all participants if solution(s) adopted are compromises that satisfy partially each individual's expectations. Does this mean that the decision process was necessarily wrongly conducted? We believe not. However, it is required to adopt a yardstick against which participation terms should be evaluated.

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, 2011). We will focus in

the following on three references that we believe are representative of some of the most important points 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 candidate dimensions to be considered when evaluating a participatory process.

- *Representativeness* is about finding the right balance between ensuring a variety of values and opinions whereas limiting the number of participants.
- *Independence* of the authority in charge of managing the participatory decision process.
- *Early involvement* of stakeholders in the decision process.
- *Influence on decision making* for those involved in the participation process.
- *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.
- *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.

This second set of dimensions is of limited interest by various means. First of all, some of the dimensions suggested are nothing but the objectives associated with participatory processes: representativeness, transparency, efficiency... This leaves the user with little help on the procedural criteria allowing the achievement of these objectives. Secondly, we believe that all these dimensions should not apply equally for all participatory decision making processes. For instance, representativeness is an important criterion only if the objectives of the decision process go beyond communication to consider a variety of values and claims in preferences tradeoffs. Similarly, the independence criterion can be hardly satisfied when the decision maker is also in charge of the decision process. Accordingly, we believe it more convenient to consider a transparency criterion where positions and responsibility structures of those involved in the development of the participation process are understood and negotiated.

Another founding work on evaluation criteria for deliberative situations has been suggested by Habermas (1987) (1991) 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.

On the other hand, competence refers to the following capabilities:

- Cognitive and linguistic abilities to formulate claims.
- Pragmatic abilities to understand and process others claims.
- Interactional abilities to structure exchanges between participants.

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.

Coming back to our illustrative example, we relied on the fairness and competence criteria introduced above to suggest context adapted OD. We actually found it extremely useful, especially in conflicting contexts, to clearly explicit the criteria against which our Organisational Design proposal was believed both legitimate and adapted. It firstly demonstrated how our intervention was free from hidden agendas and independent from the decision maker (the Prefet) influence. This fostered a climate of trust with participants which we felt as a highly valuable capital all along the decision process.

Secondly, it justified the amount of resources (in terms of availability and personal investment mostly) each participant should devote to the process. By better understanding how their participation was part of achieving the quality criteria suggested, participants showed higher willingness and commitment to the process.

So far, we explored the five determinants of Organisational Design within a fairly large literature beyond OR/MS. We do not claim that this analysis is exhaustive. However, we believe the five determinants as not-to-be-missed issues for each Organisational Design in participatory processes in general and in OR interventions in particular.

The next section will question the status of these determinants within OR literature so to discuss the way they are considered and assess the need for additional methodological developments.

III. Organisational design under the light of OR literature

OR has for long now moved from a purely technical approach of problem solving to a social process dealing with ill structured problems underpinned by complex human interactions (Ormerod R., 1996). As a natural consequence, theoretical and practical developments paying full attention to social aspects of OR have flourished. This section is dedicated to questioning how these efforts have addressed the various determinants of Organisational Design identified in the previous section. A first challenge at this level is the extremely various, cohabiting, complementary and sometimes overlapping approaches and research perspectives under the umbrella of “social interactions” and “OR”. For instance, MCDA and PSM both provide distinct, self standing, and sometimes complementary, methodological frameworks to deal with stakeholders’ involvement. Critical System heuristics (Ulrich, 1983) (Ulrich, 1996) perspective on the other side suggests a framework for exploring stakeholders’ worldviews that may benefit to any intervention methodology. Although it is fair to recognize the enmeshed character of these various research trends, we will in the following discuss them in a quite distinctive manner so to provide a fair account of the richness and variety of their individual

contributions to the field of social interactions within OR. Accordingly, five distinct perspectives are discussed in the following:

- *The analyst role(s) and competence(s)*: what is expected from an analyst prior and during his intervention to correctly handle social interactions?
- *Stakeholders analysis*: How stakeholders are identified and described during OR interventions?
- *OR intervention methodologies*: How are social interactions handled in two major families of intervention methodologies being PSM and MCDA?
- *CSH*: How the uncovering of individual reference systems suggested in CSH says about handling stakeholders' interaction?

i. *Analyst role(s) and associated competences*

The analyst is not anymore the lonely expert travelling back and forth from the real world to an abstract one looking for optimal or quasi optimal solutions; he also is a facilitator (Eden, 1990a) (Huxham & Cropper, 1994) that continuously interacts with the stakeholders to collectively build a viable solution, or at least, a collective commitment for action.

Accordingly, facilitation, understood as the analyst-stakeholders joint process of problem modelling towards desirable and feasible solutions (Kotiadis, Tako, & Vasilakis, 2014), appears as a highly effective mode of intervention for dealing with inclusiveness and conflict resolution requirements posed by messy problems. It requires a continuous combination of two processes being the management of the social (group) interactions (P) and of the problem complexity (C) (Eden, 1990a). Facilitation modelling (FM) (Franco & Montibeller, 2010) has consequently naturally spread as an intervention frame where an analyst makes his models as transparent and open as possible to participants so to take profit of their knowledge and representations and build better ones. Actually, facilitation has been adopted as a common background by a wide range of operational practices despite the variety of modelling approaches used. To cite a few: Facilitated problem structuring (Checkland, 1999) (Mingers & Rosenhead, 2004), facilitated system dynamics (Rouwette & Vennix, 2006) or facilitated decision analysis (Belton & Stewart, 2002) (Munda, 2004).

Several studies provide guidelines and formalisation attempts of the facilitation activity (Huxham & Cropper, 1994) (Griffith, Fuller, & Northcarft, 1998) (Franco & Montibeller, 2010). The latter one, we believe as most representative of these attempts, describes the following design issues associated to facilitation processes:

- Frame the focus of intervention that may range from problem structuring to options/policy evaluations.
- Define how data required by the model structure are collected. Depending on the approach used, this can be done through top down or bottom up philosophy.
- Select the type of data (qualitative/quantitative) to be used.
- Decide on the level of technology support required (type and use of Decision Support Systems).
- Adopt a degree of flexibility the analyst accepts regarding all the parameters of his intervention.
- The importance of facilitation efforts the analyst believes necessary or wants to invest in his intervention.

For the sake of exhaustiveness, one may also cite developments of behavioural theory (Hamalainen, Luoma, & Saarinen, 2013) in helping analysts gaining awareness about the biases they may introduce, paying attention to the variety of participants' personalities and cultural backgrounds or uncovering participants hidden agendas.

Accordingly, development of facilitation applications seems to be the central mean through which OR accommodated inclusiveness requirements. This has been recognised by (Ormerod R. J., 2014) who places facilitation at one of the core competence requirements for any analyst interested in deploying problem structuring methods.

Figure 3 Core competences of OR practice according to Ormerod (2014).

However, and in spite of its indisputable positive contribution in helping OR better addressing its challenges, facilitation process leaves by the wayside almost all of the determinants of Organisational Design we listed earlier. Actually, nothing is said with regard to how the analyst may shape the group structure prior to launching the decision process. Huxham and Copper (1994) have for instance acknowledged the relevance of group compositions and terms of interactions but puts it at a meta process level and did not provide further details on how to address these challenges. On the other side, it is fair to recognise that facilitation aims at organising stakeholders' contributions by framing the intervention focus and organising data collection and manipulation. In that sense, facilitation can be seen as a mean to better handle the set of topics to be discussed by participants.

Out of this picture, literature on analyst roles and their evolution with regard to enhanced inclusiveness clearly appears as putting a heavy focus on real time facilitation techniques whereas extremely few is said about the analyst as exerting control on the shape of the organisation within which interactions are to be held.

ii. Stakeholders analysis

The issue of stakeholders' identification, description and mapping has encountered a large echo in OR/MS literature both as a self standing objective for analyst intervention or as an intermediate outcome of the decision aiding process.

With respect to the first category, one of the most noticeable developments is probably the work of Ackerman and Eden (2011) on Strategic Management of Stakeholders. This workshop based approach aims at helping organisations considering stakeholders' dynamics in shaping, revising and implementing their strategies. More practically, three key questions are addressed: (a) who the stakeholders are?, (b) what are the impacts of stakeholders' dynamics on the success/failure of the organisation's strategy?, and (c) determine how and when it is appropriate to intervene to alter or develop the basis of a stakeholder's significance.

A pretty similar work has been suggested by Enserink et al (2010) whose approach puts a heavy focus on stakeholders' description and mapping of interdependencies. Developed for policy analysis purposes, it aims at providing decision makers with an assessment of stakeholders' willingness to support or block their interests. A key output of this approach is a power/interest matrix that associates participation terms (keep informed, key player, minimal effect...) to each of the stakeholders identified depending on his levels of interest and power. In doing so, this approach goes also beyond stakeholders' identification to provide recommendations on the way their involvement should be organised in the decision process. However, the way stakeholder analysis is carried here

conveys the idea of an analyst more interested in promoting DM interests and views and less in building a new and possibly better shared representation of the problem situation and the solutions to be implemented. This in consequence may raise important ethical concerns, especially in the public arena, and appeals for putting back the issue of evaluation criteria at the centre of OR interventions in participatory processes.

Wang, Liu & Mingers (2015) have on their side relied on SSM constructs and methodology to (i) transform the strategic objectives identified by an organisation into a set of achievable and complementary tasks and (ii) identify the set of social roles and associated stakeholders required by each task.

Figure 4 Stakeholders analysis according to Enserink et al (2010)

The typology of social roles (table.5 below) on which the authors rely to guide stakeholders' identification is heavily inspired from the CATWOE analysis usually deployed in SSM interventions.

Table 5 Categories of social roles defined by Wang et al (2015)

The involved		The affected			
Owners Who can create, change or destroy the system.	Customers Who are the direct recipients of the system's outputs.	Actors Who perform the activities of the system	Environmental groups who are directly necessary for the system	External groups indirectly affected by the systems activities	External groups who indirectly affect the systems activities

Deploying this approach provides decision makers with a potentially highly detailed description of tasks to be performed and their associated social structures where participants and roles are clearly defined. In that sense, this approach goes also beyond the identification of stakeholders to specify the list of tasks or activities in which their contribution is expected. Accordingly, two of the five determinants discussed earlier, being identification of stakeholders and of debate topics, are explicitly addressed.

Stakeholders analysis can also be an intermediate step in OR intervention methodologies as for MCDA or PSM. These aspects will be further discussed in the following sections.

iii. Multi Criteria Decision Analysis

It is fair to recognise that MCDA has moved from the stage where it was only interested in mathematically modelling real problems to recognise the need to organise stakeholders involvement (Belton, Ackermann, & Shepherd, 1997) (Banville, Landry, Martel, & Boulaire, 1998) (Munda, 2004) (Tsoukiàs, 2008) (De Brucker, Macharis, & Verbeke, 2013) both in building problem representations and in modelling preferences orienting alternatives selection. Social Multi Criteria Analysis (SMCA) (Munda, 2004) is for instance based on the recognition that the schematised relationship DM-Analyst is embedded in a social framework. Accordingly, a plurality of ethical principles is promoted so to ensure that variations in power repartition among stakeholders does not influence on the ability of each participant to access the debate and influence the final tradeoffs.

Openness of MCA to stakeholders' participation has also been promoted by Belton, Ackermann and Shepherd (1997) who combined problem structuring approaches (SODA) (Eden & Ackermann, 2001) with Multi Criteria Analysis. Through facilitated workshops, a group of stakeholders is invited to

collectively explore the problem situation, formulate key issues and evaluate possible alternatives. However, very little is said about how stakeholders have been identified or how their interactions have been handled through specific organisational arrangements.

In his model of decision aiding processes, Tsoukias (2008) describes MCDA through the set of intellectual products, called artefacts, resulting from multiple interactions involving not only the analyst and the client but also the actors of the problem. In doing so, he states in a clear and reproducible manner how, regardless of the intervention approach or the mathematical modelling adopted, a major place is to be given to stakeholders' involvement and gathering of their worldviews and problem representations. He suggests the following steps:

- *Step 1: Establishing the problem situation*

This first step aims at clarifying the position of the client with regard to what he believes is a problem. To do so, it is suggested to explore and characterise the set of actors expected to impact or be impacted by the decision process through the following products:

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

- *Step 2: Formulating the problem*

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.

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.
- <P>: The problem statement which transforms the client's concern in a formal decision problem (see Bouyssou et al., 2006; Colorni and Tsoukias, 2013).

- *Step 3: Building the evaluation model*

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:

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

- *Step 4: 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.

From a social interactions perspective, this model offers an active role to stakeholders and puts in place a systemic approach for identifying them and describing their rationality. It also specifies the phases where their contribution is required. In doing so, stakeholders' involvement expands from the classical modelling of preferences in phase 3 to influence on the problem description and formulation phases. This in consequence makes it perfectly compatible with PSM and more globally facilitated modelling approaches.

With regard to Organisational Design determinants, we can say that MCDA is, in the best cases, limited to stakeholders' analysis and, to a certain extent, to the definition of topics/tasks expected from their involvement.

iv. Problem Structuring Methods

PSMs are a family of "soft" methods whose purpose is to assist groups of diverse composition gain a better understanding of a problematic situation of common interest (Rosenhead & Mingers, 2001). Soft System methodology (Checkland & Scholes, 1990), Strategic Choice Approach (Friend & Hickling, 2005) or Strategic Options Development and Analysis (Eden & Ackermann, 2001) are a few examples of a quite large and diverse family of methods. It goes far beyond the purpose of this paper to introduce each of these approaches. We will rather question their main shared characteristics with regard to the Organisational Design determinants discussed in previous sections.

The first key characteristic is the reliance on models that are meant as transitional objects, in the sense that they support the journey of a group of stakeholders in collectively investigating the complexity of a given problem situation. Cognitive mapping is for instance used in SODA to capture individual representations which are then combined to build a global and hopefully insightful picture that is negotiated with all participants. These models are also purposefully relatively unsophisticated and rely on natural language (Franco L. A., 2008). This allows openness and transparency to the greater number and avoids the black box effect generated by highly sophisticated, commonly quantitative, models.

Accordingly, PSM are undoubtedly meant for greater inclusiveness and participation and place social interactions at the very heart of their process. However, and in order to manage the complexity generated by these social interactions, it is facilitation that has been adopted as a key strategy and very few is said about the organisational structure through which interactions occur. Rosenhead and Mingers (2001) put this in unambiguous terms by stating the dual responsibilities of the analyst being the development of a requisite model and the *constructive management of the dynamics within the workshop group* (P13). As a direct consequence, PSM heavily relies on facilitators' capabilities to deal with possibly large set of interacting participants and generating rich but complex worldviews and representations. For instance, Eden and Ackermann (2001) describe workshops where facilitators need to interact with all involved stakeholders to aggregate individual cognitive maps that may reach a total of 800 nodes.

Another important issue raised by PSM and which may benefit from Organisational Design is the ethics of wicked problem. Actually, Rosenhead and Mingers (2001) quote Tomlinson (1984) to remind us that highly complex and uncertain problems do not have one client but rather a *client system* that may be composed of several actors with divergent values, resources and objectives. Here again, we believe providing equal chances of suggesting, defending and challenging arguments to all members of the client system can rapidly become a heavy onus if tackled only through facilitation.

On the positive side, it is fair to recognise that by providing transient objects to participants, PSM helps structuring their interactions around a set of concepts that foster their understanding of the problem situation. In doing so, it specifies a set of topics to be addressed during participation.

In summary, although problem structuring has put stakeholders' participation at the centre of its methodologies, social interactions have been exclusively approached through facilitation which did not really allow for a careful formalisation of the various determinants of OD.

v. Critical Systems Heuristics (CSH)

Simply stated, CSH is an operational framework for uncovering, reflecting and criticising the multiple perspectives people bring into a situation (Ulrich, 1996). Based on the idea that all our judgments and claims are constructed upon not only a set of values and knowledge but also on false consciousness (self censorship induced by possibly several factors: personal perception of the power relationships in a group or of consequences of conforming or breaking with expected behaviour or opinion) (Flood, 1996), it invites analysts and stakeholders to promote *critical awareness* towards:

- *themselves* so to ensure that they do understand the sources of subjectivity encompassed in their judgements. This *reflective awareness* is of particular importance for analysts who should be conscious of the limits and constraints their methodological choices impose to other participants.
- *the others* so to be able to re-examine what they may defend as objective or taken-for-granted assumptions (Midgley, Munlo, & Brown, 1998). We will talk here about emancipatory purpose in the sense that it provides participants with the means of understanding and challenging others views.

Ulrich (1996) suggests putting critical awareness into practice through the concept of *Boundary Critique*. That is to say, a systematic process of questioning the boundary judgments through which each and everyone may process the real world to formulate claims by consciously or unconsciously deciding what counts and what should be left out of his reference system. Four basic boundary issues are to be addressed to examine each claim (Ulrich, 2005):

- *Basis of motivation*: Where does a sense of purposefulness and value come from?
- *Basis of power*: Who is in control of what is going on and needed for success?
- *Basis of knowledge*: What experience and expertise support the claim?
- *Basis for legitimacy*: Where does legitimacy lie?

With respect to this extremely brief and reductionist description of CSH, we can state the following remarks when it comes to Organisational Design determinants:

- CSH is not meant as a self standing approach. It is rather a framework to individually and collectively reflect on one or several claims depending on the interaction opportunities provided by the intervention methodology. Accordingly, designing the organisational arrangements through which these interactions may occur remains out of its scope.
- However, the philosophical and methodological principles conveyed by CSH can be of high inspiring value when it comes to OD. For instance, questioning the legitimacy of claims appeals for going beyond the views of the involved to consider also those of the affected. In that sense

it should stimulate a careful representation of all parties, including the missing ones like next generations.

- Another inspiring value promoted by CSH in particular and Critical System theory in general (Jackson, 1991) is the equal access for all participants to submitting claims and criticising others' despite any pre-existing structures of inequality of wealth, status, power or authority. In doing so, it strongly promotes the vision of ethical participatory arrangements that offset any type of pre-existing inequality.

Although we believe this ideal type of participatory situation hardly reachable, it has the merit of reminding analysts that not all organisational arrangements perform equally when it comes to participatory ethics. Accordingly, it becomes a full dimension to be considered when planning their intervention strategy.

- Finally, by describing the categories of boundary critiques and associated questions to be discussed, CSH offers a powerful tool of claims' systematic investigation. In Organisational Design terms, CSH can be seen as a provider of an organised and foreseeable set of topics that structure stakeholders' interactions. For instance, analysts can devote workshops to each of the four basic boundary issues and calibrate participation accordingly. For knowledge related boundaries workshop, external/independent experts can be invited to enlighten the debates whereas in legitimacy related workshops, specific efforts should be devoted to ensure exhaustiveness in stakeholders' representativeness.

A summary of the five perspectives' analysis with regard to Organisational Design determinants is presented in table 6 below.

What strikes out of this analysis is the inability of the various OR practices discussed to systematically address the five determinants of Organisational Design highlighted so far. More particularly, dealing with the potential variety of objectives associated by participants to the social structure or the criteria against which their interactions should be compared to seem poorly addressed in almost all of the cases. This is very likely due to the heavy focus put by OR intervention frameworks on facilitation at the expense of OD. Actually, far from being conflicting, these two strategies are to be seen as complementary since Organisational Design is interested in sizing the organisation whereas facilitation focus is on managing its dynamics once in place. On the other hand, the elicitation of topics and the ability to structure interactions according to a set of predefined artefacts is indubitably a strength of OR interventions that can be explained by the use of models as transitional objects.

From a more operational perspective, it would probably be unfair to assume that OR practitioners do not address Organisational Design determinants when acting on the field. However, in the lack of systematic and reproducible framework allowing a formal consideration of OD, it is likely that this aspect may rejoin the vast area of common sense or craft knowledge that each analyst develop thanks to his own background and set of experiences. This in return hinders the ability of OR community to share knowledge and reflect on its practices (Rosenhead, 2006). For these reasons, the authors believe it important to engage in a formalization of Organisational Design determinants in OR interventions so to prompt cross fertilization and learning on these aspects amongst the OR community. Accordingly, the next section is meant to step the first stones of Organisational Design formalization within OR interventions.

Table 6 Summary of OR perspectives regarding Organisational Design determinants.

	Organisation Design determinants					Additional Comments
	Stakeholders analysis	Objectives	Participation levels	Topics/ issues	Evaluation criteria	
Analyst roles and competences (Facilitation)	++					Literature on analyst roles and competences put the focus on facilitation abilities and leaves by the wayside almost all of the determinants of Organisational Design except for topics identification.
Stakeholders Analysis	+++		+	+		OR benefits from specific developments on stakeholders' analysis that, for some cases, go beyond to address issues related to participation level and topics of debate.
MCDA	+++	+		++		MCDA has moved towards higher inclusiveness at early stages of intervention making it relevant on stakeholders' analysis. It also benefits from a well organised structure that specifies expected outputs at each step of the process.
PSM				++		Being strongly based on facilitation, PSM unsurprisingly performs quite similarly to the <i>Analyst roles and competences</i> perspective.
CSH	++			+++	++	CSH is both a promoter of ethical values in participation and a powerful mean (boundary critique) to structure and enhance interactions.

IV. OD formalization in OR interventions

Despite the wide recognition of the importance of interactional dimension in shaping OR interventions processes and outcomes and the central role given to facilitation capabilities, the previous sections have demonstrated the extent to which some key determinants of these interactions (defined altogether as OD) are not explicitly nor systematically addressed by various intervention frameworks.

That being said, the question of the exact role(s) of Organisational Design and its interaction with already existing intervention frameworks is still to be answered. Although we have pointed the complementarity between Organisational Design and facilitation, the issues of how Organisational Design fits within OR paradigms and its implications at the methodological levels are still to be discussed.

Accordingly, this last section aims at stepping some stones for a hopefully wider debate on these aspects. More precisely, we will firstly discuss how Organisational Design fits the knowledge paradigms in which management science in general and OR interventions in particular are embedded before addressing more precisely the methodological implications of explicitly addressing OD.

Organization design and OR paradigms

OD being interested in formalizing the role of social structures underlying OR interventions, its grounding in constructivism makes no doubt. However, one may find under the constructivism umbrella several philosophies recognizing various levels of influence of social structures on knowledge production. To be more specific, we anchor our reflection on Organisational Design in critical realism (Mingers, 2000) where a sharp distinction is drawn between the ontological status of reality considered as independent from our perceptions and the epistemic status of knowledge production that remains heavily influenced by the social structures in which it is embedded.

With that being said, we need to further characterize the process of knowledge production in OR so to better address the issue of how Organisational Design fits within already existing practices and frameworks. To do so, we will appeal for existing reflections characterizing management science in general and OR in particular as design science (Avenier & Nourry, 1999) (Van Aken, 2005a) in the sense that they design the intervention mechanisms and terms through which they generate knowledge both for the end users and their associated scientific communities. More specifically to OR, Keys (2007) elaborates upon the original work of Van Aken (2005b) to analyse PSM under the light of the design processes they involve. Three distinct design processes are at play:

- *Object design*

This first process takes place in the immaterial world and aims at defining the key properties of the object or artefact to be designed. Drawings, small scale modelling or 3D representations are examples of techniques used at this level in industry. When it comes to OR, object design relates to the definition of the set of activities and concepts on which the analyst will rely to carry his intervention. Concepts like criteria, alternatives or preferences are the objects designed by MCDA practitioners whereas cognitive maps are the design objects of interest for cognitive mapping based approaches.

- *Realization design*

Transforms abstract objects into a reality. However, realization is not only about following the method or the theory as it also carries a certain level of freedom (Van Aken, 2005b) that is usually referred to as craft knowledge or individual experience. This tension between theory and practice has more generally been widely discussed thanks to the work of Argyris and Schon (1974) and their distinction between espoused theory and theory-in-use.

In the industry, this would be the process of exploiting existing or creating new manufacturing capabilities so to produce the objects wanted. When it comes to OR, it would be fair to notice that this specific point is still object to several discussions and debates (Corbett, Overmeer, & Van Wassenhove, 1995) (Keys, 1997) (keys, 2000) that remain out of the scope of this paper. We will therefore limit our description to characterising realization design as the process of engaging stakeholders in a set of interactions focused on transitional models and supported by facilitation capabilities.

- *Process design*

This third and last process is interested in the human action system (Van Aken, 2005b) generated by both object and realization design processes. In other words, it is to be seen as a meta process dealing with the organizational and contextual terms within which the two previous design processes are developing.

As van Aken (2005b) discusses it, this third process is very often tacit, based on craft knowledge and transmitted through peer observation and oral tradition.

Let's in the following discuss OR interventions through the lens of these three distinct and still intricate design processes. Whilst object and realization design focus is respectively on creating the concepts and artefacts on which the intervention will rely, namely the intervention methodologies (PSM, MCDA...) and implementing them in real contexts, process design reveals to be more complex to characterize. Keys (2007) describes the rationale of this process as the quest for understanding the way an intervention relates to the context in which it is implemented. Process design knowledge is therefore about fostering one's understanding on how these external factors may influence the success or failure of an intervention. Accordingly, he adopts a descriptive standpoint and refers to Actor-network model of analysts (Callon, 1986) on one hand and to Critical pluralism paradigm (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998) on the other hand to better analyse and characterise these mechanisms. Although we fully agree on the informative character of these frameworks to investigate the contextual aspects of each intervention, Organisational Design adopts a more prescriptive standpoint by addressing some of these factors at early stages of intervention design. Accordingly, these factors are not anymore a set of contextual constraints generating variability in OR interventions, they become a set of design factors to be addressed prior to the intervention so to improve its effectiveness and legitimacy. This perspective is fully in line with keys (2000) who spots the importance of acknowledging participants aims and objectives as well as acceptable norms and behaviours in building intervention's legitimacy.

With respect to the above, Organisational Design is at a paradigm level grounded in critical realism and interested in shaping the social structure in which the intervention will be embedded. Accordingly, it is one of the dimensions of process design alongside the already well recognised issue of selecting the right intervention methodology or combination of methodologies. Yet, it would be misleading to limit Organisational Design to process design as it is also related to the intervention developments occurring in the realization phase. Said in other terms, the social structure one can elaborate during process design may need to evolve during realization thanks to knowledge creation that may uncover new topics of discussions or reveal the need to open interactions to new participants. Accordingly, the social structure designed is not set in stone but remains subject to redesigning so to constantly fit the evolution of the problem situation and the interactions requirements.

Methodological challenges

Moving from the paradigmatic to the methodological level, we straightforwardly refute Organisational Design to be an intervention methodology since it does not provide the means to structure stakeholders' interactions using a transitional model. It is, more modestly and very comparatively to CSH, a complement of existing intervention methodologies. Its aims are to help the analyst get a grasp of the context in which its intervention takes place so to seize the social structure that better fits both the context and the intervention methodologies he will implement.

Accordingly, Organisational Design is to be used as a technique within a multimethodological framework (Mingers & Brocklesby, 1997) where various parts of existing methodologies can be combined (Mingers, 2001) as long as they share common philosophical and paradigmatic foundations. In our case, Organisational Design can be combined with existing intervention methodologies which fully recognize the influence of social structures on knowledge production during OR interventions.

The shape of these complementarities can however vary from one methodology to another. Coming back to table 3, we can see that Organisational Design complements MCDA by uncovering the potential variety of participants' objectives and explicitly addressing participation levels with respect to ethical criteria. With regard to PSM, it also invites to a careful identification of stakeholders so to reinforce the legitimacy and representativeness of the social structure underlying the intervention.

To sum up, Organisational Design is to be addressed within process design and prior to launching the intervention process in order to design the social structure of the forthcoming decision process. It is based on a constructivist paradigm and is expected to provide required inputs to set the stage of the intervention and continually adapt its social architecture to the decision process requirements. By formalizing the design and adaptation of this social structure, it takes an important share in building the legitimacy of the decision process and its associated outcomes.

V- Conclusions

This paper discussed OR interventions under the scope of the social structures they create to welcome stakeholders' interactions. In spite the already extensive literature on the way OR handles its social dimension, this paper claims the need to reach out for a new level by acknowledging not only the analyst's role of facilitator, but also the one of designer of social structures.

To defend our claim, we adopted as a starting point a set of arguments justifying the influence of these structures on various aspects of OR interventions; ranging from knowledge production to ethical and methodological considerations. More particularly, we highlighted the fundamental role played by social interactions in legitimizing the decision process outcomes both for participants and external observers. That being done, we relied on the extensive literature in social sciences to formalize the key variables participatory structures design. In practical terms, this implies identifying stakeholders and defining their participation levels, building up the participatory structures objectives based on stakeholders expectations, anticipating as much as practicable the issues and topics to be discussed and, finally, defining the quality criteria against which the participatory process will be evaluated.

The analysis of various OR frameworks under the light of Organisational Design revealed the lack of systematic and rigorous consideration of the five determinants considered altogether leaving OR interventions with the inability to justify the relevance of the social structures they create.

With the importance of Organisational Design being hopefully clearly demonstrated, we tried to set the first stones of its formalization within OR interventions by sketching its properties at a paradigmatic and methodological levels. We therefore anchored it in a constructivist paradigm and shown how it should be addressed at process design level and regularly updated thanks to the developments occurring in realization design process.

However, this formalization is nothing but a beginning that should appeal further developments in at least two domains. The first is methodological and relates to the development of sound and reproducible approaches supporting the answering of the five determinants in OR interventions. Actually, despite the echo these aspects received in social sciences, reflections have been far more focused on describing their influence rather than on providing methodological frameworks supporting their treatment. A particularly challenging objective would be to tackle these various determinants in a holistic manner that acknowledges their dynamic and interactive character instead of considering them individually. For instance, new stakeholders entering the interaction may bring new topics and problem representations that may modify the social structure's objectives. On the other hand, new objectives may require new competences and perspectives leading to invite new stakeholders. OR, as

an action oriented approach, is probably much more adapted to deal with these challenges than usual social sciences perspectives. A forthcoming paper will present a detailed approach anchored in OR tradition and aiming at answering this challenge.

The second required development is the construction of a library of working cases where the issue of Organisational Design determinants influence on OR interventions is further observed and discussed. Actually, this could be done by re-examining existing real case experiments or by adopting an Organisational Design lens when analysing realization design processes.

Références

- Ackermann, F., & Eden, C. (2011). Strategic management of Stakeholders: Theory and Practice. *Long Range Planning* (44), 179-196.
- Ackoff, R. (1979). Resurrecting the future of Operational Research. . *Journal of the Operational research Society* 30, 189-199.
- Aggens, L. (1983). *Identifying Different Levels of Public Interest in Participation*. The Institute for Water Resources, U.S. Army Corps of Engineers.
- Archer, M., Bhaskar, R., Collier, A., Lawson, T., & Norrie, A. (1998). *Critical realism: Essential Readings*. London: Routledge.
- Argyris, C., & Schon, D. A. (1974). *Theories in Practice*. San Francisco: Jossey-Bass.
- Arnstein, S. R. (1969). A Ladder of Citizen Participation. *Journal of the American Planning Association* 35, 216-224.
- Avenier, M. J., & Nourry, L. (1999). Sciences of the Artificial and Knowledge Production: The Crucial Role of Intervention Research in Management Science. *Design Issues* 15(2), 55-70.
- Banville, C., Landry, M., Martel, J. M., & Boulaire, C. (1998). A stakeholder approach to MCDA. *System research and Behavioural Science* 15, 15-32.
- Barreteau, O., Bots, P. W., & Daniell, K. A. (2010). Framework for Clarifying “Participation” in Participatory Research to Prevent its Rejection for the Wrong Reasons. *Ecology and Society* 15(2), 1-16.
- Belton, V., & Stewart, T. J. (2002). *Multiple Criteria Decision Analysis: An Integrated Approach*. Dordrecht: Kluwer.
- Belton, V., Ackermann, F., & Shepherd, I. (1997). Integrated Support from problem Structuring through to Alternative Evaluation Using COPE and VISA. *Journal of Multi-Criteria Decision Analysis* 6, 115-130.
- Bertrand, L., & Martel, J. M. (2002). Une démarche participative multicritère en gestion intégrée des forêts. *INFOR* 40, 222-239.
- Blau, P. M., & Scott, W. R. (1962). *Formal Organizations: A Comparative Approach*. Stanford: Stanford Business Classics.

- Brocklesby, J. (2009). Ethics beyond the model: How social dynamics can interfere with ethical practice in operational research/management science. *Omega* 37, 1073-1082.
- Callon, M. (1986). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc bay. In J. Law, *Power, Action and belief. A New Sociology of Knowledge*. (pp. 196-233). London: Routledge, Kegan and Paul.
- Checkland, P. (1999). *Systems thinking Systems Practice*. Chichester, UK: Wiley.
- Checkland, P., & Scholes, J. (1990). *Soft System Methodology In Action*. Chichester: Wiley.
- Chess, C., Dietz, T., & Shannon, M. (1998). Who Should Deliberate When? *Human Ecology Review* 5, 60-68.
- Connor, D. (1988). A New Ladder of Citizen Participation. *National Civic Review* 77, 249-257.
- Corbett, C. J., Overmeer, J. A., & Van Wassenhove, L. N. (1995). Stands of practice in OR (The Practitioner's Dilemma). *European Journal of Operations Research* 87, 484-499.
- Covello, V., & Allen, F. W. (1988). *Seven Cardinal Rules of Risk Communication*. Environmental Protection Agency, USA.
- Cropper, S. A. (1990). The complexity of decision support practice. In C. Eden, & J. Radford, *Tackling Strategic Problems* (pp. 29-39). London: Sage.
- Daft, R. L. (1992). *Organization Theory and Design 3rd Edition*. St Paul: West Publishing Co.
- De Brucker, K., Macharis, C., & Verbeke, A. (2013). Multi-criteria Analysis and the Resolution of Sustainable Development Dilemmas: A stakeholder Management Approach. *European journal of Operational Research* 224, 122-131.
- Donaldson, L. (2006). The Contingency Theory of Organizational Design: Challenges and opportunities. In R. M. Burton, B. Eriksen, D. D. Hakonsson, & C. C. Snow, *Organization Design. The evolving state of the art*. (pp. 19-39). Springer.
- Duncan, R. (1979). What is the right organisation structure? Decision tree analyses provide the answer. *Organizational Dynamics*, 59-80.
- Eden, C. (1990a). The unfolding nature of group decision support systems: two dimensions of practice. In C. Eden, & J. Redford, *Tackling strategic problems: the role of group decision support* (pp. 48-52). London: Sage.
- Eden, C., & Ackermann, F. (2001). SODA: The principles. In J. Rosenhead, & J. Mingers, *Rational Analysis for a Problematic World revisited. problem Structuring methods for Complexity, Uncertainty and Conflict* (pp. 21-43). Chichester: Wiley and Sons.
- Enserink, B., Hermans, L., Kwakkel, J., Thissen, W., Koppenjan, J., & Bots, P. (2010). *Policy analysis of Multi actor Systems*. The hague: Lemma.
- Fiorino, D. (1990). Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms. *Science, Technology and Human Values* 15, 226-243.

- Fischhoff, B., Slovic, P., & Lichtenstein, S. (1978). How Safe is Safe Enough? A Psychometric Study of Attitudes Towards Technological Risks and Benefits. *Policy Science* 9, 127-152.
- Flood, R. (1996). *Solving problem solving*. Chichester: Wiley.
- Franco, A., & Montibeller, G. (2010). Facilitated Modelling in operational research. *European Journal of Operational research* 205 (3), 489-500.
- Franco, A., Shaw, D., & Westcombe, M. (2006). Special Issue: Problem Structuring Methods I. *Journal of the Operational Research Society*, 57, 757-883.
- Franco, L. A. (2008). Facilitating Collaboration with Problem Structuring Methods: A case Study of an inter-Organisational Construction partnership. *Group Decision negotiation* 17, 267-286.
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Boston: Pitman.
- Freeman, R. E., & McVea, J. (2001). stakeholder approach to strategic management. In M. Hitt, J. Harrisson, & R. E. Freeman, *Handbook of strategic management* (pp. 189-207). Oxford: Blackwell Publishing.
- Friend, J., & Hickling, A. (2005). *Planning Under pressure. The Strategic Choice Approach*. Burlington: Elsevier.
- Fürnkranz, J., & Hüllermeier, E. (2010). *Preference Learning*. Berlin: Springer Verlag.
- Galbraith, J. R. (1973). *Designing complex organizations*. Addison-Wesley Publishing company.
- Gray, P. (1987). Group Decision Support Systems. *Decision Support Systems* 3, 233-242.
- Griffith, T. L., Fuller, M. A., & Northcarft, G. B. (1998). Facilitator influence in group support systems: Intended and unintended effects. *Information System research* 9, 20-36.
- Habermas, J. (1987). *The Theory of Communicative Action*. Cambridge, UK.
- Habermas, J. (1991). *Erläuterungen zur Diskursethik*. Berlin: Suhrkamp.
- Hamalainen, R., Luoma, J., & Saarinen, E. (2013). On the importance of behavioral operational research: The case of understanding and communicating about dynamic systems. *European journal of Operational research* 228, 623-634.
- Holland, J. H. (1992). *Emergence: From Chaos to Order*. Massachusetts, USA: Perseus books.
- Holquist, M. (1997). The politics of representation. In M. Cole, Y. Engestrom, & O. Vasquez, *Mind, Culture and Activity*. (pp. 389-408). Cambridge: Cambridge University Press.
- Huxham, C., & Cropper, S. (1994). From many to one – and back. An exploration of some components of facilitation. *Omega* 22(1), 1-11.
- Jackson, M. C. (1991). The Origins and nature of Critical System Thinking. *Systems Practice* 4(2), 131-148.

- Jackson, M. C. (1993). Social Theory and Operational research Practice. *Journal of Operational research Society* 44(6), 563-577.
- Janis, I., & Manis, L. (1976). Coping with Decisional Conflict. *American Scientist*, 27, 261-275.
- Joss, S., & Durant, J. (1995). *Public Participation in Science: The Role of Consensus Conferences in Europe*. Brussels: The European Commission Directorate.
- kaler, J. (2002). Morality and Strategy in stakeholder identification. *Journal of Business Ethics* 39, 91-99.
- Keys, P. (1997). Approaches to Understanding the process of OR: review, Critique and Extension. *OMEGA* 25(1), 1-13.
- Keys, P. (1998). OR as technology revisited. *Journal of the Operational Research Society* 49, 99-108.
- keys, P. (2000). Creativity, design and style in MS/OR. *Omega* 28, 303-312.
- Keys, P. (2000). Creativity, design and style in MS/OR. *Omega* 28, 303-312.
- Keys, P. (2006). On Becoming Expert in the Use of Problem Structuring Methods. *Journal of Operations research Society*, 822-829.
- Keys, P. (2007). Knowledge Work, Design Science and Problem Structuring Methodologies. *Systems Research and Behavioral Science* 24, 523-535.
- Kotiadis, K., Tako, A. A., & Vasilakis, C. (2014). Participative and facilitative conceptual modelling. *Journal of the Operational research Society* 65(2), 197-213.
- Laufer, R. (1996). Quand diriger c'est légitimer. *Revue Française de gestion* 111, 12-37.
- Le Menestrel, M., & Van Wassenhove, L. N. (2004). Ethics outside, within or beyond the models? *European Journal of Operational research* 153, 477-484.
- Margerum, R. D. (2002). Collaborative Planning: Building consensus and building a distinct model for practice. *Journal of Planning Education & Research*, 237-253.
- McAuley, J., Duberley, J., & Johnson, P. (2007). *Organization Theory*. Harlow: Pearson Education Limited.
- Midgley, G., brocklesby, J., Wood, D. R., & Ahuriri-Driscoll, A. (2013). Towards a new framework for Evaluating Systemic problem Structuring methods. *European Journal of Operational research* 229, 143-154.
- Midgley, G., Munlo, I., & Brown, M. (1998). The theory and practice of boundary critique: developing housing services for older people. *Journal of the Operational Research Society* 49, 467-478.
- Mingers, J. (2000). The contribution of critical realism as an underpinning philosophy for OR/MS and systems. *The Journal of The Operational Research Society* 51(11), 1256-1270.

- Mingers, J. (2001). Multimethodology - Mixing and matching methods. In J. Mingers, & J. Rosenhead, *Rational Analysis of a Problematic World Revisited*. (pp. 289-310). Chichester: John Wiley and Sons.
- Mingers, J., & Brocklesby, J. (1997). Multimethodology: Towards a Framework for Mixing Methodologies. *Omega International Journal of Management* 25(5), 489-509.
- Mingers, J., & Gill, A. (1997). *Multimethodology*. John Wiley and Sons Ltd.
- Mingers, J., & Rosenhead, J. (2004). Problem Structuring Methods in Action. *European Journal of Operational Research* 152(3), 530-554.
- Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management review* 22(4), 853-886.
- Munda, G. (2004). Social multi-criteria evaluation: Methodological foundations and operational consequences. *European Journal of Operational Research* 158 , 662-677.
- National Association of Environmental professionals (NAEP). (2006). Code of ethics and standards of practice for environmental professionals. *Environmental Practice* 8(1), 88.
- Ormerod, R. (1996). On the nature of OR - Entering the Fray. *Journal of Operational research Society* 47, 1-17.
- Ormerod, R. J. (2014). OR competences: the demands of problem structuring methods. *European Journal of Decision Processes* 2, 313-340.
- Pateman, C. (1970). *Participation and Democratic Theory*. Cambridge, UK.
- Pfeffer, J. (1982). *Organizations and organization Theory*. Marshfield: Pitman.
- Rauschmayer, F., Kavathazopoulos, I., Kunsch, P. I., & Le menestrel, M. (2009). Why good practice of OR is not enough-Ethical challenges for the OR practitioner. *OMEGA* 37, 1089-1099.
- Ravetz, J. R. (1971). *Scientific Knowledge and its Social Problems*. Oxford: Oxford University Press.
- Reed, M. S., Graves, A. R., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., . . . Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental management* 90, 1933-1949.
- Regan, H. M., Colyvan, M., & Markovchick-Nicholls, M. (2006). A Formal Model for Consensus and Negotiation in Environmental Management. *Journal of Environmental Management*, 80, 167-176.
- Renn, O. (1995). *Participatory Process for Resolving Conflicts about Risks*. Research report, Center for Technology Assessment, Stuttgart, Germany.
- Renn, O., & Klinke, A. (2002). A New Approach to Risk Evaluation and Management: Risk Based, Precaution Based and Discourse Based Management. *Risk Analysis* 22, 1071-1094.

- Rosenhead, J. (2006). Past, present and future of problem structuring methods. *Journal of Operational Research Society* 57, 759-765.
- Rosenhead, J., & Mingers, J. (2001). *Rational Analysis for a problematic World revisited: problem Structuring methods for Complexity, Uncertainty and Conflict*. Chichester: Wiley.
- Rouwette, E. A., & Vennix, J. A. (2006). System Dynamics and organizational Intervention. *Systems Research and Behavioral Science System research 23*, 451-466.
- Rowe, G., & Frewer, L. (2005). A Typology of Public Engagement Methods. *Science Technology and Human Values*, 30, 251-290.
- Rowe, G., & Frewer, L. J. (2000). Public Participation Methods:A Framework for Evaluation. *Science, technology and human values* 25(1), 3-29.
- Roy, B., & Bouyssou, D. (1993). *Aide Multicritère à la Décision: Méthodes et cas*. Paris: Economica.
- Schroeter, R., Scheel, o., Renn, O., & Schweitzer, P. J. (2016). Testing the value of public participation in Germany: Theory, operationalization and a case study on the evaluation of participation. *Energy Research & Social Science* 13, 116-125.
- Sibbesen, L. k., & Leleur, S. (2006). Decision Support and Multimethodology: Diiferent Strategies for Combination of OR Methods. *Proceedings of EURO XXI*.
- Stern, P., & Fineberg, H. (1996). *Understanding Risks: Informing Decision in a Democratic Society*. Washington: National Academic Press.
- Taket, A., & White, L. (1998). Experience in the Practice of one Tradition of Multimethodology. *Systemic Practice and Action research* 11(2), 1998.
- Tomlinson, R. (1984). Rethinking the Process of Systems Analysis and perational research: from practice to precept-and back again. In R. Tomlinson, & I. Kiss, *Rethinking the Process of Operational research and Systems Analysis* (pp. 205-221). Oxford: Pergamon.
- Tsoukas, H. (2009). A Dialogical Approach to the Creation of new Knowledge in Organizations. *Organization Science* 20(6), 941-957.
- Tsoukias, A. (2008). From Decision Theory to Decision Aiding Methodology. *European Journal Of Operational research* 187, 138-161.
- Ulrich, W. (1983). *Critical Heuristics of Social Planning: A New Approach to practical Philosophy*. J.Wiley & Sons.
- Ulrich, W. (1996). *A Primer to Critical System heuristics for Action Researchers*. Hull, UK: University of Hull.
- Ulrich, W. (2005). *A brief Introduction to Critical Systems Heuristics (CSH)*. Retrieved 2015 йил 29-10 from http://projects.kmi.open.ac.uk/ecosensus/publications/ulrich_csh_intro.pdf
- US administrative conference. (2017). *Administrative Conference Recommendation 2017-2. Negotiated Rulemaking and Other Options for Public Engagement*. Washington DC.

- Van Aken, J. E. (2005a). Management science as a design science: Articulating the research products of Mode 2 knowledge production in management. *British Journal of management* 16, 19-36.
- Van Aken, J. E. (2005b). Valid Knowledge for the Professional Design of Large and Complex Design processes. *Design Studies* 26, 379-404.
- Van Den Hove, S. (2003). *Participatory Approaches for Environmental Governance: Theoretical Justifications and Practical Effects in Stakeholder Involvement Tools: Criteria for Choice and Evaluation*. Paris: OECD/AEN.
- Von Korff, Y., Daniell, K. A., Moellenkamp, S., Bots, P., & Bijlsma, R. M. (2012). Implementing Participatory Water Management: Recent Advances in Theory, Practice, and Evaluation. *Ecology and Society* 17(1), 30-48.
- Walker, W. E. (1994). Responsible Policy making. In W. A. Wallace, *Ethics in Modelling* (pp. 226-245). Oxford: Elsevier.
- Wang, W., Liu, W., & Mingers, J. (2015). A Systemic Method for Stakeholder Identification using Soft Systems Methodology. *European Journal of Operational Research* 246(2), 562-574.
- Weber, T. (1922). *Economie et Société*. Press pocket.
- Webler, T. (1995). Right Discourse in Citizen Participation: An Evaluative Yardstick. In O. Renn, T. Webler, & P. Wiedemann, *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse* (pp. 35-77). Dordrecht: Kluwer Academic.
- Webler, T. (1999). The Craft and Theory of Public Participation: A Dialectical Process. *Journal of Risk Research* 2, 55-71.
- Webler, T., & Renn, O. (1995). A Brief Primer on Participation: Philosophy and Practice. In O. Renn, T. Webler, & P. Wiedemann, *airness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse* (pp. 17-33). Dordrecht: Kluwer Academic.
- Webler, T., Tuler, S., & Kruger, R. (2001). What Is a Good Public Participatory Process? Five Perspectives from the Public. *Environment Management* 27, 435-450.
- Webster, A. (1991). *Science, Technology and Society*. Basingstoke, MacMillan.
- White, L. (2005). *Evaluating Problem Structuring Methods*. University of Bristol.
- White, L. (2006). Evaluating problem-structuring methods: Developing an approach to show the value and effectiveness of PSMs. *Journal of operational research Society* 57, 842-855.
- White, L. (2009). Understanding problem structuring methods interventions. *European journal of Operational Research* 199, 823-833.
- White, L., & Taket, A. (1997). Beyond Appraisal: Participatory Appraisal of needs and the Development of Action (PANDA). *Omega International Journal of management* 25(5), 523-534.

Woolgar, S. (1988). *Knowledge and reflexivity: New Frontiers in the Sociology of Knowledge*. Beverly Hills: Sage.