

A framework for organizing participatory Water Planning and Management Team (WPMT)

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Abstract - The need to properly manage water resources has become increasingly important as states strive to improve their socio-economic and social-ecological situation. No actor can be expected to understand sufficiently the multiple interdependent physical, ecological, social, cultural and political processes that govern the behavior of water resources systems. Broad-scale, multi-governance level, participatory water management processes intended to aid collective decision making and learning are rarely initiated, designed, implemented, and managed by one actor. Participatory water management processes mostly emerge from some form of collective planning and organization activities because of the stakes, time, and budgets involved in their implementation. Despite the potential importance of these collective processes for managing complex water-related social-ecological systems, little research focusing on the project teams that design and organize participatory water management processes has ever been undertaken. In this text we have begun to fill this gap by introducing and outlining the concept of a participatory process by review previous studies. The analytical framework suggested in this text is organized around eight components; Who are Stakeholders, Drivers of stakeholder engagement in the water sector, Stakeholder Analysis, Stakeholders' interactions, Level of participation, Organizational structure, When stakeholder engagement and effective participatory processes.

Key word: Social, Cultural, Ecological, Collective, Stakeholders, Actor

Introduction

Public participation around the world has been part of a wide range of environmental applications including integrated watershed management (Sabatier et al., 2005; ISPWDK, 2005; Kenney et al., 2000), agricultural development (Wilson, 2004), ecosystem management (Knight et al., 2006), environmental governance (Rist et al., 2007), forest management (Buttoud and Yunusova, 2002; Carter and Gronow, 2005) and planning (Buchy and Hoverman, 2000; Buchecker et al., 2003). Participation typically refers to the engagement and involvement of individuals and groups in the design, implementation and evaluation of a project or plan (OECD, 2015). The rapidly expanding literature on participatory approaches in various domains of water sector (Pereira et al., 2003; Mostert 2006) shows a tremendous diversity in purpose, process design, and implementation (Von Korff et al., 2005). The academic debate typically focuses on what to do or analyze (Walker et al., 2002), who to involve (Fung 2006), or how to adapt to the local context (Miettinen and Virkkunen 2005, D'Aquino 2009). The literature provides a wide range of case studies illustrating the advantages of participation. Advantages of participation are: Better trust in decisions (Richards et al., 2004; Beirle, 2000); Improving project design using local knowledge (Irvin and Stansbury, 2004; Habron, 2003; Beierle and Cayford, 2002); Better understanding projects and issues (Duram and Brown, 1999); Integration of various interests and opinions (Griffin, 1999; Creighton, 1986); Optimizing implementation of plans and projects (Konisky and Beierle, 2001); Public acceptance of the decisions (Reed, 2008; Junker et al., 2007); Fostering and developing social learning (Blackstock et al., 2007; Pahl-Wostl, 2002). In addition, a number of clear principles for successful participation can be identified, including: A fair, equal, and transparent process that promotes equity, learning, trust and respect among stakeholders and the administration (Reed, 2008; Webler et al., 2001; Moote et al., 1997); The integration of local and scientific knowledge (Reed, 2008; Tippett et al., 2007); The establishment of rules in advance (Sabatier et al., 2005; Renn et al., 1995); An early involvement of stakeholders (Leach et al., 2002; Leach and Pelkey, 2001); The integration of all stakeholders (Smith Korfmacher, 2001); The presence of experienced moderators (Leach et al., 2002), and Adequate resources, including time (Leach and Pelkey, 2001; Keeney et al., 2000). Stakeholder engagement holds specific importance in water because this is a highly decentralized and fragmented sector, with multiple, interdependent players at different levels. The traditional role of governments as the single decision-making authority has gradually been replaced by multi-

level, polycentric governance demonstrating that a plethora of stakeholders can contribute to and better guide decision making. Water is affected by numerous external drivers and influences many other policy areas that are critical for economic development and well-being, including health, agriculture, land-use and spatial planning, poverty alleviation and energy. These policy areas tend to work in silos and further improvement is often needed in terms of consultation, participation and co-ordination to engage stakeholders in a coherent, holistic and integrated way (OECD, 2015). Formalizing, or even institutionalizing collective decision making related to water issues requires strong leadership commitment with clear objectives and strategies to prevent and manage risks of capture. It also implies securing the needed financial and human resources at the appropriate levels to sustain the engagement process. Because there are more and more actors in the water sector willing to take part in discussions to influence certain decisions, it is crucial to evaluate regularly the actual weight and value-added of stakeholder engagement in water-related decision making and policy or project implementation, and its contribution to better governance. Stakeholder analysis can be used for the preparation and evaluation of projects (ODA, 1995; Grimble and Chan, 1995), for the facilitation of stakeholder involvement in participatory projects or in cooperative resource management (MacArthur, 1997), for strategy development by project managers to assure the implementation soundness of projects or policies (Varvasovszky and Brugha, 2000), for understanding the general issues related to conservation and degradation of natural resources (Grimble and Wellard, 1997), and for a comprehensive analysis to understand better past policy making processes or to assist in formulating new policies (Varvasovszky and Brugha, 2000).

This research has been broken down into a number of component parts. It emphasizes that the stakeholders should first be identified and analyzed, that their interests and expectations should be understood, and that their level of power and influence should be understood as well. A plan for stakeholders' interaction, mapping stakeholders, time of stakeholder engagement in participatory modeling process and effective participatory processes has been outlined.

Public/ Stakeholder Participation

Public participation is constituted of forums for exchange that are organized for the purpose of facilitating communication between government, stakeholders and interest groups regarding a specific decision or problem (Rennet al., 1995). Public participation is two way communication and collaborative problem solving with the goal of achieving better and more acceptable decisions. Public participation prevents or minimizes disputes by creating a process for resolving issues before they become polarized. Public participation is intended to both inform the public and to be informed by them by actively soliciting public response regarding their problems, needs, and values, ideas about solutions, and reactions to proposed solutions to problems. A public participation program has to provide people from diverse backgrounds and interests multiple opportunities to ask questions and offer suggestions. The public participation program has to be responsive to public concerns, though this need not mean acting favorably on everything the public says. There are three primary goals of public participation: 1) Credibility: An open and visible decision-making process accessible to all on an equal basis makes the planning process credible to groups with diverging points of view; 2) Identifying Public Concerns and Values: various groups have different points of view and values, they will evaluate any proposed action from different perspectives. Public participation allows the planning team to understand the problems, issues, and possible solutions from the perspectives of the various interests; 3) developing a Consensus: An implication of the many divergent points of view is that there is no one philosophy that can guide the planning team's decisions. Consensus must be formed on an issue by issue basis. Public participation provides a process for evolving such consensus. Consensus, then, allows the team to move forward and solve the problem. If the public is not involved from early in the planning process, if participation never results in any tangible change, if the alternatives considered are only the ones the partners want, the public will get the message "we're going through the motions of public participation; don't expect anything to come of it." Good public participation is much more than "letter of the law" involvement (Charles and Kenneth, 1996). Other terms sometimes used are "public involvement," "community involvement," or "stakeholder involvement" (IAP2, 2007).

Distinctions are often made between the public and the stakeholders participation. In the literature however, these terms are not used consistently and may confuse rather than clarify understanding. The public is often considered as a collection of individuals generally unstructured and unorganized (Luyet, 2005). On the other hand, stakeholder can be defined as "any group of people organized, who share a common interest or stake in a particular issue or system" (Grimble and Wellard, 1997). In this paper, we consider the public as one specific stakeholder and therefore we use the term "stakeholder participation" (Kessler, 2004) rather than public participation.

Who are Stakeholders

Terms such as 'Stakeholder' and 'Actor' have become ubiquitous in water resources management (WRM), with analyses of them constituting essential components to decision-making processes. Although several definitions for these concepts exist, generally both terms are used interchangeably and encompass any group or individual who is affected by or who has an ability to significantly influence (either directly or indirectly) an action or

policy (Bryson, 2004). However, some definitions restrict the term ‘actor’ to a subset of stakeholders comprising exclusively those interested parties with the power and agency to affect action or policy outcomes (Enserink et al., 2010). Stakeholders are considered as people, institutions or organizations that have a stake in the outcome of decisions related to water management, as they are directly affected by the decisions made or have the power to influence the decision making process (Nandalal and Simonovic, 2003). The term ‘stakeholder’ is often interchanged with ‘the community’, however this is technically incorrect. The community can refer to people within a specific location, or with a specific interest. A community is a subset of all the actors and the actors a subset of the stakeholders, as shown in Figure 1.

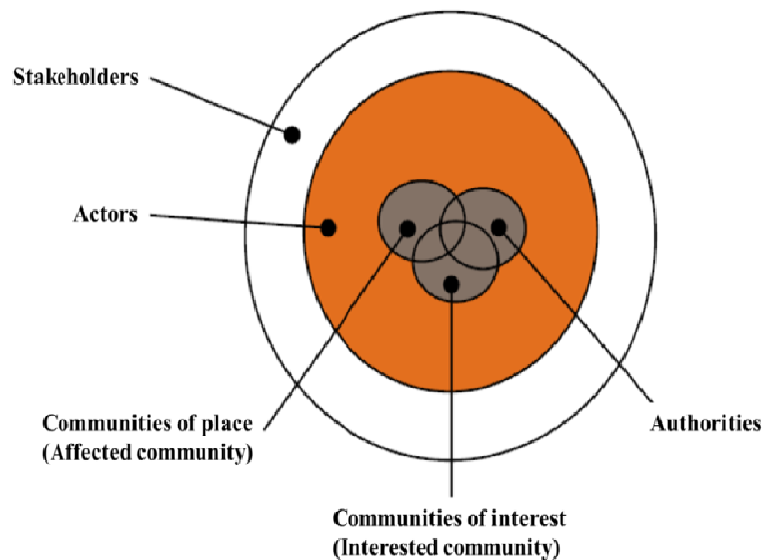


Figure 1. Relationship between stakeholders, actors and communities

Water Planning Team

The composition of a study team is a critical step in determining the water planning effort’s ultimate effectiveness. Teams just don’t happen; they’re built. Team building is the deliberate process of creating a successful team from among a group of stakeholder. The composition of the team depends on the nature of the water planning effort. While the mix of disciplines required for a team varies from study to study.

Drivers of stakeholder engagement in the water sector

The water outlook is not optimistic, and future economic, social, climate, urban and technological trends challenge water governance and the capacity of governments to address them, often calling for multi-stakeholder solutions. By 2050, the world’s population is projected to grow to around 9 billion people, with a major proportion living in urban areas. A total of 4 billion people will live in water-stressed areas, and water demand will increase by 55%, thus generating further competition among water users (especially domestic, hydropower and irrigation) (OECD, 2012).

Pressure points over water allocation, infrastructure financing and disaster management will require doing better and more with more stakeholders willing to contribute to finding innovative solutions. Four main purposes for water decision makers to engage stakeholders are: 1) Implement normative principles, 2) Improve the quality of decision outcomes, 3) Generate legitimacy in the process and 4) Solve water related conflicts (Glucker et al., 2013). The first function is rooted in democratic principles and concerns engagement that derives from the people’s right to be informed. Examples include informative meetings to raise awareness on specific water issues, such as drinking water standards, tariffs and aquifer depletion, without necessarily looking for inputs to decision making. The second function refers to situations where stakeholders may contribute by providing decision makers with key information and knowledge. The third case implies that through engagement, stakeholders develop a sense of ownership over the process and its outcomes, and tend to consider it more legitimate. The fourth case shows that inclusive approaches can also contribute to identifying and resolving water-related conflicts before final decisions are taken, and facilitating project and policy implementation. The future gloomy picture for the water sector has triggered new emphasis on the role of stakeholder engagement across public, private and non-profit sectors, combined with structural and conjunctural drivers that have pushed stakeholder engagement to develop along different rationales, these drivers showed in Figure 2.

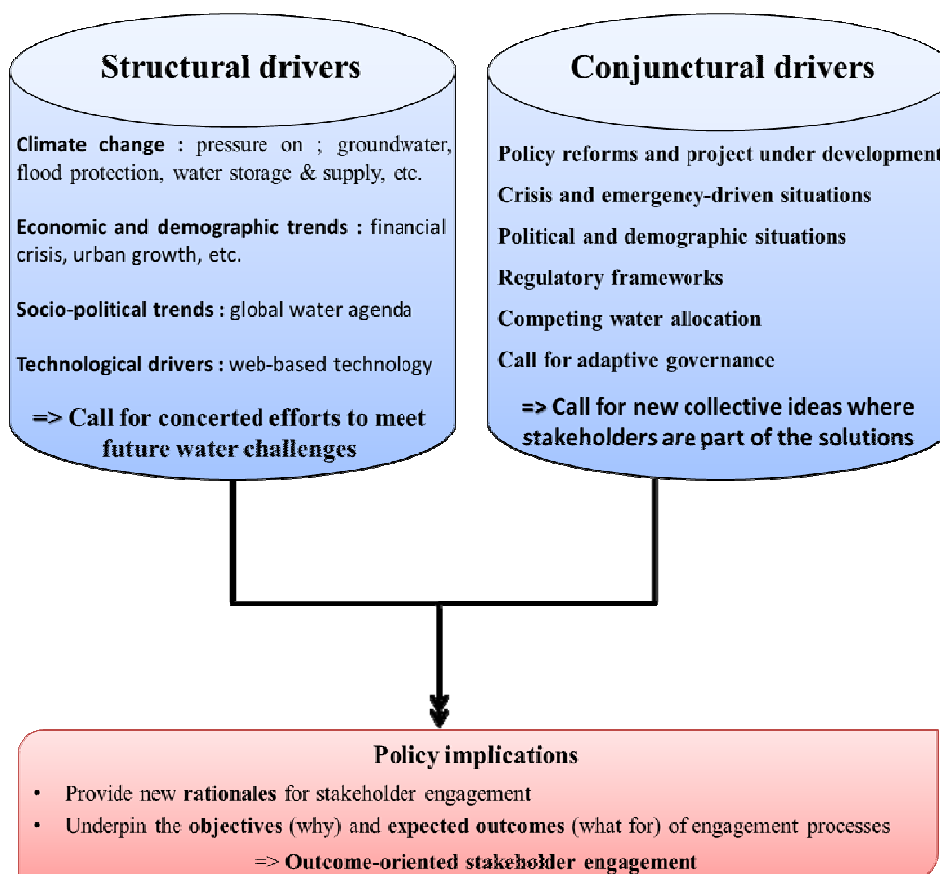


Figure 2. Drivers of stakeholder engagement in the water sector (OECD, 2015)

Stakeholder Analysis

A stakeholder analysis is a process, which provides insights into, and understanding of, the interaction between a project and its stakeholders. Stakeholder analysis systematically gathers and analyzes both qualitative and quantitative information thereby to determine whose interest should be taken into account throughout the project (Pandi-Perumale et al., 2015).

Despite their wide range, the different applications of stakeholder analysis have more in common than just a focus on stakeholders' interests. The different overview articles all describe stakeholder analysis procedures that follow similar steps. In some reviews only a few steps are covered, while in other articles the authors discuss some steps in more detail than others. Taken together the body of literature on stakeholder analysis offers a useful overview of guidelines and Known pitfalls for each step. A general outline of the different steps is presented in Table 1.

Table 1. Procedure for stakeholder analysis

Grimble & Chan, 1995	MacArthur, 1997	Varvasovszky & Brugha, 2000
General purpose of stakeholder analysis		
Dealing with and understanding natural resource management issues	Support in project planning situations (for development projects)	Understand how policies have developed & assess feasibility future directions
1. Define purpose, questions and conditions for actor analysis		
Identify main purpose of analysis	Define higher objectives of project concerned	Identify aim and time dimension of analysis
2. Preliminary scan of actor network and practical preparation		
Develop understanding of system and decision makers		Assess culture, context, level of analysis. Form analysis team
3. Identify stakeholders		
Identify principal stakeholders	List the stakeholders	Identify and approach stakeholders
4. Collect primary input data		
Investigate stakeholder interests & characteristics data collection	Determine interests of stakeholders in project objectives	Data collection using interviews and secondary sources
5. Structure and analyse data		
Identify patterns and contexts of stakeholders' interactions	Assess stakeholders' importance to project objectives Assess power of stakeholder to influence project outcome	Organize and analyse data Present findings, using tables and matrices
6. Interpretation of results and translation into stakeholder management strategies		
Options for managing stakeholders and conflicts	Consider whether additions to project design are required Consider which stakeholder interests should be allowed for during different project stages	Determine strategies for managing stakeholders

Stakeholder profiling

Stakeholder profiles help to learn as much as possible about the stakeholder and to develop a strong understanding of them (either individuals or representatives of a community group). Factors to consider when developing a stakeholder profile are; Current views, Stakeholders' expectations, Knowledge of the issue, Legitimacy of stakeholder representation, Willingness to engage, Possible impacts (negative or positive) of the stakeholder, Cultural context, Geographical scale at which they operate, Stakeholder's engagement capacity and Relationships of stakeholders with each other. Using a stakeholder profile template can help collate the necessary information to make informed comparisons and decisions regarding who to involve and how best to involve them. While an individual operational-level engagement process is unlikely to use an extensive stakeholder profiling process, it could be beneficial to inform the numerous smaller processes that occur within water management activities.

Prioritizing stakeholders

A common method of prioritizing stakeholders is to focus on those stakeholders with the most influence on the goals and objectives of the participatory process and those most affected by the proposed water management activities. This enables scarce engagement resources to be utilised more effectively, concentrating on achieving the necessary strategic and operational outcomes. Impacted and influential stakeholders are treated with respect and given opportunities to understand the proposed activities, share concerns and help develop mutually acceptable solutions.

Stakeholders' interactions

Understanding how stakeholders interact and the connectivity dynamics is important to assess their level of influence and engagement in water-related decision making and implementation. Stakeholders cannot be viewed in isolation but as embedded in webs of interrelations. They operate in formal and informal settings, with interactions of different nature, degree and frequency. Depending on their responsibilities and interests, stakeholders interact more or less often with one another. Social network analysis can provide a reading template to understand interactions between water actors (Fliervoet et al., 2016). It consists in applying network theory to analyses social networks. It views relationships in terms of nodes, representing each stakeholder within the network, and ties, which represent their interrelation. Social network analysis can help to evaluate the location of stakeholders in a network to find the centrality of each actor (i.e. the degree to which stakeholders are located close to the center of the social network thus the extent to which they are well-connected). As such, it can provide insight into the various roles and groupings of stakeholders in the water sector: which actors are leading, which actors are connecting and which actors are isolated. It can also identify clusters of stakeholders, and who is in them, as well as which actors are in the core of the network and which are on the periphery.

How Stakeholder Participate

The question of how to involve stakeholders in water resources management activities in order to achieve participatory benefits rests upon two fundamental considerations. The first relates to the level of participation that stakeholders experience, whilst the second concerns the organisational structure of that participation. Regarding the first consideration, various typologies have been developed that classify participation according to its degree of involvement or level of stakeholder commitment (Table 2). Arnstein (1969) was one of the first to develop such a typology, with her original eight-rung 'Ladder of Citizen Participation', but this has since been adapted by various scholars. Determining the appropriate level of participation is only one issue facing practitioners when engaging stakeholders. Another concern relates to the manner in which to structure such participation, particularly in those instances when large numbers of stakeholders need to be engaged in participatory planning activities.

Table 2: Various typologies model of participation

Models of Participation	Author	Year
Ladder of citizen participation	Sherry Arnstein	1969
Ladder of children participation	Roger Hart	1992
Typology of participation	Sarah White	1996
Degrees of participation	Phil Treseder	1997
Wheel of participation	Scott Davidson	1998
Active participation framework	OECD	2001
Pathways to participation	Harry Shier	2001
Clarity model of participation	Clare Lardner	2001
Strategic approach to participation	UNICEF	2001
Triangle of youth participation	De Backer and Jans	2002
Youth participation in society	De Backer and Jans	2002
Dimensions of youth participation	David Driskell	2002
Seven realms of participation	Francis & Lorenzo	2002
Ladder of volunteer participation	Adam Fletcher	2003
Challenge of public participation	Mostert	2003
Four Cs of online participation	Derek Wenmoth	2006
Power law of participation	Ross Mayfield	2006
Levels, spaces and forms of power	John Gaventa	2006
The CLEAR Participation Model	Lawndes & Pratchett	2006
Participation 2.0 Model	New Zealand	2007
Engagement in the policy cycle	Diane Warburton	2007
Online Participation Behaviour	Chain Fogg & Eckles	2007
Key dimensions of participation	Driskell & Neema	2009
Matrix of participation	Tim Davies	2009
Pathways through participation	NCVO & IVR	2009
Changing views on participation	Pedro Martín	2010

Models of Participation	Author	Year
Ladder of online participation	Bernoff& Li	2010
Online participation across age	Rick Wicklin	2010
Three-lens approach to participation	DFID-CSO	2010
Behavior Grid	Fogg	2010
The Participation Tree	Harry Shier	2010
Typology of Youth Participation	Wong	2011
Six principles of online participation	Tim Davies	2011

Level of participation: The spectrum of stakeholder participation was designed by the International Association for Public Participation (IAP2) to assist with the selection of the level of participation that defines the stakeholder’s role in any stakeholder participation process (IAP2, 2007). The spectrum shows that differing levels of participation are legitimate and depend on the goals, time frames, resources, and levels of concern in the decision to be made. The spectrum is essentially a matrix identifying the various levels of public participation. The levels of participation in the spectrum matrix include inform, consult, involve, collaborate and empower. Each level of stakeholder participation is chosen based on the specific goal of the project (Figure 3). Table 3 show the tools of stakeholder engagement for each level of participation in the spectrum matrix.

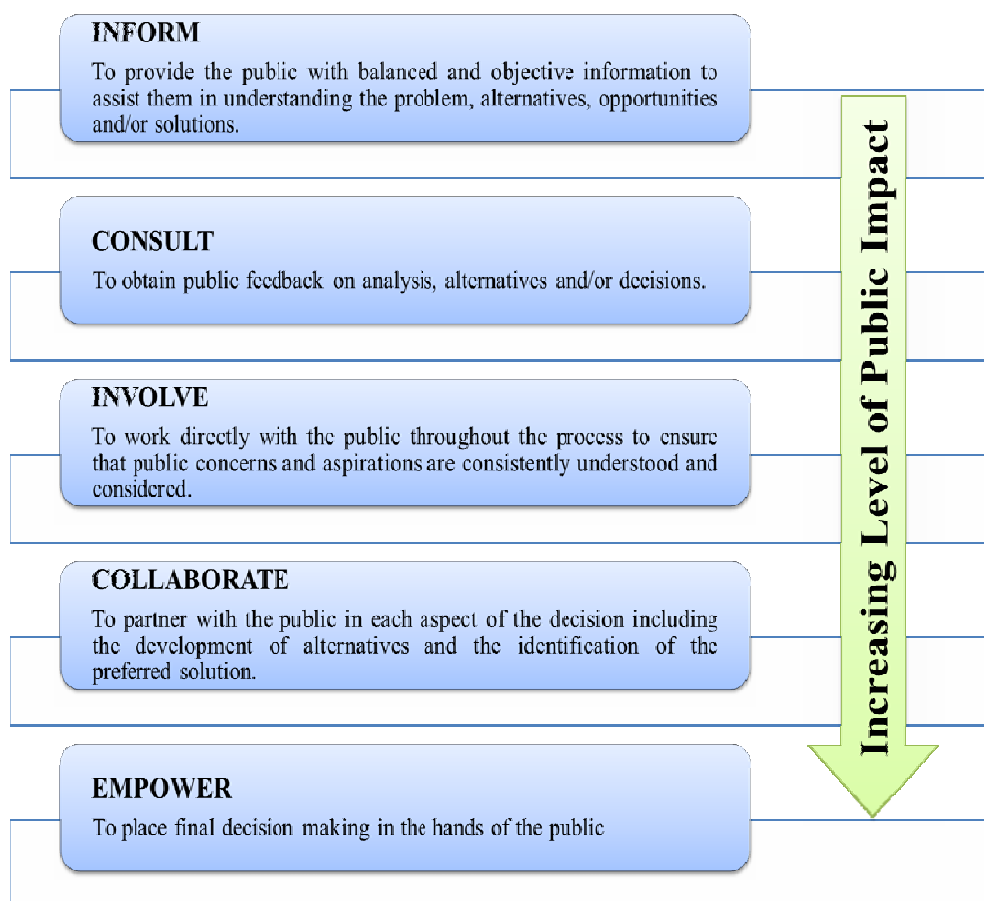


Figure 3. Spectrum Public/ stakeholder participation (IAP2, 2007)

Table 3. Classifications of stakeholder engagement tool in the level of Inform, Consult, Involve, Collaborate and Empower (IAP2, 2009; Tippett et al., 2007; Richards et al., 2004; Van Asselt et al., 2001; Rowe and Frewer, 2000.)

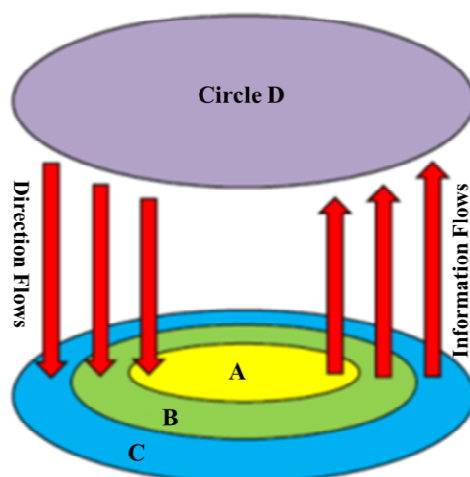
Tool	Inform	Consult	Involve	Collaborate	Empower
Community fairs					
Design charrettes					
Information contacts					
Information hotline					
Information repository					
Newsletter					
Reports					
Briefings					
Civic journalism					
Displays and exhibits					
Field trips					
Speak out (version 1)					
Surveys					
Technical reports and discussion papers					
Telephone trees					
Interactive TV					
Printed information					
Questionnaires and responses					
Role plays					
Shopfront					
Citizen committees					
Focus groups					
Key stakeholder interviews					
Fishbowl					
Newspaper inserts					
Poster competitions					
Sketch interviews					
Submissions					
Snowball sampling					
Photovoice					
Electronic democracy					
Open house					
Web sites					
Public involvement volunteers					
Public meeting					
Search conference					
Participant observation					
Future search conference					
Consensus conference					
Citizen juries					
Study circles					
Visioning					
Workshops					
Delphi study					
Conference					
Brainstorming					
Prioritisation matrix					

Tool	Inform	Consult	Involve	Collaborate	Empower
Community indicator					
Multi Objective Decision-Making Support (MODSS)					
Nominal group					
Open space technology					
Planning4real					
Mediation and negotiation					
Speakout (version 2)					
Backcasting					
Community profiling					
Media releases					
Mind maps					
Samoan circles					
Scenario testing					
Simulation (electronically generated)					
Stakeholder analysis (CLIP)					
Stakeholder analysis (Stakeholder matrix)					
Stakeholder analysis (Venn diagrams)					
Technical assistance					
Expert panel					
Kitchen table discussion					

Organisational structure: A useful way of structuring participation to limit numbers but not the influence of specific stakeholders is provided by the ‘Circles of Influence (CI)’ model, developed by sociologist Robert Waldman and now used by the US Army Corps of Engineers’ (Werick & Whipple, 1994). This approach is similar to “Orbits of Participation” (IWR, 2002). Under this model (Figure 4), trust is developed in concentric circles; planners and managers work to develop trust with leaders and organisations that other stakeholders already trust. The CI approach organizes stakeholders or subsets of the interested public according to their interests and capability of understanding complex technical issues. This can be visualized as a series of concentric circles. As an illustration, suppose there are four concentric circles, with Circle A being the innermost and Circle D being the outermost (Palmer et al., 2013). That is, those most directly involved in policy analysis activities (i.e. planners, managers and modellers who do most of the actual work; **Circle A**, communicate with trusted leaders and major stakeholder representatives at the next level (Circle B). These stakeholders then in turn provide a trusted link to all other interested parties, who have less direct involvement (Circle C). Ideally, **Circle B** participants would be active in professional or issues-oriented organisations and provide links to others whose interests they represent. Hence, **Circle C** stakeholders should see their interests represented in Circle B, and have formal opportunities to shape the work of Circles A and B via these representatives. **Circle D** contains political decision makers who provide direction to the efforts and activities of the other circles and receive information from those circles to support decision making. Politicians, their staffs, and appointed officials all may play roles in Circle D. It is important to note that communication is passed both throughout the circles (between members) and across circles (between groups of planning participants) and this information flows in all directions.

Mostert (2003), identifies six main levels of stakeholder participation in WRM, which include (in increasing order of involvement intensity):

1. Information	Stakeholders simply receive information.
2. Consultation	Stakeholders provide information to policy advisors/makers.
3. Discussion	A two-way interactive relationship between stakeholders and policy advisors/makers.
4. Co-designing	The active public involvement of stakeholders in problem analysis and policy/project design.
5. Co-decision-making	The sharing of decision-making powers with stakeholders.
6. Independent decision-making	The independent performance of planning/management tasks by all stakeholders.



- A: Directly involved Planners, Managers & Modellers
- B: Trusted Leaders & Stakeholder Representatives
- C: All Interested Parties
- D: Decision-Makers

Figure 4. Circles of Influence Model (Werick & Whipple, 1994)

The Circles of Influence model structure allows and encourages open communication throughout a participatory engagement process. Its proponents hold that this openness then helps develop trust amongst the different parties respect for each other's interests and values (Cardwell et al, 2009). Structuring participation in this way also lends itself to more easily define when and how each of the stakeholders situated within each circle is involved in specific participatory approaches. Combining the 'Circles of Influence' model with the typology of participatory levels of Mostert, one could hypothesize that participation at lower levels (1-3) would be most appropriate for Circle C stakeholders, whilst middle levels of participation (3-4) would be better suited to Circle B stakeholders working in cooperation with those in Circle A. Co-decision-making (Level 5) would likely see Circle B stakeholders collaborate with those in both Circles A and D. The top independent decision-making level (Level 6) is somewhat of a special case, in that stakeholders operating at this level would assume the role of Circle D entirely. Different stakeholders are involved in different phases of planning.

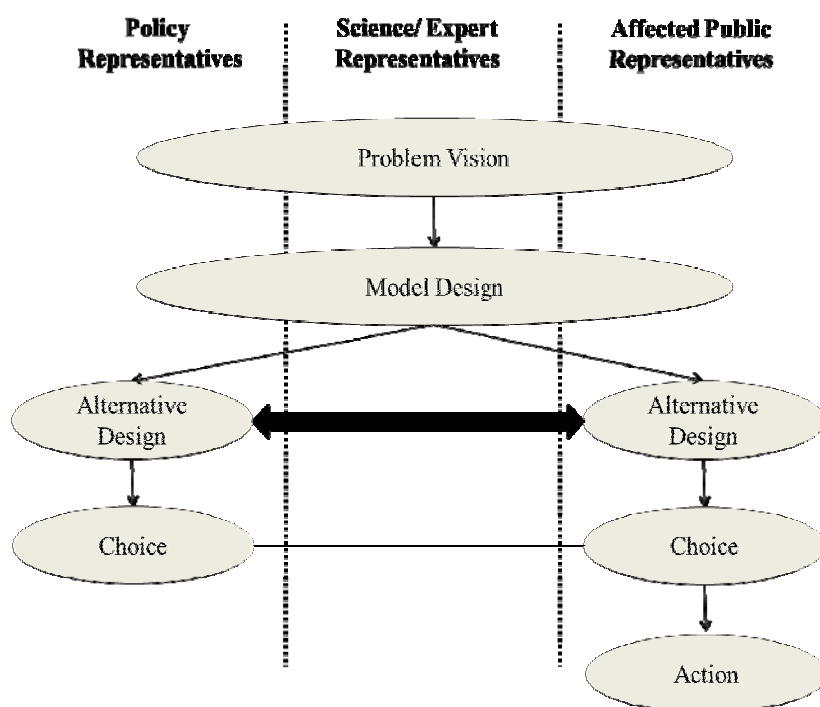
When stakeholder engagement

Stakeholder mapping is a stepping stone to understand how the water sector is organized in terms of functions and responsibilities and appropriately determine who should be engaged in decision making and implementation. Identifying stakeholders, the role they play and the influence they can have over water policies and projects processes is important to see beyond the traditional and, at times superficial, picture. An effective stakeholder mapping should help decision makers to investigate how roles are distributed, who are the key stakeholder categories, which one is pushing for what, and which ones are not being "heard" (like: Women, Young and Indigenous people, etc.)? In turn, it can support reflections on new ways to broaden the audience of engagement processes. In addition, it should not be assumed that all actors within one category are homogenous in their perceptions. Such perceptions depend on many factors – which need to be explored through the analysis – and each situation should be considered afresh rather than jumping to conclusions about the stand that different stakeholders are likely to take. Mapping exercises highlight the range of stakeholders that play a role in managing water, in terms of strategic planning, priority setting, allocation of uses, environmental regulation, information, monitoring, evaluation and level (from local to international). A typology of stakeholders can help clarify who they are, while a typology of water management function can help categorise what they do.

All stakeholders need to be informed of the various stages and outcomes of policy and project processes, but they do not need to be involved at each stage of the water project or policy. Engagement processes can be most effective when they include a careful and strategic selection of stakeholders that strikes a balance between comprehensive representation and a manageable number of participants. It is also important to take into consideration the timing of participation. Some stages of the process may be more suitable to certain stakeholder groups than to others. It is important to consider and discuss with stakeholders what they expect from the engagement process, and what could prevent them from participating. If each stakeholder's motivations are clarified from the start, the risk of confusion is reduced and the chance of greater satisfaction with the outcomes is increased. This is especially important for certain water issues that are particularly sensitive to consultation

fatigue. Strategic planning can help to identify which actors should be involved and when. It is important to find the appropriate balance between inclusiveness and empowerment of participants. Therefore, methods and processes adopted to identify who should be involved must be based on a clear understanding of the advantage and inconvenience of involving a large or small number of stakeholders with clear reasons for selection, and be as transparent as possible (OECD, 2015).

Thomas (2004) suggested that; In public policy and management decision making processes related to complex water management and planning problems, three main groups of stakeholders could be represented: 1) scientists, external experts or researchers; 2) governments, policy makers and managers; and 3) general public. Participatory modeling, where the role of the scientists, engineers and technical experts is to provide support and requested knowledge for the local stakeholders and other decision makers to formulate, structure, build and use a model or several models (i.e. the 'meta-objects') of their messy problem situation (Figure 5). The participatory modeling process constitutes a series of collective decision cycles of problem identification, problem definition, model structure and hypotheses, potential solutions, scenarios and their evaluation, culminating in final collective decisions on planned actions for implementation. In participatory modeling the stakeholders involved in the collective problem vision, model design and alternative design, phases before making their final collective choices. It is hypothesized that participatory modeling; helps to examine the real underlying problems; increases trust, appropriation and understanding of the models created, as assumptions and uncertainties are more likely to be explicitly identified and discussed; generates greater creativity and innovation; leads to an improved ability to respond to change through enhancing social capacity, adaptability, flexibility and resilience; leads to greater individual and social learning; produces richer and more realistic action plans; and provides a greater chance of adoption or implementation of problem management alternatives.



No pre-defined problem exists. The worldview, problem definition, model design, solution design and final choice between alternatives are collaboratively constructed through a series of collective decision cycles. Feedback loops between stages are likely.

Figure 5. Participatory modeling in water sector (Daniell et al., 2010)

The modelling stages in which stakeholder may be engaged during a participatory monitoring exercise are (Hare, 2011):

- **Data Collection:** where stakeholders participate in the collection of data to support model definition or later parameterization. Typically this could include participatory monitoring and surveys, or merely a request to contribute data.
- **Model Definition:** where stakeholders provide input to decisions regarding components of the model to be included, model assumptions, scenario variables, or user requirements. Stakeholder knowledge can be elucidated via interviews, card sorting, cognitive mapping, design workshops, etc.

- **Model Construction:** where stakeholders actively participate in the technical activities to determine the ontology of the model, and a working model is constructed.
- **Model Verification/Validation:** where either model components (verification) or outputs (validation) are checked to ensure that model is operating as intended. Methods include show and tell workshops, focus group discussions, questionnaires, etc.
- **Model Use:** where stakeholders use the model (either directly or indirectly, refer above). Here distinction can be made between:
 - Use that involves providing model inputs (e.g. scenarios/policy contexts)
 - Actual use of the model, where its outputs are analyzed and discussed
 - The special case where stakeholders become part of the model through acting in gaming simulations (Bots & van Daalen, 2008).
- **Alternatives/Strategies Development:** where stakeholders are actively involved in the formulation of alternative strategies or measures to deal with the problem being modelled. Again, focus group discussions and workshops could be used.

Based upon the above timing of stakeholder involvement, each of the participatory modelling approaches will also then be classified into one of the four generalised forms(Hare, 2011):

- **Front- and Back-End (FABE) form:** where stakeholders are involved in at least one modelling stage both before and after (but not including) 'Model Construction' activities.
- **Co-construction form:** where stakeholders participate in the 'Model Construction' stage.
- **Front-end (FE) form:** where stakeholders participate in any number of modelling stages prior to 'Model Construction'.
- **Back-end (BE) form:** where stakeholders participate in any number of modelling stages following 'Model Construction'.

Effective participatory processes

There are many ways to define and characterize stakeholder work. The steps outlined below offer a simple model that can help organize and describe objectives, techniques and critical issues and questions that practitioners face (Sherry, 2001):

Assessment and planning: This step involves identifying key stakeholders (who cares?), determining the nature of the water resource issues (what matters?), recognizing potential conflicts and a range of optional solutions (what might be possible?), and recognizing what level of engagement is appropriate (how do we get there?). It is also wise to assess the technical complexity of the situation, the data and analysis available (or needed), and if there are adequate resources and time to collect and deliver relevant information. This initial stage can be intuitive and quite modest, involving brief background research, some critical thinking and a few conversations. Or it can be formal and elaborate, involving stakeholder interviews and comprehensive situation assessment. The most common tools for assessing stakeholder opinions are individual interviews, group interviews, or focus groups or surveys.

Organization and process design: The products of the organizational phase might include a flow chart illustrating the time line, tasks, milestones, and sequence of interactions. It might also include a charter and/or set of ground rules. The initial process design should reflect as much of the overall effort as possible. Invariably, however, there will be diversions, changes, and revisions. A well-organized process requires adequate time and funding and needs a thoughtful communications strategy.

Education: Water resources management involves complex hydrologic issues relying on extensive data, technical methodologies, and models. It also involves technical and policy assumptions and risk analysis. This type of information requires considerable education and study. At the beginning of a project or plan, a mutual education phase allows for a complete review of the history, context, and legal or statutory constraints, as well as development of a common understanding of the problem to be solved. Later in the process, mutual education also creates a framework for future discussions, including the range and order of issues and alternatives to be addressed, an understanding of each stakeholder's interests, and development of a common technical information base.

An interest-based approach to developing goals, ideas and options: The key to building consensus is helping stakeholders share their interests— and understand and incorporate the interests of others. Interests are the underlying needs, concerns, and hopes that give rise to positions. A fundamental principle in collaboration is to help stakeholders define their underlying interests and make these known in a non-judgmental way to all participants. Reaching conceptual agreements early in a process demonstrates the value of the collaboration and establishes a foundation. The easiest first victory is to agree on a charter and ground rules. Next on the list might be defining the problem to be resolved or the questions to ask. However, to move toward solutions, agreement

on broad principles or goals can provide the foundation for success. Goals that can be expressed in a few sentences are the basic aspirations of the group and are a powerful starting point.

Building agreements: Even after looking objectively at a problem through mutual education, and gaining exposure to alternative solutions through idea generation, rarely will all group members quickly agree on one answer. The obvious solution often looks different to each stakeholder. A ‘trial balloon’, or a tentative proposed solution that is floated for feedback, is a useful tool for assisting groups to move toward convergent thinking. A single person or a group of stakeholders can create the proposal for the group to evaluate. Using trial balloons is an iterative process, where each proposal is criticized and modified to better meet interests. The group’s job is to actively consider the trial balloon, determine if there are any data gaps, and reach agreement– or reshape, reinvent, or create a new trial balloon.

Sustainable solutions: For an agreement to be sustainable, the parties need to know that their issues are going to be followed through and that commitments will be met. For example, if an environmental group seeks higher levels of water conservation in the future, they will expect assurances that actions are going to occur and that periodic monitoring will demonstrate levels of compliance. Building-in assurances (give participants comfort that their interests will be met), monitoring, funding (provide on-going information to enable stakeholders to see that elements of the agreement are being met) and an on-going venue for discussion, evaluation and adaptation (allows projects to move forward in the face of uncertainty) are essential to long-term success.

In any stakeholder interaction, large or small, short term or long, some form of these phases plays out, either deliberately or organically. For a comprehensive stakeholder process, each step is followed deliberately to ensure an organized and effective approach. But even for a single meeting, the discipline of assessing the situation, planning and organising, educating stakeholders around issues, and then (and only then) negotiating or seeking agreement is a useful sequence.

Conclusion

Public policy making is trending away from the old “top-down hierarchical model”, which exerts sovereign control over the people and civil society, to a more transparent and holistic model that involves public, non-state actors (private sector and not-for-profit organisations). The water sector has undergone this change; the traditional role of “governments” as the single decision-making authority has been replaced by multi-level, polycentric governance. This transition acknowledges the important role that stakeholders from different institutional settings can contribute to water management. This shift is demonstrated by the development and use of international hard and soft instruments for stakeholder engagement. Understanding how stakeholder engagement has evolved, as well as the key concepts and definitions that underlie it, is crucial to identifying inherent challenges and policy solutions. Naturally, it is of interest to establish the most appropriate means to incorporate stakeholder participation in project planning and computer-based modelling processes to maximise the potential benefits, minimise the negative consequences, and restrict or mitigate the impacts of any limiting conditions. It is only by doing so that the ‘risks’ of involving stakeholders in participatory management activities will become more acceptable to water managers, experts and decision-makers alike, and the demand for such approaches will increase. To do so, however, relies upon focussing attention upon the performance of participatory management exercises in achieving these aims. Public/ Stakeholder participation allows the planning team to understand the problems, issues, and possible solutions from the perspectives of the various interests. There are three primary goals of public participation: 1) Credibility: An open and visible decision-making process accessible to all on an equal basis makes the planning process credible to groups with diverging points of view; 2) Identifying Public Concerns and Values: various groups have different points of view and values, they will evaluate any proposed action from different perspectives; 3) Developing a Consensus: An implication of the many divergent points of view is that there is no one philosophy that can guide the planning team’s decisions. Consensus must be formed on an issue by issue basis. Public participation provides a process for evolving such consensus.

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