Developing new tools and methods for the Integrated Sustainability Assessment of water. The Matisse project and the Ebro River Basin

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Abstract

Persistent unsustainable problems are not problems occurring 'out there', independently from our individual and collective behaviours in our daily interactions with the environment. Most current tools and methods for the assessment and management of unsustainability tend to focus on representing changes on –apparently distant- biophysical changes, rather than deepening in the understanding of personal and agents' behaviours, motives and values, and hence, tend to show unsustainability problems as 'others' problems'. Furthermore, in practice, existing assessment tools and methods tend to limit their scope of assessment to one single area of reality, deal only with one type of knowledge and often are addressed to the wrong communities of action and change. The EU MATISSE project aims at developing new reflective tools and methods capable to overcome some of these pitfalls by supporting the co-production of relational, socially robust, and systemic narratives and visions which may stimulate transition learning and action on persistent unsustainability problems. Such narratives and visions, we argue, can be better developed, within the context of the new approach of *Integrated Sustainability Assessment* (ISA), if they depart from a multiple social agent-based perspective.

Our paper provides a first description of the ISA of water within the context of the EU project Matisse, and applies such framework in a participative way for the case of the Ebro river basin. First results show that an emerging vision of sustainability entails a great deal of collaboration between agents working at different levels, as opposed to a fragmented world in which actors pursue their interests and benefits in an un-coordinated, exploitative and short-sighted manner. In this vision, stakeholders' underline how multi-scale, multi-domain and multi-time problems such as the relationships between upstream/downstream, global/local, and short term/long term socio-economic processes need to be incorporated into the assessment and policy processes aimed at enhancing the *socioecological resilience* and sustainability of complex water systems such as the Ebro river basin.

1. Introduction

Persistent unsustainability problems are not problems which occur 'out there', independently from our individual, collective and daily multi-scale behaviours and interactions with the environment. Unsustainability is the cumulative result of the reproduction of a number of structural set of relations between natural and social systems which create a mounting number of unintended, negative and irreversible consequences both on humans and natural systems. In policy, persistent problems of unsustainability can be understood as those generated by the reiterative adoption of wrong solutions (usually of a non-systemic and short-term guise) to daily collective problems.

Most current tools for the assessment and management of environmental problems tend to focus on one area of reality, type or level of knowledge and in this way they then to suffer from a great deal of reductionism. The situation highlights the need for new approaches at the science-policy-society interfaces to deal with such problems and to facilitate transition paths to more sustainable system futures. A more systemic and integrative view both in science and policy is essential. Envisioning new plausible future

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sustainable scenarios and engaging relevant stakeholders in the definition and implementation of policy options is becoming 'normal' practice in current EU research projects and it is indeed a source of a more socially robust *knowledge for policy*.

The EU project MATISSE (Methods and Tools for the Integrated Sustainability Assessment, 2005-2008) is a three year EU project aimed at developing basic research in the area of the sustainability science, transition theory and Integrated Assessment. Its objective is to develop and improve the methods, procedures and tools for the Integrated Assessment of persistent problems, such as the unsustainable use of water resources. MATISSE sets out to develop new tools and methods capable to support the creation of new relational and systemic narratives which can incorporate such new visions. For MATISSE, the primary objects of assessment are socio-ecologic systems under a range of dynamic driving forces, including the influence of prospective policies, programmes and action plans. Under this framework, MATISSE has defined Integrated Sustainability Assessment (ISA) as *a cyclical, participatory process of scoping, envisioning, experimenting, and learning through which a shared interpretation of sustainability for a specific context is developed and applied in an integrated manner in order to explore solutions to persistent problems of unsustainable development* (Weaver et al. 2005).

The aim of this paper is to introduce this conceptual framework of ISA and to show an example of our understanding and application in the domain of the MATISSE water work package. In particular, we focus our illustration in one of the participatory *Integrated Assessment focus groups* (IA-FGs, Kasemir, et al. 2003) which are being held in the Ebro Delta to frame and help the understanding of the unsustainable persistent problems, to envision shared sustainable futures, and analyse the feasibility of the ISA in a particular social context representative of processes and conflicts around the use of water occurring elsewhere. Certainly, Water constitutes a very special domain to express the type of unsustainable relationships humans systems maintain with the natural systems, as well as of the type of multi-scale policy assessments which need to be taken when dealing with a fundamental and increasingly globally scarcer natural resource (Gleick, 2003). This notwithstanding, water can also provide a very illustrative case to understand how sustainability problems do not only steam from 'natural' scarcity situations but as a relational and hybrid result of the prevalence of conflicting cultural worldviews on the meaning of natural resources, their role in society, and on the relationships between natural and social systems in general (Tàbara, 2006, 2005).

2. The MATISSE project: developing the ISA framework

The lack of systemic analytical tools and methods able to handle tackle unsustainable persistent problems so that they are able to integrate social, institutional and cultural dimensions sets the basis of the MATISSE project. Most of expert knowledge (scientific and technical) address environmental changes mainly focussing on their final and separate effects – reductive, fragmented approaches- rather than dealing with the whole network of relationships between their ultimate causes and their systemic effects on the global socioecologic system. Matisse is not only concerned with improving the understanding of the systemic implications of the continuously evolving concept of 'sustainable development', but also with exploring the basis for an operational integration of sustainability into policy processes and structures. In this sense, Matisse somewhat adopts a perspective akin, albeit critical, to the current discussions on 'mode-II' science insofar as it aims at providing useful knowledge in its context of application, hence socially distribute and socially robust knowledge which steams from a close communication with stakeholders (Muller, 2003, Gibbons, et al. 1994, Nowotny et. al. 2001). Sustainability knowledge must aim to meet the criterion of 'strong contextualisation', although, at the same time, must be able to inform and integrate the knowledge and lessons learnt from other contexts and domains.

Participatory *Integrated Sustainability Assessment* (ISA) tries to go beyond the existing procedures of Environmental Impact Assessment or Strategic Environmental Assessment. In particular, ISA is about co-joint paradigm-change searching, rather than using in an incremental way the existing policy and science paradigms to reinforce, or partly to reform, current practices. In its participatory guise, the making of policy options in ISA is not considered only as a result of an expert knowledge process, hence neglecting other types of knowledge, worldviews, perceptions and values, but mostly a mutual learning experience which arise from direct interactions with non-expert social agents in the definition of such problems and options as well as the tools and methods to assess them. The use of knowledge only from the natural sciences is acknowledge as insufficient to fully grasp the complexities of unsustainability, and in this sense, social sciences and participatory methods can play a crucial role in improving the relevance of the defined policy options and their implementation.

MATISSE aims at focussing on those approaches characterized by integrative, systemic, multi-scale, and co-evolutionary perspectives and relates to mid and long term policy questions such as what kinds of socioeconomic development futures, what pathways of change might be feasible and compatible with these futures, and how normative concerns for sustainability might be integrated into policy making processes. This is the framework of ISA, which consists in the following states in line with the ideas of transition theory as developed by Jan Rotmans and his collaborators (figure 1) [2]:

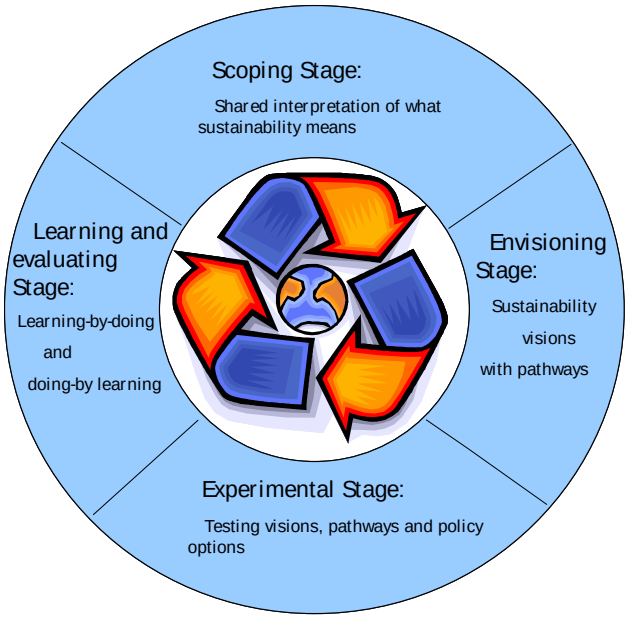


Figure 1 – ISA within MATISSE

1. **The Scoping stage**: It aims at exploring in a participatory and qualitative way the definition of the problems at hand in order to set an issue definition, its political and socio-economic context, its challenge and opportunities towards sustainability. It permits to highlight different stakeholders' perspectives with regard of their interpretation of the problems and to identify the contextual factors (cultural, ecological, economical, institutional…).
2. **Envisioning stage:** It is aimed at the development of sustainability future visions. Each desired scenario can be achieved by different pathways that should be evaluated for their socio-ecological effects. Finally, this phase implies the

[2] For more details on ISA process review Weaver and Rotmans (2006) and Van der Brugge, et al. 2005.

formulation of policy options explicit and implicit considered for the endpoint scenarios.

3. **Experimenting stage:** the sustainability visions and policy proposals methods are tested in terms of consistency, adequacy, robustness and feasibility. The impacts and the trade-offs regarding each transition pathway (scenarios) are explored.

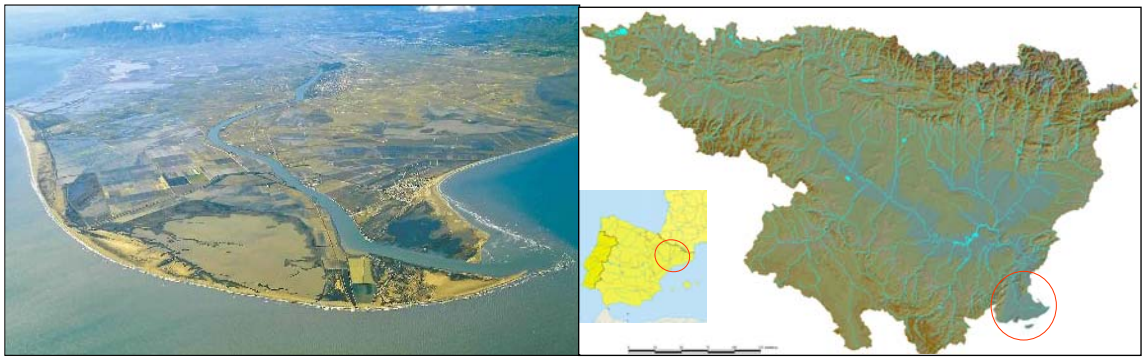
4. **Evaluation and Learning –** The aims are, first to elicit the views of the stakeholders on the process so far and the tools used and results; second, to find out whether there has been individual or collective learning as a result of participation in the process so far. These provide inputs for the project team to adjust processes, tools, methods and assumptions in the next round. On the basis of the evaluation in phase 4 and the results of the other phases, a further round of ISA might be performed. In order to continue the iterative process.

Now we move to show an illustration on how are applying such procedural template to the Ebro River Basin, and more specifically on the area of its Delta. Our results only show part of the larger on-going work carried out during the first year of the project (on scoping and envisioning) and we only focus on the description and analysis of one of the several IA-FGs which are being held in that context.

3. ISA application in the Ebro Delta

3.1. The context

Deltas are socioecological systems with an increasing vulnerability to accelerating global environmental change. First, they increasingly receive the impact of human activities, mostly due to permanent patterns Delta human occupation combined with a mounting number of economic social and recreational activities developed inland. Secondly, climate change and accelerated sea level rise threaten lowlands, which in many cases the situation is aggravated by subsidence phenomena as a result of aquifer overexploitation (IPCC, 2001). Traditional management strategies based on a partial, reductionist view of the problems regarding the use and management of water resources in these environments have often proved inefficient to deal with them and have provoke the emergence of other sources of water unsustainability. To a large extent, a Delta can represent a *microcosms* or a socioecological *meta-indicator* indicative of a whole array unsustainable processes occurring within the river basin system and beyond. This situation is reflected in the case of the Ebro delta.



Pictures 1 & 2 – Ebro River Basin location and aerial view of its Delta.

The Ebro River Basin is located in the north-eastern part of the Iberian peninsula (fig. 2). It is the largest hydrological basin of Spain and flows into a delta that represents one of the most interesting wetland in the Mediterranean basin for its rich biodiversity. The 330 km^2 of surface is characterized by a flat landscape, low population (15.000 inhabitants)

and a high ecological value in terms of containing several designated Ramsar sites important for bird migration and the presence of rare plants, fish and invertebrates. However, and despite its the apparent wilderness, the Delta is a highly humanized environment since and the present form is the result of more than two centuries of human intervention. Several socioeconomic activities, mainly from the primary sector (e.g. agriculture, fishing, aquiculture and hunting) have shaped its current landscape. Among the current land uses in the Ebro Delta, the rice crop is particularly relevant as it occupies around 65% of the total delta's surface. Besides, tourism has become more significant last years. Urbanisation in the Delta is not very intense. A part from several scattered rural houses, only two relative small towns (Deltebre and Sant Jaume) concentrate urban uses in the area. However, the urbanization pressure, mostly as second house residence, is becoming widespread and can represent an increasing threat to the conservation of the Delta natural heritage in the near future.

One of the most outstanding symptoms of persistent unsustainability of the Ebro river basin system –as well as in other Spanish river basins- was expressed in the conflicts that arose from the making and failure attempt to implement the last National Hydrological Plan (NHP). This Plan, which was cancelled by the new left-wing government after the national elections in 2004, proposed a water transfer from the Ebro river basin to other 'deficit' river basins. The proposal was highly criticised as not taking sufficiently into account the social and ecological impacts of the whole Ebro river basin, and because it framed the issue merely as a 'water scarcity problem' (that is, simply as an economic demand/supply optimisation question) rather that taking the whole matter of river basin resource and landscape management in a more systemic and comprehensive way. The National Hydrological Plan caused a wide social upheaval manifested in the largest demonstrations on socio-environmental issues carried out in Spain for over two decades. This resulted in the creation of new collaborative networks of action, even with previously confronted interests, which engaged most of the relevant social actors within the Ebro river basin. A wide range of stakeholders, which were working independently in their own individual activities, started building a cross-cutting new social movement which was named by 'New Water Culture'. This conflict exemplifies how an external pressure that threatens the whole system in which even confronting agents operate, may be the trigger for a social re-organisation that leads to the creation of new institutions to cope with that threat[3]. Among the self-defined goals of this social movement, the aim is to move a traditional management model based on water supply to the demand water management.

3.2. Integrated Sustainability Assessment focus groups.

We understand that this is not the place to carry out an extensive literature review of participatory approaches to science and policy making but rather to focus our attention in our experience in one of the exercises carried out already in the context of the application of ISA in the domain of water[4]. Our approach is based on the previous experiences in the development of a methodology called *Integrated Assessment focus groups*, the specific procedure and origins of it can be found in Kasemir, et al. (2003) and Dürrenberger, et al. (1999)

[3] Interesting enough, it worth noting that such threat which operates as *trigger of transition* is not simply a biophysical threat, but mostly an institutional one, or more specifically a biophysical threat mediated by social institutions (in this case political institutions). Hence, more research in needed to understand what type of triggers, and in what conditions, sustainability transitions start in the first place (see Tàbara, Haxeltine & Ilhan, 2006).

[4] For that purpose, one may consult, only as illustration of different but related approaches, Sarwer-Foner, B. *Participatory Action Research, An Annotated Bibliography.* Available at: http://www.ssmu.mcgill.ca/qpirg/gradefiles/par_annotated_biblio.pdf; also see R. Chambers (2005).

As mentioned above, ISA methodology consists in four main stages (scoping, envisioning, experimenting and learning). In the following line we will describe, a participatory process which was carried in the selected study area of the Ebro Delta, as part of a several number of IA-FGs that will take place along the whole river basin and focus mostly in the first two stages. It consisted in the second of our meetings with stakeholders and was held in Tortosa on the 10th of March 2006. The participants were recruited from representative institutions that play an active role in the Ebro Delta management (New Water Foundation Culture, NGO Seo-Bird life, Catalan Water Agency, Regional Council of Ebro Delta, Municipality, Farmers, and the Ebro Delta Natural Park.

One of our main purposes of the meeting was to observe the feasibility of the ISA to encourage the emergence and integration of different types of knowledge, and to learn how such methodology could be improved, e.g. what type of complementary tools, such as computer models, could be necessary. Our participatory process was also set out as a deliberative tool to obtain insights on how the stakeholders perceive and interpret the persistent problems of the Delta and their relationships among different dimensions and scales of action of the river basin. Hence, we aimed at finding out more about:

- The stakeholders' perceptions and interpretations of the unsustainable problems that persist in the Ebro Delta, in particular, identify the driving forces (causes-effects-responses) that decrease the sustainability of the area.
- Public's perspective about future scenarios of Ebro Delta in 30 years through which it is possible to elucidate strategies or pathways that helps to reach them.

In order to reach both objectives, a series of participatory dynamics were organised intended to cover the stages of scoping and visioning in a sequential mode. The first one was articulated around a cause-effect-response matrix divided into the different dimensions (ecological, economic, social, institutional, cultural, technology, others). The aim was to discuss and deliberate around *shared vision of unsustainable problems* in the Ebro Delta with a relational perspective interconnecting them. The second consisted in a visioning exercise using the collage technique to create a vision of how would be a *sustainable* scenario of the Delta in contrast to a *business as usual* one. For that exercise the participants were split in two small groups and each of them were asked to support the creation of scenarios making 'collages' on land uses maps of the Delta.

3.4. Results of the scoping stage: 'Welcome to the Delta's complexity'[5]

As a result of the first participatory dynamic, a system representation of the baseline problems in the Ebro Delta was drawn by the stakeholders, the results of which are shown in table 1. Simply, stakeholders were asked to discuss and fill that table some tags written by themselves as to start the discussion.

At the beginning, the main focus of attention were related to problems directly linked with environmental dimension (e.g. pollution, subsidence, deforestation, …) which were understood as the result of the past and present practices in the exploitation and control of the river basin natural resources, under what has been called 'structuralism paradigm'. At the same time, and in contrast, a more systemic and relational worldview emerged during the discussions. Several participants perceived and explained the Delta's changes and its evolution as an intimate, dynamic relationship between natural resources and their exploitation: 'Changes in rice crops productions affect biodiversity'; 'water irrigation management affect crops…' So it appeared among the participants that a more complex and richer perspective was needed to comprehend the system. As it was expected, economic dimension was perceived as a significant driving force of change. The

[5] As quoted by one of our participants.

increasing tourist pressures and the crisis of the agricultural sector were underlined as the main ones.

However, as the activity was moving on, the focus shifted to the institutional context. One of the most relevant results of the workshop was the strong perception the participants had on the key role of the institutional dimension when thinking in the sustainability of the Ebro Delta. The participants agreed on the lack of integrated management of the river basin due to an institutional fragmentation. An example which they provided was related with the impacts caused downstream due to the dams' construction. Water regulation for irrigation, industrial and urban uses, and flood risk control have provoked regression and subsidence problems in the delta system. This is seen as the result of a sectoral management of the river and a partial problem framing by conventional assessment methods. Another example given was the historical treatment of the Delta in two administratively separate parts, which not often have collaborate toghether. The northern and southern hemi-deltas pertain to different administrative counties (*comarques*).

	ECONOMIC	ENVIRONMENTAL	INSTITUTIONAL	CULTURAL	TECHNOLOGIC
CAUSES	-Agricultural market sustainability -River Basin Regulation -Tourism -Lack of Economic Resources at local level	-Intensive agriculture -Deforestation -Wind energy parks -Foreign species introduction -Ecosystems fragility -Landscape	-Absence of integrated management -Public Participation -Urban Laws disconnected with landscape	-Origin value -Cacique structures -No individual conscience -No Universities in the region -Old water Culture -No participation -Humanization process	-Hydroelectric Power -Uncontrolled groundwater
EFFECTS	-Rice production decreasing -New projects, new social conflicts -Human occupation of risky spaces close to the river	-Salinization -Subsidence -Habitat loss -Contamination -Species´ loss -Disadvantages to the primary sector	-Non-coordinated administrations		-Caudal stabilization -Breaking dynamics of water system
RESPONSES	-Origin denomination	-Hard protective measures -Water quality -Water circulation -Environmental indicators	-Associations -Institutional coordination -Agenda 21 -Non-normative management plans -Cooperation plans	-Social movements	

Table 1 - Cause-effect-response matrix used by the participants during the workshop

The general perception of the participants was that there are many administrative bodies responsible for different areas of River Basin Management, and that more coordination is needed, especially when they are from different institutional levels (national, central or local). For instance, in the coastal areas, Public Maritime Domain is at hands of the Central Government (Directorate of Coasts within Ministry of Environment) whereas inner coastal zone like the Natural Park is hold by the regional government and navigation channels management are Ministry of Public Works' responsibility. This was precisely seen as the root of unsustainability.

Thus, one of the questions that arose from this exercise was the following: what should be the institutional context design that would permit to cope with unsustainable problems in a more collaborative way?

3.5. Results of the envisioning stage: two contrasting perspectives of the future

The two pair of scenarios –two per each subgroup- were quite different, although can be grouped in two categories. After a plenary session and the participants named and described them as it is follows:

- **Technical-expert perspective:** These visions were mainly focussed on individual, scattered problems (e.g. energy extraction, coastal erosion problems, loss of aquiculture, population growth…) and in order to search solutions they deepen more in the causes and in the particular solutions for each problem. Generally speaking, the proposals mainly worked towards the improvement and reinforcement of the biophysical capacity of the system to cope with environmental problems. Several proposals were innovative and have a systemic perspective like the 'managed realignment strategy' of the shoreline and the restoration of the wetlands in order to deal with changes and dynamics of the Delta (Ledoux, 2004). In Spain, this kind of alternative has never been considered as in a real assessment process.

- Socio-institutional perspective: These visions were related with the institutional and organisational aspects, entailing a great deal of collaboration between agents working at different levels, as opposed to a fragmented world in which actors purse their interests and benefits in an un-coordinated, exploitative and short-sighted manner. One of the main findings of the workshop held with local stakeholders in the Ebro Delta was that there is an urgent need to coordinate and strengthen social networks to achieve sustainability. It seems clear that sustainability implies a large degree of empowerment and coordination between different agents at different scales. In particular, an emerging vision of sustainability is that unsustainability is the result of the lack of conscious collaboration between agents working at different levels with the overall goal to reduce their impacts on aquatic systems and on other agents. Although participants believe that beauty of the landscape and the ecological value of the Delta is the main sustainability resource, this is depending on the better organisation, planning and coordination of the institutional context.

Picture 3 & 4 - Envisioning exercise using the collage technique (Kasemir, et al. 2000)

3.6. Discussion

ISA aims at appraising unsustainable persistent problems from a systemic and multi-scale perspective and therefore departs from the acknowledgement of the need to integrate social diversity and plural patterns of interpretation of the system under study. In this sense, ISA can be understood as a tool of the larger societal process of *sustainability learning* (Tàbara, 2005). In our participatory exercise, the application of

the two first stages of the ISA helped in promoting the integration of different kinds of knowledge in the evaluation process and tried to approach our discourse in a multi-scale, participatory, and systemic fashion. For that purpose, within the Matisse water work package we are also developing a multi-scale social agent-base model called the World Cellular model, in which stakeholders also participate in the initial stages of it development (Tàbara et al. 2006).

Specifically, the scoping exercise contributed to a more accurate representation of the unsustainability drivers within the Ebro Delta. It was able to assess relationships between the origins and the effects of processes of both human and natural systems dynamics in an interrelated and integrated way. Through the cause-effect-matrix exercise the participants were able to connect the impacts of human actions with economic, cultural, ecological, technological and social dimensions. The process also helped to acknowledge some linkages among multi-scale process in water management in their different spatial scales of action – local, meso, and global, and from the very individual to the global. Another output of this exercise was the emergence of systemic and relational worldviews. The perception of the Delta as a dynamic and as a result of a bi-directional relationship between nature and society confirms the presence of a co-evolutionary worldviews among the stakeholders. This contrasts with the hegemonic discourse that has leaded the traditional hydraulic paradigm of increasing water supply defending 'nature control by society'. In that sense, scoping phase open up the debate and broaden the problem framing.

In the envisioning exercises our expectations were that the process would promote the integration of those worldviews that push the Ebro river basin towards the shared sustainable vision. Through the participative procedure some emerging worldviews and perceptions highlighted the need to address institutional issues in order to enhance future sustainability of the Delta. These contrast with conventional worldviews characteristic of more traditional assessment processes characterised by being focused on their final and separate *effects* -once they have already entered into the socio-ecologic systems and are dealt in a fragmented way- rather than dealing with *the whole network of relationships between their ultimate causes and their systemic effects* on the socioecological systems. The former perspective was referred as *socio-institutional* while the later was called *technical-expert*. However, we believe that both perspectives are not exclusive but complementary and a real effort should be done to integrate them as part of the whole assessment process.

The importance of the institutional context and of building social capital to cope with external perturbations was acknowledged in the *socio-institutional perspective*. This finding is not new and has largely been discussed the existing literature. As argued by several authors (Adger, 2005; Berkes et al. 2002; Folke et al. 2002; Olson, 2004) the creation of new institutions and forums strengthen social capital and provides social resilience to socioecological systems. Social capital can procure better means to cope with abrupt changes and hence improve the resilience of local populations, particularly in the context of resource-dependent livelihoods, like the case of some relict economic sectors of the Ebro Delta. Also, as stated by Olson (2004) adaptive capacities are needed to deal with environmental perturbations. Hence, collective action is also recognised by Adger (2003) as one strategy to increase adaptive capacities of socioecological systems to face future uncertainties, specially coming from climatic changes. The conflict which arose from the threat posed by the National Hydrological Plan (NHP), was indeed a catalyst to build social capital and networks of trust between actors that previously not only did not collaborate with each other but were regarded with suspicion. In the Ebro river basin the threat motivated as a response which led to a new emerging strong communal identity. Many participative institutions and new forums of discussion were created although the challenge now seems to be how to organize them. Our stakeholders were aware that more coordination among these institutions is needed.

In short, participants were believed that more coordinated collective action is necessary to prevent the unsustainable problems presents and to adapt to the changing future and dynamic environment that characterise the Delta. But this may depend, however, on building trust and social capital in the first place. To a large extent, *the problems of sustainability* –and the possible development of pathways to deal with them- *are problems* of *identity and responsibility* –of understanding that such problems are not just 'out there' and that have nothing to do with our personal actions, values and behaviours. In this sense seems clearer that tools and methods of ISA that support collective action in a bottom-up participatory fashion and take into account such relational approach are well suited to reach this goal. The question then arises in our case on how is possible to cooperate, and to organise these large number of formal and informal social movements which were engaged in the debunking of the NHP, once the 'threat' of such plan has passed. Our exercise has helped in reflecting on the opportunities and difficulties for transitional changes towards sustainability and in particular about the great challenge 'to learn to collaborate together'.

4. Conclusion

One of the main insights that we obtained from applying the ISA process in the context of the Ebro Delta was a vision from stakeholders of sustainability as a situation in which relevant social agents continuously *learnt to collaborate together* for the common good. This does not mean that all actors participate of the same set of goals and interests that drive their actions, neither that all of them share the same worldviews and ideas about the future. Rather, it means that the different views of the future are not necessarily completely at odds with each other, and that certain degree of complementary and of positive synergies can be found among them within a minimally common understanding of the problem situation (that is, about what is the problem, but not necessarily about what we need to do about it). To put a example in another field of collective action, in the same way that institutions working for the guarantee of tolerance in the public sphere (religious, sexual, …) from a common ground of the situation should be able to protect all positions except those based on intolerance, those institutions and social processes aimed at guaranteeing sustainability should be able to protect and defend all legitimate positions –also from a common understanding of the context- with regard to the use of resources, except those which completely oppose to the maintenance of the minimum accepted standards of sustainability. Evidently, this is just one of the visions of sustainability, and still opposed to others, which may not even consider sustainability as a problem, and which are present and influence the management of natural resources. In our research a 'socio-institutional' vision of sustainability contrasted with another one which appeared under the heading of the 'technical-expert' perspective, indicating that a move in the path of sustainability transition may need to integrate the two.

Hence, our results are only part of the visioning stage of a fully-fledged ISA process, still in motion. ISA provides a structured framework that permits to integrate different sources of knowledge in the process of framing, envisioning and elucidating strategies, pathways and system interventions towards sustainability. We have provided an example of an operationalisation of ISA in the specific context of the Ebro delta. Through the first stages of the ISA with stakeholders we have underlined how multi-scale, multi-domain and multi-time problems such as the relationships between upstream/downstream, global/local, and short term/long term socio-economic processes need to be incorporated into the assessment and policy processes aimed at enhancing the *socioecological resilience* and sustainability of complex water systems such as the Ebro river basin. This impinges directly on the issues of power and peoples' responsibilities, which most current tools and methods for the assessment of water resources often overlook. In other words, to a large extent, assessing sustainability is about assessing *who is responsible.* In that way, we need to create new tools and methods able to unveiling who has most of the burden of the causes of unsustainability as well as most of the capacity to participate in

the making and implementation of possible pathways of action to deal with them. In particular, new, criteria and new processes for multi-agent collaboration, built on extended identities of interest, need to be developed within the context of an greater awareness of the consequences of each social agent' action and their impact on other agents. New tools and methods may be necessary, but only useful, if they really contribute to change current system relationships.

However, many difficulties remain. One of the criteria of quality in Integrated Sustainability Assessment should be closeness and relevance to decision-making. At present, we have only conceived our process as an exercise to learn how ISA should be, rather than to show how ISA is, e.g. as a tool to inform and guide specific policy processes and decisions in concrete situations. In our case, the ISA was still performed as a basic research experiment and our expectations regarding its influence for decision-making processes are necessarily low. But on the other hand, the analysis on the visions of sustainability through the integration of different sources of knowledge has broaden our understanding and has enormously enriched our assessment of the whole system dynamics and the kind of problem that we confront in the domain of the sustainable management of water resources.

In particular, our application of ISA for the case of water that has allowed us to better identify those key elements which drive in driving current unsustainability, not only from our 'expert' perspective but more importantly from the perspective of the 'people of the context'. Hence, deliberative process might open up new debates and improve the capacities for greater awareness and control over negative consequences of different policy alternatives and measures. Our procedure has led to of an array of –hopefully- more socially robust policy options; and some of them may be more adaptive with regard to fast changing system dynamics. Nevertheless, further research is needed to understand and assess to what extend these options may contribute to enhancing socioecological resilience both from biophysical side (e.g. wetland restoration through managed realignment) and socio-cultural side (e.g. institutional coordination and collaboration). This will take us to next experimenting phase of the ISA process.

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