A participatory modelling process

Since the late 90s, about hundreds of scholars and practitioners in the world have focused together on an innovative methodological framework for shaping shared solutions for sustainability. Their framework is underpinned by the hypothesis that dealing with the complexity of current sustainability challenges requires new forms of knowledge and operational practices. Over the centuries, local communities have developed complex and flexible overlapping institutions in order to continually adapt their rules and practices to uncertain environments. Today, this knowledge may be useful to change the current ways to think about sustainability. Yet, ways of interacting between such diverse forms of knowledge as local and scientific knowledge, and in a less extent from different disciplinary fields, require developing a specific methodological framework. In the late 90s, a French interdisciplinary team set up a simulation framework that succeeded in providing a more balanced exchange of knowledge between disciplines as well as with local knowledge, which provided local concrete solutions of sustainability management in applied contexts (e.g. d'Aquino et al., 2002; Etienne, 2014). This framework, called *Companion Modelling*, combines simulation games and computerized participatory modelling in a way that allows diversity of knowledge and worldviews to be expressed and within a shared perspective of concrete scenarios towards sustainable futures. During the last two decades, this *Companion Modelling* approach has spread out in the worlds of both scholars and practitioners (from environment to development agencies): see http://www.commod.org/. The approach is used to set up collective appraisals and agreements for complex issues of sustainable management with the rationale of taking account of local points of view as much as scientific knowledge (see references below).

As regards the theoretical background, the multi-level ComMod process attempts to remove the dominant influence of scientific positivism on local knowledge. In this perspective, during the initial participatory design the modeling process does not integrate steps neither scientific knowledge (environmental state, sustainable practices, climate trends, etc.) nor points of view about what is "good" or "bad" for the future. The epistemological challenge lays on to framing as much space as possible to locally-held knowledge and worlds view (d'Aquino, 2007; Barnaud et al., 2013, Etienne 2014). The hypothesis is that local knowledge requires non-normative and opened frameworks to better express its original points of view and principles to deal with complex sustainability challenges. The multi-level ComMod framework also defines that a successful scaling-up of innovative knowledge is needed in order to reach a true transformative impact. A sound basis is then that succeeding in scaling up impacts requires social sciences skills, because scaling up requires dealing with different governance levels, institutional arrangements and social networks. Implementing a scaling up process requires an overarching framework within which participatory workshops are interlinking the different institutional levels (d'Aquino and Papazian, in press). This impact process requires a 'multi-level' and incremental organization of overlapping participatory simulation workshops at different levels or arena of governance (d'Aquino and Bah, 2014). This "cascading" strategic approach of knowledge process (d'Aquino, 2009; 2014a; 2014b) thoroughly combines a diversity of actions (from participatory workshops to lobbying, and towards farmers as well macro levels decision makers). Beyond knowledge processes, this multi-level engagement frame also sets a huge political challenge: rising up a common political dialogue then commitment, from local levels to policy levels (see below the research questions in the last part). This way of refocusing scaling up and knowledge management lays the ground for a pragmatic theory of change.

Local communities have long developed adaptations to uncertain availability of resources, which concern not only flexible practices but also a specific design process of social rules to conserve flexibility while preventing disorder (e.g. Mehta, Leach et al., 1999; Ostrom, 2005; Reed et al., 2008). Indeed, several authors have pointed out that different ways of framing knowledge and values are too often concealed (e.g. Dougill et al., 1999; Cash et al., 2006; Scoones, 2009). This raises the epistemological question of what is meant by the term "local knowledge" when addressing sustainability (Reed et al., 2008; Stringler and Reed, 2007). From our own perspective, local knowledge is not simply understood as practical knowledge but as an alternative representation of nature-society relationships, in particular adaptability, and between individuals within a society, in specific flexible and overlapping institutions (Berman et al., 2012).

Our hypothesis stems that this local way of thinking adaptability is today more than ever useful to deeply transform our ways to achieve sustainability (Berkes and Folke, 1998).

These questions of cognitive construct are today fundamental but often remain unaddressed or only treated implicitly (Bouwen and Tailleu, 2004; Kolb, 1984). After several decades of participatory experience, a major obstacle remains, namely how to avoid deforming the local cognitive frame with scholars' scientific background (e.g. Gardners and Lewis, 1996;, Sellamna, 1999; Agrawal, 1999). Indeed, participatory approaches that really aim to elicit local knowledge are rare (e.g. Wakeford and Pimbert, 2004; Lynam et al., 2002 and 2007). Thus, this unaccomplished goal must be pursued by designing methods that allow unusual worldviews to be expressed (Scoones, 2009). Ian Scoones (2009) highlights the need to articulate knowledge, politics, scales, and dynamics for future sustainability. Directions of change will only be achieved when framings and normative commitments have to become more explicit (Hagmann et al., 2002; Fraser et al., 2006; Reed et al., 2008). Concerning knowledge, theoretical approaches like collective action, transaction costs, and common pool resources (Ostrom, 2005) have provided a sound base to acknowledge institutional complexity in environmental management. However, these theories struggle to deal with informal relationships and the "overlapping accommodation" of multi-level management (Berkes, 2002; Plummer and FitzGibbon, 2004). They frequently underestimate state-level socio-political complexity, which is too often seen as a mere monolithic structure (Carlsson and Berkes, 2005). Accordingly, new directions in research and practice are required: flexible management arenas (Olsson et al., 2004; Fraser et al., 2010), in which the policy process becomes a central tenet (Fraser et al., 2006; Armitage et al., 2009). Indeed, even though several sound theoretical works have been dedicated to this way of thinking (Funtowicz and Ravetz 1994, Rölling 1996, Gunderson and Holling 2000, Walker et al. 2004, Chambers 1997), we may not know how to practically design, and even perhaps think about, this kind of trans-level and overlapping approach of sustainability.

In this perspective, a specific framework and participatory policy process has been developed during the last years in Senegal, to make this local production of innovative knowledge better impact sustainability policies designed at larger scales. The Sahelian societies have progressively tailored land rules in order to fit the constant variability and scarcity of Sahelian natural resources. In Senegal, a multi-level approach has been developed to (i) enable local people to shape new principles of sustainability policies by building on their own embedded behaviors and knowledge, and (ii) to value such "self-designed" outputs into transformative knowledge to be inserted in operational policy frameworks. As the process has the huge ambition of involving stakeholders at different locations and at different levels in the society, an incremental strategy has been set up, progressively adding new groups to the pool of stakeholders already involved in the process. Sahelian stakeholders' engagement in this kind of self-modeling process led to some unusual principles of sustainability policies. They started working on policy design by tailoring their own model of sustainability: a complex drylands uncertainty where the overall long term sustainability relies on the access to some few and vital resource niches (d'Aquino and Bah, 2013). From this setting, participants naturally simulated some unconventional environmental management principles, drawing on their long ability to 'surf on' this kind of complex uncertainty: e.g. a potential shift between a first regulation system to be applied in 'normal' environmental conditions, and a second regulation system to be applied in critical situation, which allows everybody accessing the few vital resource niches. In Senegal, this multilevel simulation process is now used by civil society since one year to facilitate the insertion of local innovative knowledge into public land policies (http://www.cirad.fr/nos-recherches/resultats-de-recherche/2014/gestion-des-ressources-au-senegal-des-ateliers-de-simulation-participative-pour-concevoir-les-politiques-publiques).

However, the Senegalese policy agenda gets carried way since mid-2014, and the Land Reform and Pastoralist Chart are going to be devised during the next months. The participatory and modelling platform which is set out by researchers and civil society needs now to be enriched by disciplinary knowledge and to be inserted into the final step of the decision making process… Policy time is less regular than research time and a research for policy making needs to be very reactive.