Peut-on évaluer expérimentalement l'impact des processus participatifs en gestion de l'eau ? Etude d'une méthode générique ciblant l'évaluation de capabilités

Sarah Loudin

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Sarah LOUDIN

Can we use a social experiment to assess the impact of participatory processes for water management ? Studying a generic method tackling the evaluation of capabilities.

Directeur de thèse : **Nils FERRAND**
Co-encadrement de la thèse : **Patrice GARIN**

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Composition du jury :

Mme Sylvie LARDON, Directrice de Recherche, INRA	Présidente
Mme Juliette ROUCHIER, Directrice de Recherche, CNRS	Rapporteure
M Jérôme BALLET, Maître de Conférences, Université de Bordeaux	Rapporteur
M. Nicolas BECU, Chargé de Recherche, CNRS	Examinateur
M. Alexandre Apsan FREDIANI, Associate Professor, UCL	Examinateur
M. Arnaud BANOS Directeur de Recherche, CNRS	Examinateur
M. Olivier BARRETEAU, ICPEF, Irstea	Examinateur
M. Nils FERRAND, Chargé de Recherche, Irstea	Examinateur

UMR G-EAU
Irstea, 361 rue J.F. Breton, BP 5095 34196, Montpellier Cedex 5

“To boldly go where no one has gone before”

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DG-ACTA: Directorate general for land use and conservation of agricultural land, attached to the Tunisian Ministry of agriculture, water resource and fisheries (in French: « Direction générale de l'aménagement et de la conservation des terres agricoles »)

IWRM: Integrated water resource management

NMR: New management rule

NRM: Natural resource management

PP: Participatory process

PR-OSCAR: "Monitoring and applied research program for the development and conservation of agricultural land" (in French: « Programme pilote d'observatoire et de recherche appliquée pour l'aménagement et la conservation des terres agricoles »)

RPG: Role-playing game

SPARE: Strategic planning for alpine river ecosystems

SD: Standard deviation

WAG: Wat-a-game

WRM: Water resource management

GENERAL INTRODUCTION

1. RATIONALE OF THIS THESIS

"*The Paris floods, that saw extreme rainfall swell the river Seine to its highest level in decades, were made almost twice as likely because of the manmade emissions driving global warming, scientists have found*" (Vaughan 2016). This opening sentence of a 2016 press article covering the floods in the French capital exemplifies how the impact of climate change on water bodies is being more and more discussed in the society.

During the last decade, in addition to such widely covered events, a series of scientific reports (e.g. IPCC 2001; 2007; 2014) have outlined various climatic scenarios for the next decades and raised the awareness of policy-makers and the general public about the importance of climate change, climate mitigation and climate adaptation.

Water resources are particularly at risk. The predicted climate change scenarios established by the international scientific community impact them in various ways and, with these water resources, entire ecosystems and societies which rely on them to survive (e.g. for freshwater supplies, agriculture, forestry, fisheries, etc.) may also be severely impacted. In Europe for instance, "*climate change is likely to significantly reduce water availability from river abstraction and from groundwater resources*" (IPCC 2014, 1272), but also to increase extreme climate events, coastal and river flood risk and provoke changes in temperature and rainfall all over the continent, leading to meteorological droughts or heavy precipitation events. In Africa, "*climate change will amplify existing stress on water availability […](high confidence)*" (IPCC 2014, 1202) and is likely to provoke a reduction in precipitation over the northern part of the continent, as well as increasing vulnerability of agricultural systems and limiting access to safe water and sanitation.

Tension regarding the uses made of water resources may consequently grow, especially in areas where these are scarcer and where there is competition for their uses (Nordås and Gleditsch 2007; García-Ruiz et al. 2011). This is why in a spirit of democracy, stakeholders of all kinds (including citizens) who may be affected by these changes should be given the opportunity to count in the decision-making and policy-making processes related to it, so that they are not simply passive subjects but rather active agents who can influence these processes. They should consequently be able to take part in the management of their environmental resources.

Among the scholars who advocate such a paradigm, those in the field of human development have been particularly vocal about the importance for people to be able to influence the environment they live in (see for example the work of Nussbaum (2000) on the ten central freedoms that should be guaranteed for every human being). Sen himself, pioneer of the capability approach, defended this position in a 2004 article entitled "Why We Should Preserve

the Spotted Owl". There he discusses a growing interest in "*exploring the role of citizenship in achieving sustainable development*[1]*"* and "*positive initiatives to involve citizens in environmental policies*" (Sen 2004c, 10).

But while he also points out "*an increasing disappointment […] with the evident scepticism of public authorities that it can be fruitful to appeal to a sense of social responsibility*" among citizens (Sen 2004c, 10), we argue that, on the contrary, there is increasing interest among these same authorities in involving local stakeholders in the processes of natural resources management (Reed 2008). This is particularly true in the field of water resource management (WRM) because water is a vital resource for humans. As Delli Priscoli puts it, "w*ater for all and meeting minimum basic needs are vitally tied to the principle of human dignity*" (2004, 221).

Local stakeholders are now being more and more trusted by authorities and policy-makers to have valuable insights and capacities that allow them to be meaningfully implicated in decision-making processes related to water management. In certain countries, laws are multiplying to ensure the participation of all types of stakeholders to the management of their water resources. It is for example the case in the European Union, which adopted a Water framework directive (2000) that requires Members State to encourage the involvement of all types of stakeholders in the conception of river basin management plans.

This has led to the *"mainstreaming of participation in the field of public policy for water management and more broadly for natural resources management"* (Bonnard 2015, 1). For instance, among the list of seventeen Sustainable Development Goals adopted in 2015 by the United Nations, the sixth goal "Clean water and sanitation" considers the involvement of local communities in the water management process as an important target to reach by 2030[2] (United Nations n.d.). Behind the institutionalization of public participation lie several objectives: one is the transformation of participants taking part in the participation process to develop their capacities to "*think, value and act*" (Sen 2004c, 11), in other words, to develop their "capabilities".

The capability approach is a theoretical framework that focuses on the freedoms of "being" or "doing" available to people and that they have reasons to value (Sen 2000a). Capabilities correspond to the valued opportunities available to a person or a group of person. Once people have access to capabilities, they can choose or not to transform them into achieved functioning, depending on their agency. The capability approach was initially conceptualized as an individual-centered approach. But several authors have argued that capabilities also exist at the collective level and correspond to opportunity freedoms that are reached and developed on the scale of a

[1] We define sustainable development as a state of society where living conditions and resource uses continue to meet human needs without undermining the integrity and the stability of the natural system (Brundtland et al. 1987).

[2] Target 6.B: *"Support and strengthen the participation of local communities in improving water and sanitation management"*

group of individuals, through the exercise of collective agency (Ibrahim 2006) and the mean of collective action (Pelenc, Bazile, and Ceruti 2015).

The development of the individual capabilities of participants who take part in a participatory process, but also of collective capabilities in a group of participants, may eventually lead to the improvement of their overall capacity to manage water resources. Participants with access to capacities related to collective action that they value should be better able to take full advantage of a participatory process, according to their interests and strategies. This may in turn lead to a more sustainable management because when participants exercise their agency and decide to act out of free will and the interest to manage water together, the decisions taken are more likely to last longer and be more acceptable. Certain conflicts may also be avoided thanks to democratic deliberation (Johnson 2002; European Commission 2003; Blomqvist 2004; Barbier and Larrue 2011).

This is what this doctoral work stems from: the need to understand what transformations public participation may induce among participants and how they may do so, through the lens of individual and collective freedoms of action.

2. SUMMARY OF LITERATURE REVIEW AND RESEARCH GAPS

2.1. WHAT IS PUBLIC PARTICIPATION AND WHY IT IS IMPORTANT TO EVALUATE IT

At the root of the spread of public participation for natural resources management lies the emergence of the "*green discontent*" in the 1960s, fueled by a critique of modernization and its negative effects on the environment, but also of the governance systems that frame it (Barbier and Larrue 2011, 68). Since then, academics and practitioners have questioned and criticized top-down solutions and centralized public natural resources management for their lack of legitimacy and efficiency in initiating social or governance changes (Koffi 2013; Pahl-Wostl 2009; Daniell 2012). In parallel, extensive empirical studies and theoretical developments have demonstrated that local communities and institutions could efficiently manage these resources (Ostrom 1990; Dietz, Ostrom, and Stern 2003).

Progressively, public participation was institutionalized based on three main arguments identified by Barbier and Larrue (2011): (i) the legitimization and the public acceptance of projects and the attenuation of conflicts; (ii) the improvement of the quality of decisions; (iii) the improvement of democracy in environmental decision making.

We define public participation as "*arrangements*" where various stakeholders gather and contribute together to a decision-making process, in a more or less direct and formal way (Van

den Hove 2001, 4), thereby "*allowing people to influence the outcome of plans and working processes*" (European Commission 2003, iv).

The main feature of public participation is the involvement of local stakeholders (including citizens) in the environmental decision-making process. The forms taken by these processes vary greatly (e.g. advisory groups, citizen juries, collaborative modelling, etc.). These multiple formats of participatory processes correspond to multiple levels of engagement and communication among stakeholders. They depend on the contexts in which a given process takes place, its operational or democratic objectives set by its organizers or by participants themselves, or by "*the capacity for stakeholders to influence outcomes*" (Richards and Carter 2007; Tippett, Handley, and Ravetz 2007; in M. S. Reed 2008, 2419). At their highest level of engagement (e.g. what Arnstein (1969, 2) called "*citizen control*"), which is the level we will consider here, they consist in building partnerships between stakeholders and offering them a definite input into the decision-making process (Rowe and Frewer 2004; Bryson et al. 2013). Depending on this level of involvement, its shapes and the methods used, the impacts of a participatory process on the ecosystem and on participants may also vary greatly (Ridder, Mostert, and Wolters 2005).

It is generally accepted that public participation is beneficial to natural resources management (Fiorino 1990; Laird 1993; Webler 1995; Webler, Tuler, and Krueger 2001; Beierle and Cayford 2002; Lebel et al. 2006; Tàbara and Pahl-Wostl 2007; Coenen, Huitema, and O'Toole Jr 2012). In the literature, its benefits are often presented in terms of increased relevance, appropriation and durability of the decisions made within it, as well as the satisfaction of democratic expectations (European Commission 2003). Indeed, an increased understanding of the socio-ecosystem by participants may lead to improved decisions and actions. Subsequently, participants are more likely to apply new rules they would be able to influence in a system they understand better (European Commission 2003; Reed 2008; Muro and Jeffrey 2012; Hassenforder 2015).

Participatory processes can also lead to the enhancement of "*the quality and durability of environmental decisions that are made through engagement with stakeholders*" (Reed 2008, 2420; Seghezzo et al. 2017). This corresponds for example to the better adaptation of the decisions resulting from the deliberative process to the local socio-cultural and environmental conditions of interventions. It can also correspond to the higher quality of the resulting decisions, depending on the initial objectives set by the organizers or the participants (e.g. the fairness of the final outcomes, their legitimacy and the direct effects on the natural resources) (Webler, Tuler, and Krueger 2001).

When the level of participants' engagement in the process is high, participatory processes may even foster long-term autonomy (Renn, Webler, and Wiedemann 1995). They may also favor the emergence of co-generated knowledge and social learning (defined as "*a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks*" (Reed et al. 2010, para. 18)), as well as collective action. Through group dynamics, participatory

processes may lead to long-term social and relational change, like so involving the transformation of local people and communities towards the achievement of change, as well as "*the enhancement of [their] capabilities to define and address their own needs and aspirations*" (Duraiappah, Pumulo, and Parry 2005, 5; Sen 2000a; Daquino 2007; Frediani 2015).

These normative expectancies and observed benefits have nonetheless been counterbalanced by certain field observations. As a result, in parallel to their development in the world of policy-making and natural resources management, participatory processes have received various criticisms. These are based on the fact that they could be used simply as a tool to achieve objectives pre-set by the governing forces (Daquino 2007). They have also been accused of serving as consensus-building processes, or as tools aimed mainly at securing funding and solving ordinary conflicts, hence losing their initial ambition of transforming society towards the enhancement of the autonomy and emancipation of marginalized individuals and groups (Barreteau, Bots, and Daniell 2010; Blondiaux and Fourniau 2011).

Consequently, progress is still required to understand, depending on specific variables such as contexts, issues or implementation protocols, how participatory processes impact the individual participants, the group and eventually their decisions and practices. That is why during the last decade the need for a new readable and comparable evaluation tool to identify and measure the transformative effects of participatory processes and produce reliable assessments has emerged among practitioners and the community of researchers throughout the world.

2.2. THE OBJECTIVE OF MY EVALUATION AND MY POSITIONING

The interest in combining the field of participatory processes' evaluation with a recent and promising theoretical framework such as the capability approach lies in the fact that few evaluation methods exist and that this arrangement could enrich both areas.

The innovative aspect of this research also corresponds to its main challenge, which is the integration of both individual and collective capabilities into an evaluation framework. We identify two main challenges:

(i) First, it is unclear how the participation of stakeholders in a management process impacts their capacities to act, or their values. This is the case at the individual level and at the collective level;

(ii) Second, the method for measuring these transformations in the capability space[3] of participants is questionable. There is no consensus on the most relevant way to

[3] In Chapter 1 we describe the capability space of a person as the pool of resources, conversion factors, choice and eventually capabilities available to every person (Frediani 2010).

operationalize the capability approach, or on the most relevant way to evaluate participatory processes for natural resources management (NRM).

In order not to disperse our research efforts, we consequently decided right from the beginning of this thesis to exclude from our scope of analysis a number of other effects induced by participatory processes. This specification of our evaluation subject was the result of a compromise between the exploration of an innovative framework and the design of an innovative tool to evaluate participation for NRM and the practical and timeframe related to this three-year thesis. We will, thus, evaluate neither the procedural quality of participatory processes, that is to say "*the effects that are directly relevant to the decision-making process, sometimes even independently of the impact on the outcome*" (Van den Hove 2001, 6) (e.g. improving the quality of the information available to participants for the decision-making processes, improving the process efficiency in terms of time and costs, etc.), nor the substantial impact on the final decisions taken by participants (e.g. the better environmental, social, technical or economical relevance of the choices stemming from the participatory process, etc.) (see Van den Hove 2001 for an exhaustive list). Instead, we will focus solely on the valued capacities of participants and on the effects and potential transformations of these capabilities over time induced by their engagement in a participatory process.

We considered this focus beneficial to the quality of the evaluation, for researchers but also for practitioners who manage participatory processes for NRM. Indeed, the use of a reflexive tool for practitioners will give them indications as to which capabilities to strengthen among participants, during a participatory process. Public participation at its highest level of engagement is a demanding process for participants and practitioners. It consists in several steps, such as collecting and analyzing information, assessing the situation, proposing solutions and discussing their feasibility, proposing new management rules, designing and evaluating an implementation plan, etc. (Hassenforder et al. 2017). In order to ensure long-term social and relational changes among a group of participants, practitioners should ensure a constructive and inclusive deliberation process, in which every participant has the opportunity, if so wished, to discuss his or her point of view with the rest of the group (Carpini, Cook, and Jacobs 2004; Reed 2008). This also ensures that participants can take full advantage of the opportunities available to them during the process, as well as the ones they would likely to have access to. It is consequently useful for practitioners to identify a handful of the most decisive capacities in relation to these participation steps and measure them. With a one-time evaluation, practitioners would know which capability is absent, low or strong and facilitate the process accordingly. Evaluating the state of development of these capabilities over time, with multiple evaluation moments, would allow for observing if the capabilities of the participants are being strengthened by the participatory process or not. It would also be valuable for the participants who would better understand the collective dynamics taking place among their group.

This should be done with respect to the interests that participants have in these capacities, so as not to impact their motivation negatively. This is important because public participation for decision-making relies on the intrinsic motivation of people to actively engage in the process

over time. Without a certain appreciation of the various phases of the collective reasoning and the decision-making process, participants may eventually lose interest in it. Motivation is a key to ensure long-term changes (Hibbert, Piacentini, and Dajani 2003).

3. RESEARCH QUESTIONS

The main research question of this thesis is the following: *is it possible to use a social experiment based on a role-playing game (RPG) to evaluate the impact of participatory processes for water management on its participants?*

We divide this research question into two sub-questions. Based on a social experiment relying on a RPG:

(1) Can we measure individual and collective capabilities related to collective action among a group of participants in a participatory process for water management?
(2) Can we evaluate over time, following an *ex ante ex post* protocol, the evolution of the same individual and collective capabilities and their link with the participatory process people are taking part in?

4. THESIS STRUCTURE AND CONTENT

This thesis is organized around five chapters, which follow a logical order. We discuss in Chapter 1 and 2 the theoretical and practical background that led to the specific design of the CappWag evaluation tool. We present its design process and its final form in Chapter 3 and the results of its implementation on two case studies in Chapter 4. All of the discussion points related to these four chapters are gathered in Chapter 5, in which we tackle the reliability and the relevance of the evaluation tool for researchers and practitioners. We present further below the content of the five chapters.

In Chapter 1, we will present the main concepts and practical applications related to the capability approach. We will discuss how participatory process impact the development of a group's capability space and vice versa, and why we consider it as a relevant evaluative framework to observe the impacts of participatory processes on participants, both at the individual and the collective level. We will also discuss in Chapter 1 the various challenges and guidelines developed in the literature to operationalize such a readable and comparable evaluation tool and produce reliable assessments. Finally, after discussing which capabilities are the most relevant to include in our evaluation tool, we will settle for three of them: *being able to express oneself in front of a group, being able to collectively make the diagnosis of a problematic situation of management, and being able to collectively make and implement management rules*.

In Chapter 2, we will discuss how a social experiment based on mixed qualitative and quantitative methods of evaluation is particularly suited for the evaluation of individual and collective capabilities. The use of a RPG, complemented with a questionnaire and a focus group, will be explored. Based on the literature on social experiments and games related to NRM, we will discuss how such an apparatus can provide a compromise between internal and external validity and be adaptable to various contexts and fields of implementation. A special attention will be given to the link between participant's behaviors and actions in games and in real life.

This will lead us to present in Chapter 3 the design process of our experiment, called CappWag. Building on established academic methodologies and practices, the design of CappWag will also comprise an *ad hoc* aspect related to its innovative use to measure valued counterfactuals. We will list and discuss the main challenges faced during the design process of CappWag (such as ensuring the internal and external validity of the measures while taking into account practicability and implementation constraints, such as its playfulness). We will present the result of this process: an evaluation apparatus made of two workshops to allow an *ex ante ex post* evaluation of a group of participants, based on two semi-abstract RPGs: CAPPWAG-RIVER and CAPPWAG-LAKE. We designed them as independent evaluation apparatuses that could also be used separately one from another and provide evaluators and participants with a measure of their individual and collective capabilities at a given time.

In Chapter 4, we will present the results of the first implementation of the CappWag evaluation tool on two case studies: (1) one-time evaluation workshops implemented in August 2017 with local government officers in Tunisia, in the frame of the PR-OSCAR project and (2) *ex ante ex post* evaluation workshops implemented with first-year Master's students from the University of Montpellier, France, between October 2017 and January 2018. Twelve workshops in total will be discussed. For each group of participants who took part in a CappWag workshop, we will evaluate the three capabilities we focus on, as well as their resources and conversion factors. We will also discuss the differences observed between individuals and groups' dynamics, structures and capability spaces. In the case of the Master's students case study, we also discuss the evolution over time of these characteristics.

Finally, we will discuss in Chapter 5 the overall efficiency of the CappWag evaluation tool to capture capabilities at the level of the individuals and of the group of participants. Chapter after chapter, in a reverse order, we will discuss the strengths and weaknesses of our measures, of the design of the tool and of the relevance of using a social experiment to perform such an evaluation within participatory processes. We will eventually discuss the relevance of the capability approach to understand the interests and capacities of participants in relation with their involvement in a participatory process, and the difficulties met to capture collective capabilities, but also to simply implement the tool on the field. All along Chapter 5, we will outline improvements to be brought to the evaluation tool through a series of guidelines for future uses of CappWag. They are intended for researchers and practitioners and should help them improve the implementation and the analyses of the results of the CappWag tool.

CHAPTER 1 – THE CAPABILITY APPROACH: A THEORETICAL FRAMEWORK TO EVALUATE PARTICIPATORY PROCESSES

1. INTRODUCTION

The capability approach covers vast field of research, made of intricate definitions and practical uses. From its first outline at the end of the 1980s, it evolved into today's prolific field of study, strengthened and boosted by Sen's Nobel Prize in Economics Sciences in 1998. Throughout this time, its main concepts have developed and the approach has been enriched by the work of scholars coming from numerous different disciplines.

In this chapter, we present the main definitions and practical applications related to the capability approach, and discuss how it provides a relevant theoretical framework to evaluate participatory processes related to WRM. The chapter is structured as follows: the first section gives an overview of the background of the capability approach and its academic, political, economical and social uses. The second section presents the main concepts that constitutes the core of the capability approach and specifies the definitions that we will adopt in this thesis. The third section explores the links between capabilities, participation and sustainable development. The fourth and fifth sections develop the operationalisation possibilities envisioned for the approach and discusses the various challenges to overcome in order to build a practical evaluation framework. Finally, the sixth section addresses the main limitations and criticism that the capability approach have received.

2. A HISTORY OF THE CAPABILITY APPROACH AND ITS ACADEMIC, POLITICAL, ECONOMICAL AND SOCIAL IMPACTS

The definitions and uses related to the capability approach evolved through the last thirty years. We recount in this section its historical evolution and uses.

2.1. THE FIRST STEPS OF THE CAPABILITY APPROACH

In 1979, Sen gave, at Stanford University, USA, the Tanner lectures on human values, called "Equality of What?" Sen raised in his speech the essential question of which attributes should be equalized among a society's members. The metric used to perform interpersonal comparisons is crucial for it leads to the conditions' specification in which an individual is considered disadvantaged compared to the rest of the society. Should these comparisons be built on wealth,

or on a broader range of resources? Should it take well-being or happiness into account? (Clément, Le Clainche, and Serra 2008). In his lecture, Sen discussed and questioned the relevance of equality measurement through primary goods or marginal or total utility and "*outlined for the first time his conception of capabilities*" (Deneulin and Shahani 2009a, 31).

The capability approach differentiates itself from utilitarianism, which advocates the logic of rational choice theory, based on the search for well-being maximization and focuses on resource accumulation, as well as income and amounts of expenditure. According to utilitarianism, every moral action should exclusively aim at pursuing the happiness of the greater number. A moral decision should aim at maximizing collective well-being, that is to say the sum of individuals' utility (Clément, Le Clainche, and Serra 2008). As Robeyns (2005, 96–97) explains it:

"Sen is concerned not only with the information that is included in a normative evaluation, but also with the information that is excluded. The non-utility information that is excluded by utilitarianism could be a person's additional physical needs due to being physically disabled, but also social or moral issues, such as the principle that men and women should be paid the same wage for the same work. For a utilitarian, this principle has no intrinsic value, and men and women should not be paid the same wage as long as women are satisfied with lower wages. But it is counter-intuitive, Sen argues that such principles would not be taken into account in our moral judgements".

The capability approach also draws on Rawls' justice theory, which builds on theoretical and idealistic principles and advocates the use of "primary goods" (Rawls 1971). According to Rawls, primary goods are the goods that every person is supposed to desire. They can be natural (such as health, intelligence, imagination, etc.) or social (such as rights, liberties, and opportunities; income and wealth; and the social bases of self-respect). Individuals are assumed to want more rather than less of these goods. Therefore, it would be possible to evaluate individuals' well-being according to what primary goods they have or do not have (Wenar 2013).

Sen criticizes Rawls' use of primary goods as an answer to the "equality of what?" question because they are means and not intrinsic ends, and therefore would not serve for interpersonal comparisons and would not be able to account for the wide scope of human beings' diversity. For Sen, the amounts and kinds of goods needed to reach the same level of well-being is different for every person (Sen 1980; 1992; 2004b; in Robeyns 2005).

Sen consequently seeks to establish a theory that could define justice based on concrete situations and focus on achieving chosen objectives, rather than on accessing the means to achieve those objectives. He also aims at presenting persons as "*reasoners*" with the right to make choices, that is to say, as "*diverse, thinking, adaptative agents*" (Gasper 2007, 356). According to Sen, these issues should be addressed through the thorough analysis of the "*real freedoms*" available to people to live a valued life and to choose between different alternatives of "being" and "doing". These real freedoms then allow people the access specific resources, or opportunities, that they can then transform into achievements, depending on which goals they

value (Sen 2000b). The concept of capabilities is the central element of this theory. It allows going beyond established approaches tackling welfare, inequality and poverty and instead, focuses on livelihood means (Bonnard 2015). In this way, the capability approach represents an alternative to measuring inequality between people and well-being beyond primary goods or marginal or total utility (Sen, Nussbaum, and Glover 1995; Sen 2004b; in Robeyns 2005). Sen considers freedoms both as ends and as means of development (which is why one of his book is called "*Development as freedom*").

Several scholars have attempted to develop, based on the capability approach, a broad normative framework for the evaluation of individual wellbeing and social arrangements (Frediani 2010). As Sen (1992, 5; in Deneulin and Shahani 2009a, 31) puts it, "*A person's capability to achieve functionings that he or she has reason to value provides a general approach to the evaluation of social arrangements, and this yields a particular way of viewing the assessment of equality and inequality*". Through this framework, poverty is consequently conceived as a deprivation of capabilities; inequality as the inequitable distribution of capabilities and vulnerability as the deficiency of certain capabilities. Empowerment is understood as the expansion of the space of people's capabilities (Makkaoui and Dubois 2010).

When working on human development and well-being, priority should thus be given to an increase in the effective freedoms that people have access to, in order to achieve prioritized outcomes (Gasper 2007). As Deneulin & Shahani (2009a, 31) express it, "*the key idea of the capability approach is that social arrangements should aim to expand people's capabilities*". In this perspective, assessing development means being able to analyze the evolution of people's freedom through time.

2.2. ACADEMIC, POLITICAL AND ECONOMICAL USES

As Robeyns (2006, 371) puts it, "*the capability approach is extremely interdisciplinary, perhaps even post-disciplinary*". It provides an alternative framework of thought for a wide range of issues related to people's well-being and social arrangements, as well as policy-making and social changes (Stewart and Deneulin 2002; Robeyns 2005).

In the past two decades, the capability approach has been more and more studied and appropriated by scholars and policy-makers (Robeyns 2005). This interest led to the publication in 1990 by the United Nations Development Programme of the first annual Human Development Report, partly based on the capability approach in which human development was defined as "*both the process of widening people's choices and the level of their achieved well-being*" (UNDP 1990, 10). In this report, human development is considered as a double process, encompassing "*the formation of human capabilities such as improved health, knowledge and skills – [and] the use people make of their acquired capabilities - for leisure, productive purposes or being active in cultural, social and political affairs*" (UNDP 1990, 10). It is in this vision of development as the

enhancement and the expansion of people's capabilities to help them achieve the life they value that Sen's core idea of capabilities and agency lies (Sen 2000b; Ibrahim 2006; Deneulin and Shahani 2009a). Since then, more than five hundreds regional or national Human Development Reports have been published throughout the world, using similar analytical frameworks (Robeyns 2006).

The capability approach is nowadays used in many fields, from development studies to welfare economics, social policy-making and political philosophy (Robeyns 2005). Robeyns (2006) identifies nine main fields of application of the capability approach: (i) general assessments of human development at the national level; (ii) assessments of small-scale development projects; (iii) analyses to identify the poor in developing countries; (iv) poverty and well-being assessments in developed countries; (v) assessments of disabled people's deprivation; (vi) assessments of gender inequalities; (vii) theoretical and empirical assessments of public policies; (viii) criticism and assessments of social norms, practices and discourses and (ix) the use of capabilities and functionings as concepts in non-normative research settings (e.g. in ethnographic research or for explanatory analyses).

2.3. THE CAPABILITY APPROACH APPLIED TO SUSTAINABLE DEVELOPMENT AND NATURAL RESOURCES MANAGEMENT

During the last decade, the capability approach has been applied to sustainable development issues, as seen in the founding work of Leßman (2011), Rauschmayer, Omann and Frühmann (2012) or Ballet et al. (2005; 2011; 2013). Some authors have suggested considering certain environmental conditions (such as a clean air, clean drinking water, a stable climate, etc.) as an independent "*meta-capability*", as these are crucial for the development of people's basic capabilities and intersect them all (Holland 2007, 6; 2012).

Moreover, and as we will discuss it in section 3.2, the capability approach builds on the vision of individuals as beings characterized by the valued capacity to put the interest of the collective before their own. In this regard, people may favor broader perspectives such as the well-being of future generations, or the preservation of natural resources for their intrinsic values, over the interests of their own group and, on this basis, be receptive and engage in sustainable development (Rauschmayer, Omann, and Frühmann 2012; Pelenc, Bazile, and Ceruti 2015).

In order to be sustainable, human development should involve a focus on expending or preserving the freedom of people to take part in the management of their natural environment (as defended by Nussbaum in her list of ten central human functional capabilities – see section 5.1). This is especially true in the current environmental context marked by the impacts of climate change on ecosystems and societies.

Several scholars have pointed out the weaknesses in the way the capability approach considers the ecological dimension. Pelenc et al. (2013, 78) for instance state that Sen does not devote any "*particular attention [...] to environmental issues*" and that the capability approach "*suffers from a lack of concern for ecological constraints and, consequently, for environmental sustainability*". Nevertheless, the capability approach provides an interesting analytical framework for environmental justice **(Ballet, Koffi, and Pelenc 2013)** because environmental issues can be evaluated *"from the spaces of freedom in time and in space"* and because the relationships between human beings are strongly interwoven with their physical environment **(Ballet, Koffi, and Pelenc 2013, 33)**.

3. THE CAPABILITY APPROACH: MAIN CONCEPTS AND DEFINITIONS

Since it was first outlined by Sen in 1979, the capability approach has slowly but surely evolved and enriched itself through the work of many scholars and policy-makers coming from various disciplines and fields of practice. This broadness is a major strength of the capability approach, but it has also led it to become a complex conceptual field, structured around a vocabulary set that keeps evolving. The expansion of the approach has naturally required a series of adjustments and working simplifications, even though several ambiguities and unclear boundaries still remain **(Gasper 2007)**.

3.1. THE MAIN CONCEPTS BEHIND THE CAPABILITY APPROACH

Various interpretations of the capability approach and its main concepts exist and cohabit in the literature. It is hence important to define them clearly and specify which definition we retain in this thesis. As summarized by Deneulin and Shahani (2009a), the capability approach revolves around three main concepts: functioning, capability and agency, to which we add resources and conversion factors (see Figure 1 for a schematic illustration of the links between the five concepts).

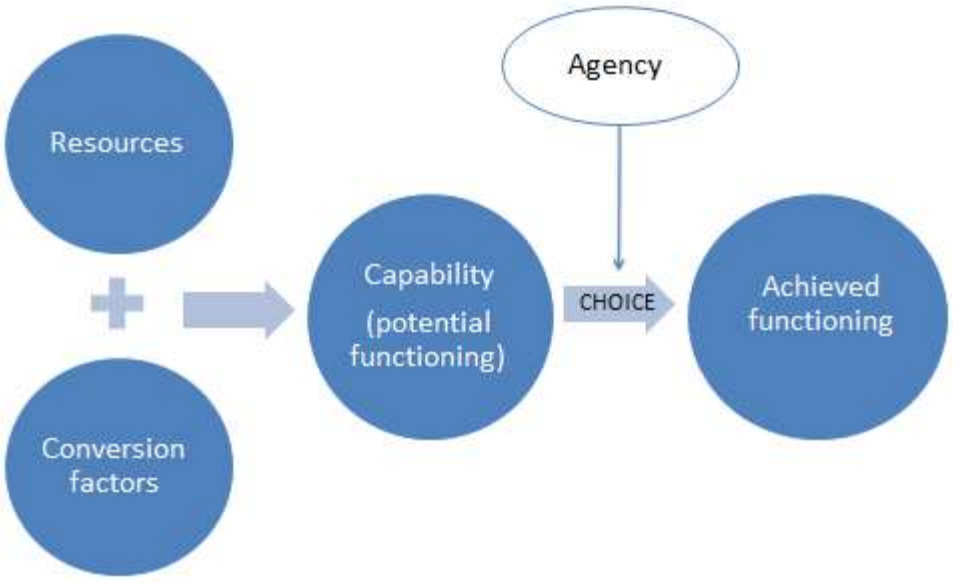

Figure 1: The five main concepts behind the capability approach at the individual level and their sequential relationship (inspired by Pelenc, Bazile, and Ceruti (2015))

A functioning is a "being" or "doing", in other words an achieved choice, which a person value and have reason to value.

A capability corresponds to the freedom to achieve these valued "beings" or "doings" that contribute to his or her well-being. Achieved functionings are like the tip of the capability iceberg: both potential and achieved choices are considered by the approach, which is related to "*positive freedom*"[4] (Pelenc, Bazile, and Ceruti 2015, 227), but only achieved functionings are visible to an external observer. Hence the capability approach takes into account what people are and do, as well as what they could be and do if they would have the choice. Examples of capabilities include "being able to be well fed", or "being able to speak up for one's rights" (Bakhshi and Dubois 2008)[5]. The capability approach is related to access to, rather than to

[4] Positive freedom can be defined as such: while "negative liberty is the absence of obstacles, barriers or constraints - one has negative liberty to the extent that actions are available to one in this negative sense, positive liberty is the possibility of acting — or the fact of acting — in such a way as to take control of one's life and realize one's fundamental purposes" in http://plato.stanford.edu/entries/liberty-positive-negative/.

[5] As Robeyns (2005, 100) notes, "one does not find this usage of capabilities (as being the individual elements of one person's capability set) in Sen's earlier writings". Instead, in his earliest work a capability was defined as "the various functionings that a person can choose to adopt, according to his or her values in order to achieve the expected lifestyle" (Sen 2000b). In this definition, each capability refers to one person, and vice versa. Robeyns (2005, 100) points out that "in his later writings he uses both uses of the word capability interchangeably".

achievement of, objective well-being (Gasper 2007). The various types of freedom available to a person are thus both instrumentally and intrinsically valuable (Sen 2000b). The capability set of a person represents the total amount of potential or achieved functionings of this person, in other words, the extent of his or her positive freedom (Robeyns 2005; Gasper 2007). As a result, a person's capability set consists of several capabilities.

The capability set of a person depends on his or her access to resources and his or her conversion factors. A person's resources can be material or non-material goods, such as time, money, services, but also human capital, education and knowledge, etc. They could also be defined as people's endowments and entitlement, such as tools, access to land property rights, granted access to natural areas, etc. (Pelenc et al. 2013; Pelenc, Bazile, and Ceruti 2015). The transformation of those resources into effective capabilities, that is to say their relevance in generating functionings, is affected by a series of conversion factors, which vary from context to context and person to person (Frediani 2010; Chiappero, Salardi, and Scervini 2016).

The conversion factors of a person influence the transformations of resources into capabilities. They can be divided into several categories, such as "*personal conversion factors*" (for example, metabolism, health condition, sex, age, intelligence, knowledge, network, etc.), "*social conversion factors"* (for example public policies, social norms, discriminating practices, gender roles, power relations, etc.) and "*environmental conversion factors"* (for example climate conditions, geographical location, infrastructure, public goods, etc.) (Robeyns 2005, 99; Frediani 2010). Conversion factors could also be described as internal (the agent's own characteristics, such as psychological and cultural factors) or external (the context within which the agent operates, such as environmental, social, political, cultural factors) (Sen 2000b; Robeyns 2005; Pelenc, Bazile, and Ceruti 2015). Even though there are many ways to classify and organize the different conversion factors available to people, they are all strongly interconnected, "*shaping and influencing each other*" (Frediani 2010, 179).

Capabilities are anchored in a specific context. A capability can be valid in one context but not in another, depending on the resources and conversion factors available to people, but also to relationships of power among individuals, groups and institutions. There are no absolute capabilities, in the sense that the presence or absence of certain resources or conversion factors for people can strongly impact the existence of capabilities.

Some scholars, such as Frediani (2010), describe this pool of resources, conversion factors and eventually capabilities available to every person as the "capability space" of this person (see Figure 2 below).

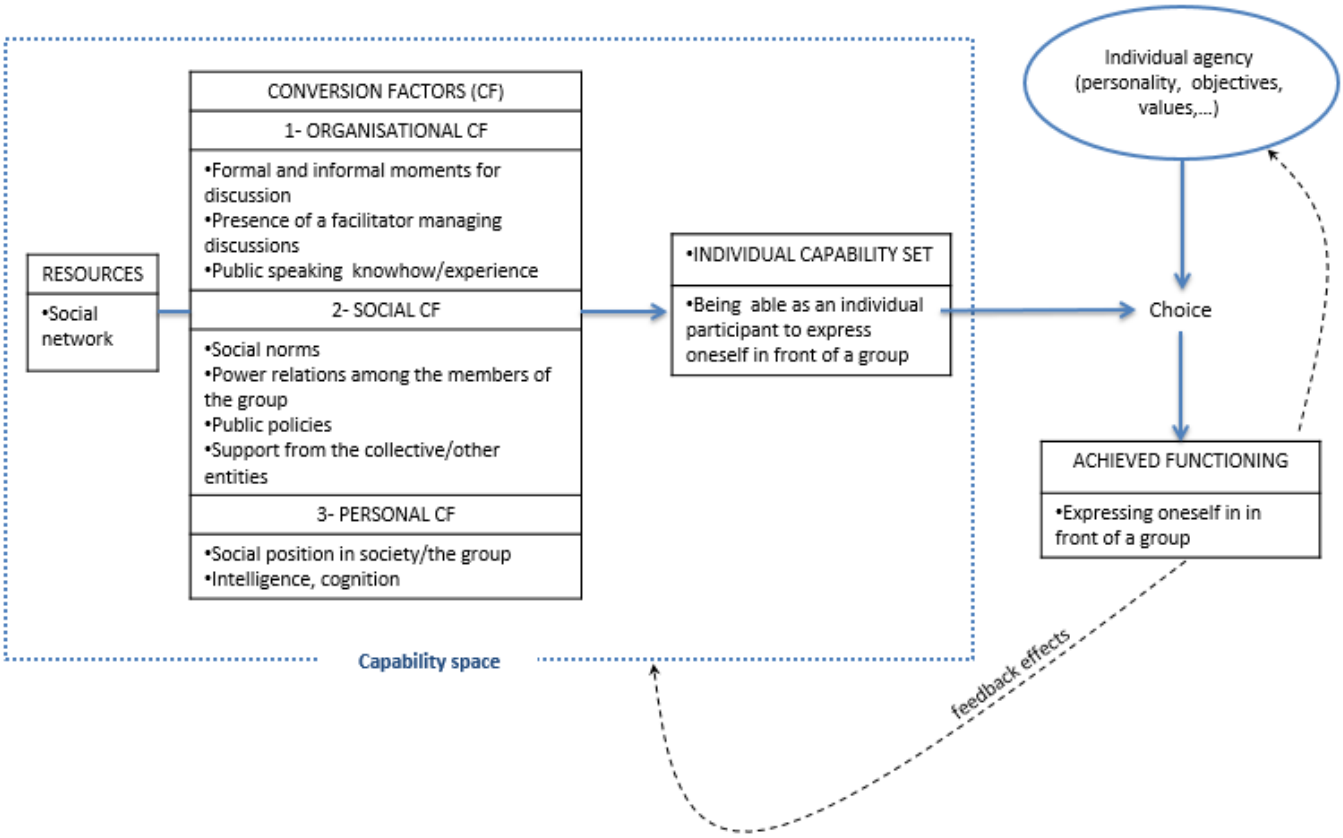

Figure 2: An illustration of a capability sequence applied to the individual capability "being able to express oneself in front of a group" (inspired by Pelenc, Bazile, and Ceruti 2015)

Finally, the importance of freedom of choice in the capability approach leads to another core notion, which is the agency of people. It corresponds to the capacity of a person to act, pursue and realize goals in accordance with his or her values (Sen 2000b; Deneulin and Shahani 2009a). Therefore, as Sen puts it (Sen 2000a, 19), an agent is "*someone who acts and brings about change and whose achievements can be judged in terms of her own values and objectives*".

Agency freedom also represent a person's freedom to adhere to values and pursue goals other than his or her own, that is to say beyond his or her own personal well-being (Sen 1985b), and involves notions such as sympathy, generosity or even commitment to others. For Sen, the concept of agency makes people "*the driving force of their own development*" (Sen 2000a; in Pelenc, Bazile, and Ceruti 2015, 227).

Capabilities and agency are two distinctive but equally important and interdependent aspects of human life (Pelenc, Bazile, and Ceruti 2015). Sen distinguished the two aspects by associating capabilities with the opportunity aspect of freedom (or well-being aspect) and agency to the process aspect of freedom. While the capabilities refer to the capacity to achieve valued

"beings" and "doings", agency is related to people's capacity to change their own situation and have an impact on their own lives, as well as on the social environment they live in.

Crocker and Robeyns (2009) state that the agency of an individual also reflects its capacity to be an active participant in the process of change, rather than a passive recipient of the provided instructions or assistance. Like so, agency could even be defined as "*a special type of capability which underpins the whole process of the capability approach*" (Crocker 2007; in Frediani 2010, 180).

It is interesting to note that exercising agency does not necessarily contribute to one's well-being and might even lead to its reduction (Sen 1992; in Frediani 2010). One example often used to illustrate this point is the case of two persons who are starving and consequently deprived from the functioning of being well-nourished. While the first person who is very poor and cannot afford or access food, lacks the capability of being well-nourished, the second person who, for personal reason (e.g. political reasons), is purposely starving (e.g. during a hunger strike) does possess it (Sen 1985a). This second person is using his or her agency freedom to express a political opinion. Even though this person has the capability of being well-nourished, the choice not to be is voluntary, even if it means lowering his or her achieved well-being (Robeyns 2005).

As Pelenc, Bazile and Ceruti (2015a, 227) puts it, "*the normative goal of human development can be subsumed to the improvement of people's capabilities through the exercise of their agency*". Thus, empowerment could be described as the improvement of people's agency, a key-factor in the increase of human development.

Sen acknowledges the importance of social interactions in the capability approach, for obtaining a capability is a process dependent on people's agency, which is in turn strongly reliant on the social opportunities available to people (Sen 2002). He states that "'*no individual can think, choose, or act without being influenced in one way or another by the nature and working of the society around him or her*'' (Sen 2002, 80). He also argues that individuals and the opportunities available to them should not be viewed in isolated terms, for "*the options that a person has depend greatly on relations with others and on what the state and other institutions do*" (Drèze and Sen 2002, 6). But despite these interdependencies, Sen, and many scholars after him, argues that the capability approach is practicable solely at the individual level. He uses the concept of "*socially dependent individual capabilities*" to describe capabilities that would appear out of the interactions between agents (Sen 2002, 85). In this frame, collective capabilities would refer to capabilities related to humanity at large, such as, for example, the capability of humanity as a whole to drastically reduce child mortality (Sen 2002; Ibrahim 2006; Deneulin 2006).

3.2. A FOCUS ON COLLECTIVE CAPABILITIES

Other scholars have acknowledged the existence of collective capabilities of another sort. Evans (2002) discussed first the concept of collective capabilities, which he related to the way to attain

development as freedom for the less privileged and result of collective action. In this perspective, people would attain these collective capabilities through means of structured groups: "*Organized collectivities--unions, political parties, village councils, women's groups, etc.--are fundamental to "people's capabilities to choose the lives they have reason to value." They provide an arena for formulating shared values and preferences, and instruments for pursuing them, even in the face of powerful opposition*" (Evans 2002, 56). As Stewart (2005) and Ibrahim (2006) emphasized, collective action is reached not only through political or associative groups, but also through more traditional collective structures, such as families, neighborhoods or communities. These newly generated and collective capabilities (see Figure 3) allow "*the interacting group of people to carry out things and achieve states of being that would not be possible when acting alone*" (Pelenc et al. 2013, 88), or in the words of Ibrahim (2006, 398), "*the new choices that the individual alone would neither have nor be able to achieve unless he/she joins a collectivity*".

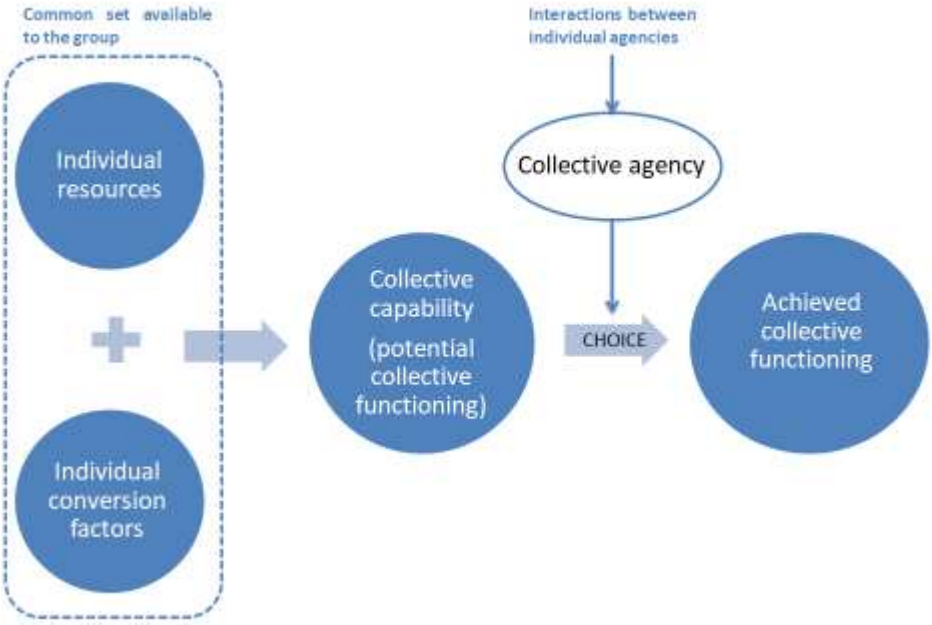

Figure 3: The five main concepts behind the capability approach at the collective level and their sequential relationship (inspired by Pelenc, Bazile, and Ceruti (2015))

A defining feature of collective capabilities is that they cannot be reduced to a function of the individual capabilities of the group members. Collective capabilities are not simply the aggregation or the average of the individual capabilities of the group members. They can be either superior or inferior to those (Ibrahim 2006; Duray-Soundron 2008). They are inherent to each group and emerge depending on the social interactions taking place among the group, as well as between the group and its direct political, social, cultural, economical environment. As

Stewart (2005, 4) puts it, "*since people are essentially social their social networks form an important part of their total wellbeing*". For instance, collective capabilities will emerge among a group when agreements or alliances take place. In contrast, collective capabilities might decrease over time or not exist among a group in the case of a disagreement or a conflict among the members of the group, or because of what Stewart has called "*the constricting effects of families or communities*" (Stewart 2005, 4; Panet and Duray-Soundron 2008).

During a participatory process, people may reach collective capabilities through the exercise of their collective agency. We retain in this thesis the definition proposed by Pelenc et al. (2015a, 229): "*collective agency encompasses the capacity of the group to define common goals and the freedom to act to reach the chosen goals*". According to these same authors, a group of people builds collective agency thanks to an "*intangible basis*" (i.e. interactions between the individual agencies of the persons in the group leading eventually to "*the definition of a common goal and a set of shared representations*") and a "*tangible basis*" (i.e. the pooling of resources and conversion factors in a "*common set*" available to the group) (Pelenc, Bazile, and Ceruti 2015, 229).

Once the members of a group possess a collective agency and a set of collective capabilities, they can transform them in collective actions, that is to say achieved collective functionings (Pelenc, Bazile, and Ceruti 2015). We illustrate on Figure 4 an example for two collective capabilities.

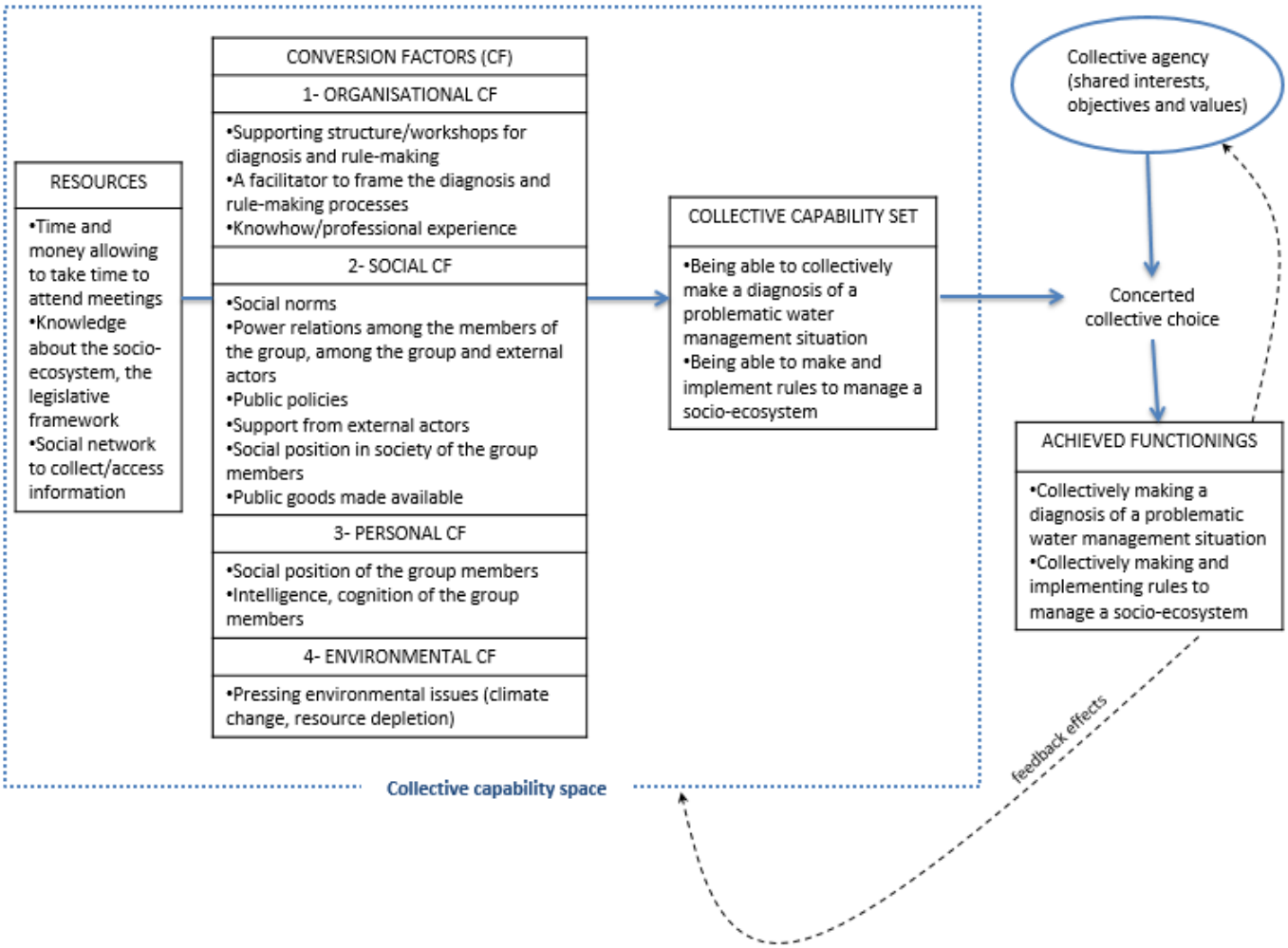

Figure 4: An illustration of a capability sequence applied to the collective capabilities "being able to express oneself in front of a group" (inspired by Pelenc, Bazile, and Ceruti 2015)

Several scholars, such as Ibrahim (2006), have advocated a different sequence, stating that collective actions (as well as institutional settings and social capital) are the main factors leading to the emergence of new collective capabilities. This doctoral research is based on the previous emergence sequence described by Pelenc, Bazile and Ceruti (2015).

The emergence of collective capabilities is not a linear process. The achieved functionings reached by a group impact in return its set of capabilities, as well as the individual capabilities of its members. This might eventually lead to the updating of individual and collective goals. Indeed, collective capabilities have a strong impact on individuals and they affect individual choices by affecting individuals' perception of their environment and their values, as well as determining their capacity to transform a capability into an achieved functioning (Ibrahim 2006).

In the same way, the actions that a group undertakes to reach its goal also impact its collective agency, as well as the individual agency of its members.

To sum up, there are two main differences between individual and collective capabilities:

(i) the process through which they emerge and expend: reaching collective capabilities implies for the members of the collective the use of their individual agency freedom to build a collective agency. Scholars such as Dubois **(2008)** have even stated that being present and not necessarily active in a group was a sufficient level of participation for an individual to benefit from a collective capability;

(ii) the potential of collective capabilities to benefit the whole community **(Ibrahim 2006)**.

Several criticisms have been made of the concept of collective capabilities. Some scholars have argued that increasing the freedom of one collective group would necessarily lead to reducing that of another group, a viewpoint that has sometimes been referred as the "*zero-sum view*" **(Carter 1999; in Ibrahim 2006, 405)**. It does not take into account the fact that collective capabilities generally increase not only among a group, but also for a group and other social collectives related to it, if, for example, the first group decides to share benefits of the increase in its collective capabilities with its surroundings **(Ibrahim 2006)**.

Other scholars have noticed that (1) collective capabilities might not be valued by all the members of a group, or that (2) collective capabilities might not be equally distributed among the members of a group, or that group affiliation might not always be beneficial. We reject argument (1) because collective capabilities are generated through a free and voluntary engagement of the group members in collective action. We also reject argument (2) because the idea behind collective capabilities is that, even though they might indeed not be shared equally among all the members of a group, each one of those members should in a general way enjoy "*a wider range of "*choices*""*, thanks to their engagement in collective action **(Pelenc, Bazile, and Ceruti 2015, 228)**.

Collective capabilities, because they are "*an absolute pre requisite to collectively manage common goods*" **(Pelenc et al. 2013, 88)** such as natural resources, will receive special attention in this doctoral research.

3.3. A FREEDOM DECOMPOSED

3.3.1. THE SCALE OF MEASUREMENT OF A COLLECTIVE CAPABILITY

We define a group as "*two or more individuals who are connected by and within social relationships*" (Forsyth 2018, 3).

In order to identify the existence of individual and collective capabilities in these groups, we look at their structure (how members are organized in the group, their interrelations and their interactions) and their dynamics (the interpersonal processes occurring between members over time) (Forsyth 2018). We detail in Table 1 the main elements defining a group's structure and dynamics.

Group structure	Position of members within the group: leaders, followers, compromisers, opponents, etc.). Individuals who stand out in the group. Norms: consensual standards that define which behaviors should be performed in the context of the game Interpersonal relationships between members: existence of alliances, conflicts, etc. Division of the initial group into subgroups: subgroups of two, three or more members based on various criteria (physical location around the water body, shared interests and values, etc.)
Group dynamics	Actions and achievements: focus on the decisions taken by the group of subgroups of players, and on their achieved functionings linked to the three observed capabilities Content of the discussions between players: "*task interactions*" (related to "*conjointly adjusted actions of group members*" in the game) or "*relationship interactions*" (related to emotional and interpersonal links between members of the group).

Table 1: Interpretation grid of a group's structure and dynamics (Forsyth 2018, secs. 1–1)

As we have discussed it in the previous section, collective capabilities are evaluated based on a minimal condition: that every member of the group should, to some extent, positively value the freedom that is subjected to the evaluation. This means that if one member, or more, of the group does not value a freedom or does not take part in the associated collective functioning on a free and voluntary basis, we cannot talk about the existence of a collective capability on the scale of a group involving this member. In such cases, the collective capability may exist on the scale of the group minus this one individual, that is to say on the scale of a "subgroup" of people.

3.3.2. THE THREE DIMENSIONS OF A CAPABILITY

We argue that, in order to be observed, a capability can be decomposed in three core dimensions, as illustrated on Figure 5: (1) functioning, (2) capacity and (3) value. In this grid, we consider that the term "capacity" refers to the ability of an individual or a group of individuals to behave or act in a certain way, regardless of the value they give to the behavior or action.

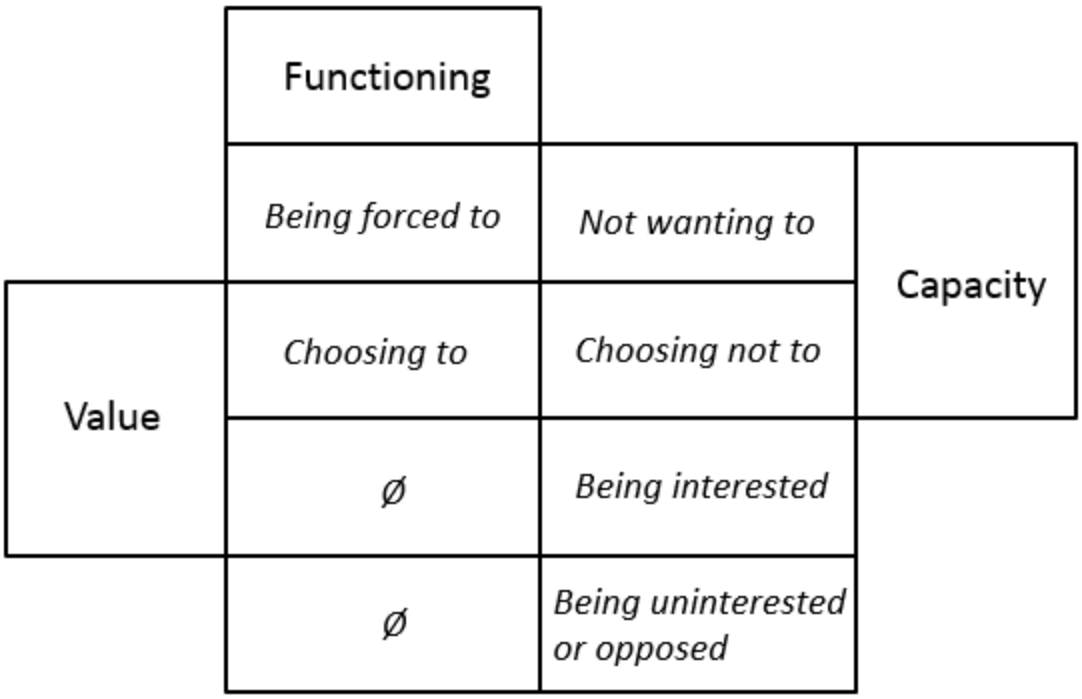

Figure 5: The three dimensions of a capability and its six possible stances.

When they cross each other, these three dimensions produce six possible stances for people to adopt:

(1) *"Being forced to" be or do something*: this stance corresponds to a person or a group of persons who achieve a functioning but do not value it. We consider that if they act and attain a certain state of "being" or "doing" but actually have a no interest in the freedom to do so, it is then very likely that an internal or an external pressure constrained them to act in such a way (e.g. a political or social pressure).

(2) *"Choosing to" be or do something*: this stance corresponds to the realization of a capability through the achievement of the corresponding valued functioning.

(3) *"Not wanting to" be or do something*: a person or a group of persons who possess the capacity to do something but neither value it nor feel constrained to turn it into an action.

(4) *"Choosing not to" be or do something*: this stance corresponds to the non-realization of an existing capability through the non-achievement of the corresponding functioning.

An achieved functioning can result from the choice of a person or a group of person sharing similar goals and interests, but also from their perceived constraints. These constraints can be

internal (e.g. emotional, cognitive constraints) or external (e.g. social, political or context-related constraints). This distinction is important because when a low or non-existent functioning is the result of a choice, the existence of the associated capacity is not challenged (it is then a non-actualized functioning). But if it is the result of a constraint, the associated capacity might very well not exist.

(5) *"Being interested" in being or doing something:* a person or a group of person does not possess the capacity to realize an action and consequently is not able to achieve the corresponding functioning. Yet, on the scale of the individual, he or she would still value the freedom. In the case of a group, it would correspond to a configuration in which all of its members value (or are at least are neutral towards) the said freedom. This particular stance of a capability corresponds to an interest in a freedom of performing a certain action, even though it is not accessible to them. Such a capability state may be associated with a will to learn how to possess the capability. A person or a group of person could also value a freedom of being able to do something, without wanting to possess this freedom. Such a positive attitude towards a freedom without the wish to learn it could also be associated to self-censorship, that is to say, to a scant belief in one's capacity to learn something or to do something properly and hence a disinterest into possessing the capacity to do it.

(6) *"Being uninterested or opposed" in being or doing something:* a person or a group of person would not value a freedom that they anyway do not possess. This lack of value and capacity could be related to a lack of interest, or even opposition or hostility, towards the freedom.

As shown on Figure 5, two combinations of the three capability dimensions were not taken into account into our analytical framework because they were considered to be unrealistic. Indeed, because possessing a capacity is considered as a prerequisite to implementing an action, the existence of an achieved functioning without its capacity-counterpart is considered as impossible.

4. THE LINK BETWEEN THE CAPABILITY APROACH AND PARTICIPATION

Participation is very important for the capability approach because according to Sen, it allows people to reflect and discuss which capabilities they value. Participatory processes are thus often considered simply as a tool to establish what people value and which capabilities they consider worth reaching. It is during the last decade that a handful of researchers have started to look at how exactly the capability approach could be used as a frame in which to evaluate participatory processes.

Participation holds a special place in the capability approach because it should be the process that allow a society or a community to discuss the principles of justice and the capabilities they value. Participatory processes represent a method "*by which participants […] together set social and economic objectives that are mutually constructive and that expand their real freedoms"* (Frediani 2006, 2). On entering the participation arena, people should be able to exercise their agency and engage in a collaborative learning process, in order to encourage individual and collective action (Frediani 2015). Participation can thus be considered both as a tool to identify and agree on common values and as an end, and its outcome should not be pre-determined. For these reasons, we consider that the capability approach is a pertinent framework to measure potential transformations among people and groups of people occurring during a participatory process. We consider that the approach provides a relevant set of indicators to assess participatory processes and whether they actually improve people's freedoms and well-being.

The link between participation and capabilities is therefore twofold, as illustrated on Figure 6. On the one hand, owning a certain set of capabilities can ensure the implementation of a fair and effective participatory process (Duraiappah, Pumulo, and Parry 2005). On the other hand, participatory processes have effects on individual and collective capabilities, be it their emergence and strengthening or their decrease or absence.

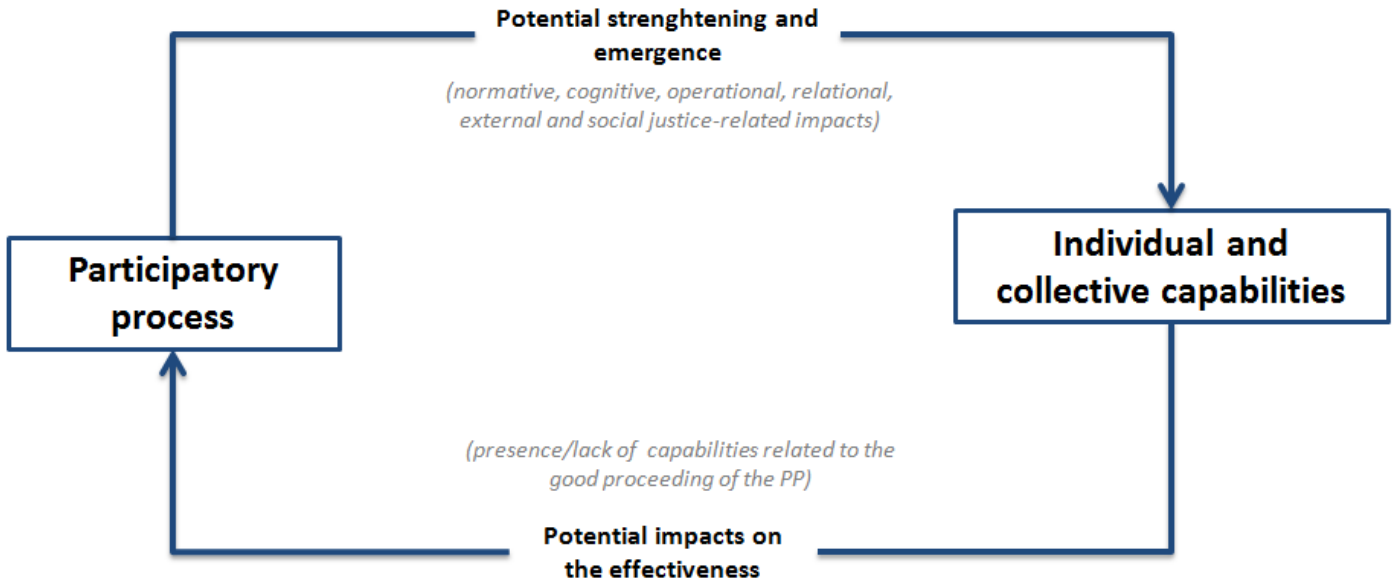

Figure 6: The twofold relationship between participatory processes and the capability approach.

First, using the capability approach to evaluate participatory processes is relevant because participation allows the members of a community to discuss, debate and agree on the justice principles they value. According to Frediani (2015: 11), authors have argued that "*to be*

transformative, the process of participation needs to account for a certain set of normative procedural characteristics". The capability approach encompasses fundamental human features that correspond to these characteristics. The presence or lack of specific procedural capabilities among a group of participants, that some authors such as Frediani (2015, 1) have called "*participatory capabilities*", may influence how fruitfully a participatory process progresses. Participatory capabilities represent the valued freedom, that is to say the choice, the capacity and the opportunity of an agent or a group of agents to achieve their objectives related to the effective progress of a participatory process. Those objectives are notably related to inclusion, equal partnership, transparency, sharing power, sharing responsibility, empowerment and cooperation dimensions (Duraiappah, Pumulo, and Parry 2005). Those participatory capabilities, individual or collective, can for example correspond to: *being able to cooperate among or as a group, being able to take and share responsibility among the different members of the group, being able to share power among the different members of the group, being able to ensure transparency and an equal diffusion of the information, being able to be inclusive towards any person who is concerned by WRM and wishes to join the participatory process, being able to recognize and take into account every participants' skills and abilities into the participatory process, being able to promote within the group accountability, mutual learning and even empowerment* (Duraiappah, Pumulo, and Parry 2005; Frediani 2015).

Second, participatory processes may impact the capability space of participants and have effects on the development of their individual and collective agency and capabilities. Participation is a time in the life of a community when its members can discuss and agree on the principles of justice and the capabilities they value. Participatory processes give participants the opportunity to work together, to make decision proposals and to become actors of change. During the time of a participatory process, participants may change their values because of interactions with each other and public discussion. They may also develop their knowledge or skills solicited during the process. By giving people the opportunity to deliberate over what they want, what they can do, what they could do, how to attain their objectives and act to achieve them, participatory processes allow them to influence and share control and commitment over a set of various actions, such as priority settings or policy-making (The World Bank 1996; Paz Goldfarb and Grinberg 2002).

The intrinsic multidimensionality of the capability approach makes it an interesting frame in which to evaluate the transformative effects of participatory processes on individuals and groups. Indeed, public participation may lead to the redistribution of decision capacities, the improvement of the relevance and appropriation of policies, and increase in long-term autonomy, as well as in participants' well-being (Arnstein 1975; Sewell and Phillips 1979; Renn, Webler, and Wiedemann 1995; Wesselink et al. 2011; Maurel et al. 2007; Jones et al. 2009). The changes in participants related to their engagement in participatory processes can be (i) normative (changes in the values and preferences of the participants), (ii) cognitive (changes in the knowledge, learning process and comprehension related to the environment, and consequently representations and beliefs of the participants), (iii) relational (change in the social

relationships among the group), (iv) operational (change in the practices and the actions of the group), (v) external (change in the overall NRM) and/or (vi) related to the social justice regime among the group and the changes connected with other agents (Rydannykh 2011; Ferrand and Daniell 2006; Daniell 2012).

Capabilities inspired by these types of changes related to the involvement of people in participatory processes may hence correspond to: *being able to collect information and define a problem to deal with, being able to identify the actors related to this problem, being able to discuss the issue and build an informed point of view, propose solutions and strategies and assess them, being able to choose an action plan to collectively manage water, being able to implement this solution and to monitor it, etc*. (see Annex I for an exhaustive list). We identify this type of capabilities as "participation-triggered capabilities" which focus on the individual and the collective achievements.

Because of this twofold link existing between public participation and the capability approach, we consider that this normative framework is relevant to evaluate participation. This relevance was also pointed out by Frediani **(2015, 7)**, who argued that the success of participation should be measured in relation to "*the impact on agency of individuals and groups*".

Because we focus on the impacts of participatory processes on its participants, their capacity to manage a resource and the value they give to this capacity, several capabilities and their affiliated indicators (i.e. resources and conversion factors), which comes into the category of "participation-triggered capabilities", will be chosen here.

5. THE CAPABILITY APPROACH PUT INTO PRACTICE

Several challenges are to be addressed before engaging in the design of an evaluative tool based on this approach. As Alkire (2005, 122) puts it, "*the capability approach is a proposition, and the proposition is this: that social arrangements should be evaluated according to the extent of freedom people have to promote or achieve functionings they value*". A series of specifications and methodological choices must be made so that the most relevant dimensions of participatory processes may be chosen to be evaluated through the capability framework.

5.1. THEORETICAL SPECIFICATIONS: THE SELECTION OF VALUABLE CAPABILITIES

The community of researchers working with the capability approach is divided concerning the selection of the most relevant capabilities to measure states of well-being and whether a list of essential capabilities for human development should be drawn up.

As we have previously seen, Sen defends a "participatory view" and argues that the capability approach is deliberatively incomplete, for the list of capabilities that should be valued (and evaluated) for each context should be the outcome of a public deliberation process (Sen 2004a; Claassen 2011). According to Sen and as part of his "*participatory and democratic turn*" (D. A. Crocker 2008, 18), it is through the process of fruitful participation and regular public debates and discussions that the community and its members should agree on common justice principles and valued capabilities (Drèze and Sen 2002). Consequently, Sen deliberately refrains from endorsing the use of a "*pre-determined canonical list of capabilities, chosen by theorists without any general social discussion or public reasoning*" (Sen 2005, 158). Instead, he emphasizes the underspecified nature of the approach (Gaertner 1993).

Nevertheless, because of its "*resistance to overt prescription*" (Deneulin and Shahani 2009a, 43), the capability approach gives many possibilities to people and researchers to further specify what constitutes valuable capabilities. That is why several authors have built operational lists of capabilities and chosen to evaluate the capabilities they considered the most important. This approach could be described as "an expert view" of the capabilities' evaluation process.

Nussbaum is probably the scholar who has developed the most discussed list of valuable capabilities. Her list stems from her conception that philosophers, as well as constitutions, have an important prescriptive role to play in policy design and evaluative prospects (Crocker 2008). She proposes a list of ten central categories of human capabilities, which she has qualified as flexible since their first presentation: (1) Life; (2) bodily health; (3) bodily integrity; (4) senses, imagination and thought; (5) emotions; (6) practical reason; (7) affiliation; (8) other species; (9) play; and (10) control over one's environment (Nussbaum 2000). According to Nussbaum, such a list avoids the central issues of omission and power. Indeed, individuals and communities, when asked to define which capabilities they value, may involuntarily omit important ones; or the final outcome of the public deliberation may be influenced by social or economic elites or majorities to advance their own interests. She states that "*just as people can be taught not to want or miss the things their culture has taught them they should not or could not have, so too can (they) be taught not to value certain functionings as constituents of their good living*" (Nussbaum 1987, 175; in Deneulin and Shahani 2009a, 43). Nussbaum argues that all governments should endorse these ten universal categories of capabilities and that they should be incorporated into every constitution. With this list, Nussbaum "*enters the capability approach from a perspective of moral–legal–political philosophy"* (Robeyns 2005, 103) and intends to provide citizens with arguments for constitutional principles that they should have a right to demand from their governments (Nussbaum 2003; Robeyns 2005). In this way, political communities could better guarantee optimal capabilities for all citizens. They should have the necessary resources and conditions to access the above listed capabilities; the choice to transform them in functionings would be left up to them (Crocker 2008).

Other scholars have thus chosen to propose revisable lists and methodologies adapted to specific case studies and evaluative contexts and then let the wider community of researchers

debate the proposals, eventually leading to their validation or rejection (Crocker 2008; Deneulin and Shahani 2009). Alkire (2002) for instance has described and compared various approaches intersecting that of Sen and Nussbaum, such as (among others) the domains of life satisfaction listed by Cummins (1996), the nine axiological categories of Max-Neef (1991) or the ten central human values listed by Schwartz (1994). Several authors have also, for instance, listed capabilities related to young people's well-being (Biggeri et al. 2006; Wüst and Volkert 2012; Van Ootegem and Verhofstadt 2012; Trani, Biggeri, and Mauro 2013; in Pelenc 2017)

By endorsing Sen's posture which asserts that there is no pre-given set of capabilities, we would assume that the only relevant and feasible evaluation method should be based on a self and local listing of capabilities by the group of participants. This would however hold back the initial comparative aims of the evaluation tool. Indeed, with this posture, attempts to replicate and compare the very same evaluation process over several cases would be made much more difficult. Likewise, reconciling different views of what the most important capabilities should be for the group might prove to be quite difficult, especially when they turn out to be dissimilar.

Moreover, in a spirit of practical implementation of our evaluation tool, the participatory identification of capabilities is a time-consuming process, especially since it adds to the time already required to implement the participatory process itself, as well as its evaluation. Engaging citizens on a long-term basis in a participatory process requires their time and their energy, which might result into participants' fatigue. In this context, adding an extra workshop might even weaken their engagement with the whole process, even though it may, by itself, constitute a sound aspect of the participatory process.

Our aim though is to generalize the assessment of our method. We argue here that the second option, that is to say the selection of capabilities based on the literature, is consequently the most appropriate methodology with which to build this evaluation tool.

5.2. METHODOLOGICAL CHOICES: THE CAPABILITY SPACE AS THE PRIVILEGED SCALE TO EVALUATE A PARTICIPAPTORY PROCESS FOR WATER MANAGEMENT

Several authors have issued recommendations for developing an operational evaluation tool, going into more or less detail regarding the specifications for transforming the capability theory into "*an object of practical value*" (Comim 2001, 1). Robeyns for instance (2006) argues that three theoretical specifications should be made in order to operationalize the capability approach: whether to focus on capabilities or functionings; which capabilities should be selected and whether capabilities (or functionings) should be aggregated and given weight. We address these specifications in the following sections, in view of our evaluative objectives.

One essential methodological choice that the evaluator must make in order to design an evaluation grid based on the capability approach is whether capabilities or functionings are being measured. According to Robeyns (2006, 359), "*as far as the choice between functionings and*

capabilities is concerned, all applications have focused on functionings rather than capabilities". Indeed, the identification of capability requires a counterfactual reasoning, that is to say, the deduction of possibilities available to people stemming from actualities. As Crocker and Linden (1998, 321) sum it up, "*the person with plenty of food may always choose to fast, but there is a great difference between fasting and starving, and it is this difference that we wish to capture*". From the presence of a functioning is derived the existence of the associated capability. But when no functioning is identified, a careful analysis of the resources, conversion factors and agency of people is required to understand and determine whether the capability exists or not. Gasper (2007) points out that even when capabilities are identified among individuals, it is still a challenge to compare the opportunities valued by people. Two people or groups of people with identical capability sets might end up making different choices and achieve different functionings (Robeyns 2005).

In the case of participatory processes for WRM, we deem it more relevant to focus on the capability space of participants, instead of on their functionings. We consider the analysis of functionings insufficient to understand the full extent of what people, as individuals and together as a group, could or could not do depending on the extent of their capacities, their values, or their resources and conversion factors (e.g. material shortages, social or political pressures, lack of knowledge, etc.).

5.3. WHICH CAPABILITIES EXACTLY TO SELECT? FOCUS ON THREE CAPABILITIES TO EVALUATE

The final major theoretical choice concerning the selection of capabilities is also a practical one. Which capability exactly should we evaluate? This interrogation relates to another one that should be answered first: what should their level of precision be?

5.3.1. LEVEL OF PRECISION AND APPROPRIATE NUMBER OF CAPABILITIES TO EVALUATE

We differentiate various levels of capabilities. For instance, a broad capability refers to a capability whose related indicators, resources and conversion factors are numerous and well defined. Such capabilities might, for the participants undertaking the evaluating process, be easier to relate to concrete beings and doings connected to collective action for water management. A broad capability would correspond for example to "being able to cooperate together as a group". Such a capability encompasses more detailed capabilities, such as "being able to express one's ideas" or "being able to listen to other people's ideas". From this example, we understand a detailed capability as a very specific freedom of being or doing that is the basis for other capabilities.

In order to conduct the exploratory research undertaken in this thesis, we considered it more judicious to select broad individual and collective capabilities instead of detailed ones. Indeed, we assumed that broad capabilities encompassing various resources and conversion factors may be easier to evaluate than detailed ones.

Because the process of measuring one capability requires a long and careful planning, as well as thorough analysis, we narrow down the number of capabilities that we evaluate to three. The limitation allows an exploration of the detailed mechanisms behind both individual and collective capabilities, and consequently of the resources and conversion factors behind them.

5.3.2. THE SELECTION OF CAPABILITIES RELATED TO COLLECTIVE ACTION FOR NATURAL RESOURCES MANAGEMENT

As we discussed in the introduction to this thesis, many types of participatory processes exist. Because we aim at building an evaluation tool for participatory processes that offer the highest level of engagement to participants, we argue that capabilities related to collective decision-making are the most desirable ones to focus on.

A decision-making process is made up of numerous steps. e.g. assessing the situation, collecting and analyzing information, suggesting solutions and assessing their feasibility, suggesting new management rules, designing an implementation plan, evaluating these, etc. (Hassenforder et al. 2017). None of these steps should be compulsory for the participants, but practitioners should ensure that they do have the capability to go through them if they want to.

We consequently designed an extensive list of capabilities related to participatory WRM. This list is based on the main steps and capacities that participants may engage in and call for if they want to join a collective decision-making process (see Annex I for the complete list). We divided the listed capabilities into several categories: individual and collective categories, but also thematic categories, whether they concerned autonomy, having responsibilities, cooperation and "working together", collective action or mobilization.

5.3.3. THE FINAL THREE CAPABILITIES

Based on this list, we selected three relevant capabilities for collective action for WRM.

The selection was made with two practical objectives in mind. First, no capabilities related to the relation of the group of participants with external stakeholders who are not part of the evaluated participatory process were selected. We considered that these would not easily fit into the frame of what can be practically measured during a single or dual workshop.

Second, and as we discussed in section 4 above, participatory processes gives participants the opportunity to discuss and agree on important principles that will guide their decisions and

actions related to the management of environmental resources and to their own organization as a group. That is why we singled out three capabilities that correspond to critical features used to cope with socio-environmental adaptation for the members of a group who engage in a participatory process.

(1) *Being able as an individual to express oneself in a determined social context*

In order to contribute to long-term social changes, it is important to ensure a constructive and inclusive deliberation process where every participant has the opportunity and the capacity, if he so wishes, to discuss his or her point of view. A participant should be able to formulate and express opinions and ideas on a given subject. Other participants should listen when he speaks up. Figure 2 summarizes the capability sequence related to this individual capability.

(2) Being able to collectively make a diagnosis of a problematic situation

Making the diagnosis of a situation corresponds to the process of identifying the nature of a problem and the reasons that lie behind it. When making a diagnosis of a situation, people infer causal relationships between two or more variables in a system. The process of diagnosis-making also involves an interpretation and a judgment of the situation, depending on the beliefs and values of the people involved (Dutton, Fahey, and Narayanan 1983). The capacity to collectively understand an issue and share a common vision of a socio-ecosystem is an important stance in engaging in collective decision-making (Lardon and Piveteau 2005). Being able to collectively make a diagnosis is crucial in terms of strategic planning because thanks to this process and the final result, people may be better able to plan ahead and identify the most valuable and desirable outcomes of a participatory process.

(3) *Being able to collectively make and implement rules to manage a socio-ecosystem*

Taking part in decision-making and rule-design for the local stakeholders is an outcome of the participatory processes we focus on. This freedom is the key to collective environmental resources management (Ostrom 1990). The capacity of a group of participants to deliberate over the management of a socio-ecosystem, design its own rules and implement them reflects the social dynamic of the group, its reflexivity and its self-control. Similarly to the previous capability, Figure 4 summarizes the capability sequence related to this collective capability. Examples of management rules include regulating social interactions during the deliberation process (e.g. not talking at the same time, but in turn), sharing the available information on the socio-ecosystem with everyone, not producing a certain amount of pollution or consuming a certain amount of water during a given time, etc.

These three capabilities are representative of the participatory WRM needs through deliberation, diagnosis and self-regulation. They are not independent of each other. As illustrated on Figure 7, a logical link exists between them.

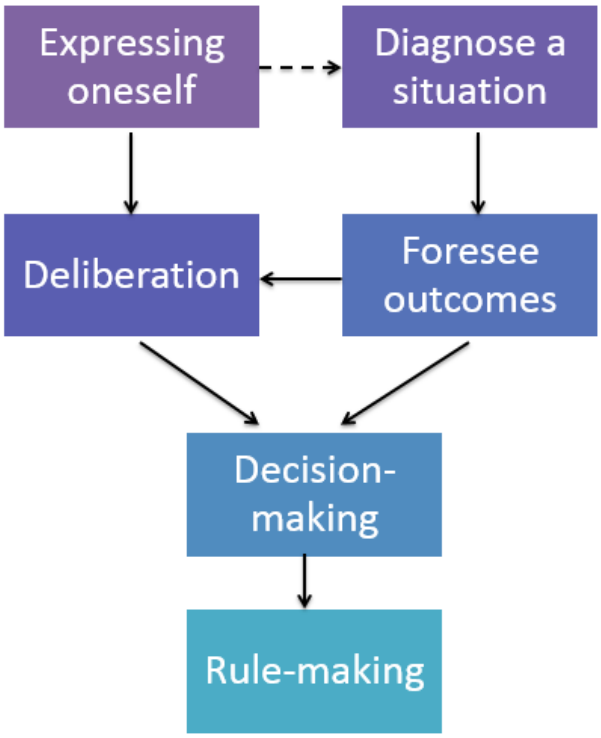

Figure 7: Three decisive capabilities to ensure the efficiency of a participatory process for NRM.

The individual capability of expressing oneself is related to the two collective capabilities "diagnosis" and "rule-making". Being capable of talking in front of a group makes the involvement of the individual in the two collective capabilities depend on his choice, instead of it being imposed by the state of the group (e.g. one or several participants monopolizing the conversation; one participant talking but not being listened to). In this sense, "being able to express oneself in front of a group" also serves as a conversion factor and underpins the possession of the two other capabilities for the group (as illustrated on Figure 7 above). A group whose members cannot speak up and discuss their ideas together is unlikely to possess the freedom to collectively make a diagnosis of a problematic situation or regulate it.

The collective capability "diagnosis-making" is related to the individual capability "expressing oneself" because only with individuals discussing together, sharing their understanding of the socio-ecosystem and agreeing on a common vision, can the diagnosis take place. This collective capability may also relate to the collective capability "rule-making and implementation". A collective diagnosis can be a path leading the group to take a decision, thus facilitating the collective definition of a rule.

However, the realization of a collective diagnosis is not a precondition to the conception and implementation of collective management rule. A group could agree on a collective diagnosis but not be able to agree on a collective management rule (e.g. because of discordant interests between the group members). Similarly, a group may make and implement collective rules without sharing a common vision or understanding of their socio-ecosystem (e.g. when the group members consider that a negotiated agreement on management rules is better than no agreement at all) (Mermet and Berlan-Darqué 2009). A group could also very well adopt a "procedural rule" that has no direct connection with their collective understanding of the socio-ecosystem (e.g. "members of a participatory process taking part in a formal group discussion must speak one after the other").

As we will see in Chapter 4, these three capabilities represent three different levels of complexity for the measurement. Self-expression among a group depends on each individual evolving in a specific social context. Collectively making a diagnosis of a situation and collectively regulating a socio-ecosystem involve complex interactions between the members of a group. Collective rule-making presents a priori the highest level of complexity, because it involves both the design of a rule, discussions on it, and its acceptation by the collective, as well as its implementation. These three capabilities are representative of the complexity of other capabilities that can be of use in a participatory process, hence our initial interest in focusing on and evaluating them.

6. EXISTING METHODOLOGIES TO EVALUATE CAPABILITIES: A REVIEW

The practicability of the capability approach and the challenges to measuring the valued freedoms at its core have long been discussed in the literature (Robeyns 2006). In her words, "*putting the capability approach into practice is not a straightforward exercise*" **(2006, 373)**.

The main difficulties encountered by scholars in putting capabilities into practice have been widely discussed in the literature (see Frediani, Boni, and Gasper 2014; Kleine 2010; Heckman and Corbin 2016). They are notably related to the measurement of counterfactuals (Comim 2001; Heckman and Corbin 2016), and to the dependence on the stated preferences of people in order to identify their values and capacities. The preferences of people in terms of valued freedoms is at the center of the approach, yet it can happen that people have been "*habituated to inequality*" and are "*unaware of possibilities of social change*" (Sen 1990, 127; in Frediani, Boni, and Gasper 2014). In this case their preferences may be adapted to the oppression they live in and lead to problematic stated preferences, e.g. preferences that affect one's own or other people's well-being (Ray 2006; Ibrahim 2011; Frediani, Boni, and Gasper 2014). People may reinterpret or misrepresent reality when they are asked to report their functionings, capacities or values, and this may undermine the reliability of the data. These difficulties are even more significant at the collective level, where the freedoms to be and act are not necessarily equally shared nor valued by all the members of a given group of people (see Alkire 2008; in Ibrahim 2009). Moreover, the changes over time in the capability space of participants

are often a medium to long-term process. This implies temporal scale issues for tracking and measuring those changes.

Despite the relevance and the interest of looking at participatory process through the capability approach, as well as the operational methods suggested in the capabilities' literature, few evaluation tools based on it have been developed. According to Robeyns (2006, 358), "*the main measurement techniques that have been explored so far are descriptive statistics of single indicators, scaling, fuzzy sets theory, factor analysis, principle component analysis, and structural equation modelling*".

Among the existing attempts, we single out the proposals of several scholars. Grunfeld (2013) for instance developed an analytical frame, taking the shape of a development and evaluation tool for initiatives in the field of information and communication technologies for development, combining theories from the latter with the capability approach. This frame is based on semi-structured focus groups and face-to-face interviews. Another researcher, Gigler (2004), developed an individual and collective evaluation framework based on data from several consultation workshops conducted with indigenous people in Peru. El Harizi and Klemick (2007; El Harizi 2008) developed a tool to measure the collective capabilities of local communities in the Sudan and their capacity to manage natural resources. With the help of a panel of experts, researchers focused on six weighted categories of capabilities (level of autonomy, ability to take initiatives, ability to manage funds, ability to organize, ability to manage communal land, "level of achievement") measured with forty-five indicators to create a tool called "the Community Capability Index". After testing the original index on the field, the researchers built five new alternative categories of capabilities based on the data they gathered among the local communities, broadly named "*mobilization, money management, land tenure security, common vision of problems, and communal lands management*". For example, one category of capabilities here, the "*ability to mobilize*", encompasses several indicators, among them what could be described as sub-capabilities (or more detailed capabilities, as discussed in section 5.3.1), such as the "*ability to mobilize resources"* or the "*ability to find solutions*". A survey was then run among local communities so that they could evaluate their capabilities themselves.

Several scholars working in the field of health economics have also developed evaluation grids, such as the ICECAP-A grid (Al-Janabi, N Flynn, and Coast 2012; Flynn et al. 2015; "ICECAP-A - University of Birmingham" n.d.) and ICECAP-O grid (Grewal et al. 2006; Coast et al. 2008; "ICECAP-O - University of Birmingham" n.d.), based on two rounds of semi-structured interviews with older people and adults.

We also single out the recent work of Bartiaux et al. (2018, 1220), who used a large-scale quantitative survey tackling the ten capabilities listed by Nussbaum (2000) in order to, among others, combine a measure of energy poverty and capabilities deprivation at household levels and determine the link between the two, but also explore how to combine "*self-perceived energy poverty with a more procedural definition of poverty*".

If the assessment of collective capabilities often relies on quantitative or qualitative analyses, the use of mixed approaches and methods could be a way to go beyond the difficulties aforementioned. One example is the work of Biggeri and Ferranninni (2014), who engaged in this direction and developed a mixed assessment tool relying on focus group discussions and a RPG to make quantitative and qualitative analyses of community capabilities. Because this example is the closest to our experiment in terms of methods, we will discuss it further in Chapter 2.

7. LIMITS OF AND CRITICISM ADDRESSED TO THE CAPABILITY APPROACH

The capability approach holds a great deal of interest for those who aim at evaluating the impacts of participatory processes on individuals and groups. However, it also presents a certain number of limitations that should be acknowledged when building an evaluative tool based on its main components.

One of the main criticisms of the capability approach concerns its under-specification. As explained by Gasper **(2007, 356)**, it led to "*various different versions, even as presented by the same author or by authors who think they are in agreement. A shared stance that capability is a relevant informational space in evaluation is far from constituting a shared approach. Managing the tensions occurs partly through vagueness and ambiguity, which is problematic*". When navigating the literature dedicated to or inspired by the capability approach, one must be aware of this issue because it directly impacts the way the approach is put into practice in different fields, by different researchers. One solution, suggested by Gasper in the same article, would be to clearly distinguish several variants of the capability approach and work with them depending on the context, which could be better adapted to different research purposes and easier to amend and improve. This solution could certainly be interesting for whoever seeks to use the capability approach as an evaluative frame for single case studies, but it might also undermine one of the approach's major strengths, which is its relative universality and adaptability to many different contexts. The deliberate incompleteness of the capability approach and the fact that Sen has not provided clear guidelines to practitioners or researchers about the identification and the assessment of capabilities, or which capabilities or functionings should be considered valuable, has also been criticized by scholars. Several practitioners or researchers looking for clarity or persuasion in this approach have consequently been left unpersuaded **(Gasper 2007; Frediani 2010)**.

Other criticisms of the capability approach are related to normative issues **(Bonnard 2015)**. It has been for example underlined that the capability approach, even though it calls for multidimensional analyses of well-being, is somehow still attempting to compartmentalize the space of freedoms, which means that it does not completely differ from economical utilitarianism. Dubois and Mahieu **(2009, 246)** even qualify the approach of a pioneer critic of utilitarianism, but which is also "*strongly marked by the method of reasoning proper to social choice theory*".

Moreover, the capability approach does struggle to take into account adaptive preferences (Baber 2007) and "*auto-coercion*" that can strongly influence the transformation of effective capabilities into achieved functionings (Dubois and Mahieu 2009, 253).

Another major criticism that has been made of the capability approach is that it focusses too much on individuals and does not sufficiently take into account the group, nor the social structures (Robeyns 2005). First, the capability approach has been said to be too individualistic and has been criticized for not paying sufficient attention to groups. According to Robeyns (2005), some scholars, such as Sen, strongly believe in people's ability to be rational and resist social and moral pressure coming from groups, recognizing and identifying at the same time "*social functionings*" (such as for example "taking part in the life of the community", "communicating", "being well-integrated in society") (Frediani 2010, 176). Nevertheless, they do recognize that social and environmental factors influence the conversions of commodities into functionings, and that societal structures and constraints influence the choices that lead to the transformations of capabilities into functionings (Robeyns 2005). Other scholars have paid more attentions to the influence of social norms and group-based processes of different kinds on people's freedoms and choices (see for example the work of Bourdieu (1980; 1987) developing the concept of *habitus* which states that people's way of perceiving and thinking their environment is strongly dependent on their cultural and social capital – see Chapter 3 for a more detailed account) (Pham 2019).

Some authors have gone further in this direction and developed a branch of literature tackling collective capabilities (see section 3.2), arguing that Sen's approach failed to recognize the role of collective resources and conversion factors, as well as that of collective agency. Second, the capability approach would not take into account the context and the social structures among which participatory processes take place. Scholar have pointed out that because it has for a long time focused solely on the individual, the thorough examination of the impacts of institutions, social structures and their history on people's capabilities has not been sufficiently taken into account (Stewart and Deneulin 2002). Likewise, the asymmetries and the ratios of power between stakeholders might not be fully taken into account in an evaluative frame, which would subsequently lead to missing information crucial to interpreting a given situation. Robeyns (2005, 110) argues that institutions and social structures are indeed essential elements influencing the means of the capabilities, but "*hardly ever the capabilities directly*". She considers nonetheless that, for political or social purposes, it is crucial to know about them because they can be changed, as a means to increase people's well-being.

Finally, moving from theorization to operationalization is a long journey full of pitfalls. Scholars agree on the difficulty in operationalizing the capability approach. Major simplification may be made to obtain a practicable framework and the obvious danger is to simplify too much or in an inappropriate way, until clarity and relevance is lost (Gasper 2007). In addition to what people do and what they could do to produce a viable evaluation one should also aim at understanding the socio-politico-environmental context in which people live and act together. Gasper (2007, 357) gives two examples of inappropriate reduction when operationalizing the capability approach.

The first is the "*use of the notion of a separate sphere of 'economic welfare', for which per capita GNP is supposedly a satisfactory indicator*", since this would "*tacitly undermines the original rationale of the capability approach*". The second is the weakening of the valuation of capabilities by people: indeed, Sen insists that people should "have reasons to value" the capabilities, and not only "value" them, because "*the capability approach's very rationale lay in a distinction between considered and unconsidered lives, between reasoningly valued as opposed to directly felt well-being*".

8. CONCLUSION

A theoretical overview of the approach leads us to believe that it is a relevant framework in which to look at participatory processes' effects on individuals and groups. It puts an emphasis on autonomy, collective action and empowerment dynamics, which are essential to strengthen a sustainable involvement of the population into WRM. Because the development of a group's capability space impacts the participatory process and vice versa, it is a privileged approach that should be applied to the development of an evaluative framework. Nevertheless, the challenges to developing a readable and comparable evaluation tool to measure transformative effects related to participation and to producing reliable assessments are numerous. Even though several authors have, during the last decade, suggested rules and guidelines to operationalize the capability approach, there is no consensus. Three individual and collective capabilities related to collective action will be part of our evaluation tool: being able as an individual to express oneself in a determined social context; being able to collectively identify and put into words a problematic situation and make a diagnosis of it; and being able to collectively make rules to manage a socio-ecosystem. An efficient participatory process would focus not only on the quality of the final decision, but also on the strengthening of people's capabilities. Reciprocally, an effective group of participants would possess these three capabilities, which would enable them to participate fruitfully and therefore ensure a better decision-making process Further operational specifications lead us to consider the use of a social experiment as a way to go beyond the limitations associated with the approach and to evaluate people's capabilities.

CHAPTER 2 – A SOCIAL EXPERIMENT TO EVALUATE CAPABILITIES

1. INTRODUCTION

The specifications discussed in the previous chapter make us consider an evaluation tool based on mixed methods (both quantitative and qualitative) and several measurement devices as a relevant option to evaluate individual and collective capabilities in a participatory context. The use of a RPG as a space to "test" the achievement of actions related to the three evaluated capabilities may be particularly interesting to measure the presence or absence of a capability among a group of participant.

We review in the second section the strengths and shortcomings of already existing methods of evaluation for participatory processes, and then in a third section what social experiments and RPGs are and their link with NRM and public participation. We discuss in a fourth section the assets of a protocol based on a RPG and complementary measurement tools for the evaluation of capabilities. Finally, we discuss in the fourth section which methodological challenges should be carefully addressed during the design process of our experiment.

2. EVALUATING A PARTICIPATORY PROCESSES FOR NATURAL RESOURCES MANAGEMENT: AN OVERVIEW

An evaluation defines how effective the means chosen to attain certain objectives are. When applied to public participation and participatory processes, it usually aims at assessing their effectiveness for reaching certain outcomes, whether they concern its context, its process, its output, outcomes and/or its impacts (Breakwell and Millward 1995; Guérin-Schneider et al. 2010; International association for public participation - Canada 2016). As Bellamy et al. note, evaluation is fundamental to support "*progressive learning at individual, community, institutional and policy levels"* (2001, 408; in Hassenforder et al. 2016) and, hence, to strengthen people' conversion factors, resources and eventually, their capabilities.

Defining what the effectiveness of a participation process means exactly represents a difficulty in itself. As the International Association for Public Participation (2016, 4) summarizes it, "*the notion of "*effectiveness*" is subjectively determined through value-laden attributes. Also, participation as a concept is value-laden itself, consisting of many complex variables that are not easily identified nor measured*". For these reasons, establishing a consensual normative definition of what effective public participation is and an agreement on the appropriate evaluation criteria for it is a challenge. In a similar way, the capture of collective values and their development over time in a decision-making arena represent another methodological difficulty for the evaluator (Barbier and Larrue 2011).

These theoretical and methodological obstacles have slowed the progress in this field of research (International association for public participation - Canada 2016). Nevertheless, because there is a strong need "*for both workable methodologies and systematic evaluation*" of participatory processes (Johnson 2002, 21), especially in the field of water management where they are widely spread, several authors have during the last fifteen years developed theoretical and practical frameworks and guidelines to define criteria for evaluation and use them to evaluate the effects of participatory processes. Among the "*constellation of methods*" (Smajgl and Ward 2013, 56) used to assess decision-making processes, some of them have specifically been developed for public participation in the field of NRM. Interesting examples include:

- The "Nine Criteria Approach" (Rowe and Frewer 2000; Rowe, Marsh, and Frewer 2004) gathers nine evaluation criteria, divided into acceptance and process-categories. If the first category refers to the credibility and the sincerity of the process, the second refers to the quality of the process' organization (Blatrix 2009; in Guérin-Schneider et al. 2010). This framework provides a straightforward and clear grid to evaluate the process itself, but it does not take into account the final outcomes of the process, nor its potential impacts on the participants.

- Bréthaut (2016) proposes an evaluation grid for participatory process for water management based on three main evaluation criteria: their social, substantial and procedural efficiency. Just like the framework proposed by Rowe and Frewer (2000; 2004), the evaluation grid only applies to the form of the process itself and does not take into account its effects on participants.

- The Comparison of Participatory Processes tool (Hassenforder, Smajgl, and Ward 2015) investigates public participation through a cross-comparative analysis. The tool lists twenty evaluation criteria related to the context, process and outputs, outcomes and impacts-related -characteristics of the participatory process. Due to its genericity, the authors consider that context-specific information might not be captured; this limits understanding of key elements related to the effectiveness of the participatory process (International association for public participation - Canada 2016).

- The ENCORE framework stands for "*External, Normative, Cognitive, Operational, Relational and Equity*" (Ferrand & Daniell, 2006; Daniell, 2012, Hassenforder, 2014). It aims at assessing changes occurring among the individuals taking part in a participatory process. These changes can be related to the values and preferences of the participants, their knowledge, comprehension and beliefs related to the environment, their social relationships within the group, their practices and actions, the overall impact on water management and, finally, the social justice regime among the group and the changes entailed for other agents.

- The Monitoring and Evaluation of Participatory Planning Processes framework (Hassenforder et al 2015), based on the ENCORE framework. The MEPPP framework aims at monitoring and evaluating a specific type of participatory process, which is

participatory planning. Divided into six main phases, it focuses on three clusters (context, process, outputs-outcomes) and include descriptive and analytical variables. Even though it is a general framework that must be specifically adapted to every different case study it is used for, it is an interesting suggestion for identifying as many impacts as possible, including impacts on the participants. However, the authors point out that this dual characteristic (a framework which is both general and specific) makes it a demanding process in terms of resources and time for the evaluators, which may limit its implementation in the field.

What we gather from these examples of evaluation frameworks is that even though the generation of interests oriented toward community values rather than more selfish or individual values has long been observed by researchers (Beierle 1999), only a few evaluation tools have attempted to measure it. They tend to focus instead on the quality of the process or on the substantial effects on the environment. Consequently, progress is still required to understand, depending on specific variables such as contexts, issues or the implementation protocol, how participatory processes impact the individual participants, participants as a collective and, eventually, their freedoms to make the decisions and implement the practices they value the most. That is why we propose to complement these tools by exploring the use of the capability approach as an evaluation framework.

3. A SOCIAL EXPERIMENT BASED ON A ROLE-PLAYING GAME TO EVALUATE PARTICIPATORY PROCESSES: DEFINITIONS AND PRECEDENTS

This research aims at exploring the use of a social experiment as a generic and comparable evaluation tool to measure certain transformative effects due to the participatory processes in the capability space of participants. Because we seek to evaluate the presence or the absence of individual and collective capabilities among groups of people, the measurement protocol must reveal achieved individual and collective functionings, but also unachieved functionings and capacities, intentions and values. These counterfactuals are difficult to grasp with single traditional measurement tools, which would only reveal parts of the capability iceberg but may not give a full picture, strengthened by data triangulation. That is why we have chosen to use a social experiment to perform this task. By doing so, we assume that the social interactions that take place during the experiment are related to those taking place in real life, and hence, to their real capabilities. In this way, if the participative process impacts these capabilities, changes should appear in the way participants behave and act during the experiment. In order to ensure the accountability of the observed changes in the capability space of participants, we propose to realize this evaluation before (*ex ante*) and after (*ex post*) the evaluated participatory process. We will demonstrate in this section how a RPG specifically designed to meet this task and complemented by additional evaluation tools is relevant to serve as the basis of this *ex ante ex post* experiment.

3.1. DEFINITIONS

The management of common-pool resources such as water have been the subject of a wide number of experiments, from behavioral economics to social-psychology (Poteete, Janssen, and Ostrom 2010; Anderies et al. 2011). A social experiment traditionally consists in "*the random assignment of human subjects to two groups to examine the effects of social policies. One group, called the "*treatment group," *is offered or required to participate in a new program, while a second group, the "*control group," *receives the existing program. The two groups are monitored over time to measure differences in their behavior*"[6]. A social experiment follows a precise protocol and, despite their names, all the groups that take part in it receive controlled treatment.

These experiments take a variety of forms, from conventional laboratory experiment to natural field experiment (see Anderies et al. 2011 for a review). We will explore in this chapter the use of a framed field experiment. This uses an abstract framing, an imposed set of rules and a nonstandard participant pool and is carried out in the field context or with a field commodity (Lusk, Pruitt, and Norwood 2006; Anderies et al. 2011).

An experiment entails "*an environment in which a number of participants make decisions in a controlled setting. The rules (institutional arrangements) of the experiment define the payoff structure, the information participants have […]. Participants voluntarily consent to take part in an experiment prior its initiation. They receive instructions on the possible actions about which they can make decisions and possible outcomes that depend on the decisions of all participants in the experiment*" (Anderies et al. 2011, 1573).

As the center piece of our social experiment, we propose to use a RPG. We define a RPG as a social structure introduced into a group of players, reproducing the most important processes, networks, and structures of a real NRM decision-making system and involving actors, rules, and resources (Saunders 1999; Kriz 2003). In this research, our RPG will model a real-life WRM situation and serve the purpose of, and act as a "pressure-cooker" by putting players in a realistic and time-condensed management situation.

3.2. ROLE-PLAYING GAMES FOR EVALUATION: A REVIEW

The use of a RPG builds on various bodies of literature in which serious games were developed for experimental and educational purposes.

[6] https://www.encyclopedia.com/social-sciences/applied-and-social-sciences-magazines/social-experiment

In the field of experimental economics for instance, a number of games aim at testing hypotheses concerning people's skills and behaviors, usually in controlled laboratory settings (Carpenter, List, and Harrison 2005b; Ostrom 2005; Poteete, Janssen, and Ostrom 2010; Madsen and Stenheim 2015; Heckman and Corbin 2016). Recently, a wave of field experiments has emerged to bridge the controlled settings of laboratories with fields' specificities in order, as Levitt and List (2009, 7) put it, to "*organize data to make measurements of key parameters, assuming a theory is correct*". One notable example is the work of Janssen et al. (2013), who combined the use of a RPG with an ethnographic analysis to study the impact of regulations on common resources harvesting. This methodology presents similarities with our experiment. But contrary to economical experiments, the CappWag experiment assumes that players can act as "*diverse, thinking, adaptive agents*" and adopt different perspectives when confronted with an environmental management dilemma, rather than necessarily adopting rational behaviors (Bots and van Daalen 2007; Gasper 2007, 356).

Given a common focus on collective action and group dynamics, our approach is also close to the evaluations made in the field of human resources management. In both cases, the evaluator seeks to understand the individual and collective capacities owned by the evaluated people (Armstrong and Taylor 2014). They differ, however, because, in the field of human resources management, the actuated performance is at the center of the evaluation whereas we focus on actuated and values actions (achieved functionings) as well as non-actuated and valued actions (potential functionings, i.e. capabilities).

The fields of policy making for NRM and public participation also resort to RPGs in order to discuss the complexity of socio-environmental systems with stakeholders and citizens and improve people's skills in terms of individual or collective action. They serve as educative tools, as well as enhancers of participation and discussion of diverse stakeholders (Dionnet et al. 2006; Morardet, Milhau, and Murgue 2012). For instance, the companion modeling approach (Barreteau et al. 2003; Étienne 2013; Barreteau et al. 2013) envisions participatory modeling and the use of RPGs as a support for the evolution of players' knowledge, perceptions, behaviors and practices, towards the enhancement of collective action planning. Examples include the simulation game FISHBANKS, initially designed as a role-playing simulation representing the exploitation of a fisheries under the conditions of free market, has since then been widely used as an educational tool to discuss NRM issues (Meadows, Fiddaman, and Shannon 1993; in Ruiz-Pérez et al. 2011). REHAB, another computerized RPG tackling common pool resource management and conservation, also presents similarities with the CappWag experiment because it was used to assess the impacts of knowledge and communication between players on their management choices (Le Page et al. 2016). A last example is the board game Concert'eau (Richard-Ferroudji and Barreteau 2007; Richard-Ferroudji 2008). It simulates a collective decision process, with contextual elements borrowed from two case studies, which allowed to outline categories of argumentation integrated in the game.

Following in their footsteps, the role-playing game CAPPWAG was designed based on the Wat-A-Game (WAG) open methodological platform (which has been extensively tested and

implemented worldwide). WAG is part of the CoOPLAaGE package of integrated methods and tools that tackle multilevel decision and management process (among which the ENCORE framework that was discussed in section 2) (Abrami et al. 2016). It is particularly inspired by INI-WAG, "*an abstract and simplified case [that] does not use language specific elements [and] is based on a common set of international bricks and rules*" (Abrami et al. 2012, 7). It also stems from two computerized adaptation of the WAG tools: (1) URU, a highly simplified adaptation of INI-WAG that was developed for laboratory experiments and aims at exploring the interactions between uncertain information and the relationships among resource users, in a context of irrigation (De Waard 2017); and (2) KNOWTS, a model that was developed, based on WAG, to evaluate the capacity of stakeholders groups to manage complex systems and how the knowledge about this system (especially through their involvement in participatory modeling workshops) can influence their management.

Our experiment shares with them their simplified representation of complex socio-ecosystems and their design, even though its objective is not to teach something specific to players. Indeed, unlike educative tools, the main goal of our RPG is to put players into a realistic simulated management situation in order to measure their freedoms. Because of this, the usual objectives assigned to these types of game are not directly pursued here (e.g. raising awareness, developing innovative thinking or testing new ideas). Despite the similarities with educational RPGs for NRM, our RPG will not be used as a participatory instrument, but rather as part of the evaluation tool of a participatory process.

4. THE ASSETS OF A SOCIAL EXPERIMENT TO EVALUATE CAPABILITIES

We detail in this section four main assets that led us to select a social experiment as a privileged way to evaluate capabilities over time.

4.1. THE CONTROLLABILITY OF THE EVALUATION TOOL

First, a RPG allows for measuring skills and aptitudes through observation in a controlled setting. In a game, incentives to act in one way or another can be adapted to fit the measure of the variable of interest (Heckman and Corbin 2016). That is why we expect the game to act as a "pressure-cooker" by putting players in a realistic and time-condensed situation of NRM.

Because our evaluation tool takes the shape of a social experiment, we would ideally compare the results of a group of participants receiving the treatment (i.e. a group of people taking part in a participatory process for water management) with a control group (i.e. a group of people not taking part to such a participatory process), in order to better understand the influence of the variable "involvement in a participatory process".

We did not work with a "control group" in this doctoral research because of practical issues (it was not possible to gather several groups of participants and non-participants to participatory processes for water management, as we will discuss is later in Chapters 4 and 5). We will instead use investigative apparatuses (e.g. individual interviews) in order overcome this lack of control group and understand precisely the impact of the process on participants' behaviors during the experiment. Moreover, the lack of control group should not prevent the evaluation of capabilities in every group of participants because they are inherent to them and may not be found as such in any other group.

4.2. THE TRIANGULATION OF THE DATA

Second, the association of quantitative or qualitative measurement tools allows the researcher to confront the actual behaviors of players and their functionings or absence of functionings with their stated preferences, in this way strengthening or, on the contrary, questioning the reliability of their statements (Daré 2005) and hence their actual capabilities.

Daré (2003; 2005) and Biggeri and Ferranninni (2014) point out that a RPG alone is not sufficient to investigate social relationships or measure a capability and is not a substitute for classic analyses, but rather complements them by allowing the researcher to combine static and dynamic, objective and subjective assessments. Indeed, even though a RPG can contribute to measure functionings, it is not sufficient by itself to perform the complex task of identifying a capability. The presence of a functioning should mean that a capability exists, but the absence of a functioning is much more difficult to interpret. Let us take the example of the capability "being able to create rules to manage a socio-environmental system". In a game simulating such a system, a group could voluntarily choose not to implement rules of collective management, even though they might be perfectly capable of doing so. It could be their choice to let the system regulate itself, or maybe the group would not favor collective action but would prefer more individualistic management. This counterfactual aspect is the main difficulty that has to be overcome, in order to identify a capability with certainty. The differentiation between the absence of a functioning due to the absence of the capability, and the absence of a functioning due to a voluntary choice made by the group, is that in the latter case, the group would exert its collective agency

That is why, in order to measure the capabilities of people, we propose to rely on mixed qualitative and quantitative methods. The RPG furnishes a support for the expression of capabilities and functionings, as well as for quantitative data, tracing the attitudes and strategy choices of the group and its members. The classical evaluation devices (a questionnaire and a focus group) will allow the research to gather more qualitative data and complement the analysis thanks to a better understanding of the relationships within a local eco-sociological context and its impact on the capability space of the group. The triangulation of the various data collected by means of this hybrid tool will improve the reliability of the evaluation.

4.3. THE TRANSFERABILITY OF THE EVALUATION TOOL

Third, such a social experiment based on mixed methods should make the evaluation transferable from one context to another. This repeatability implies a certain level of genericity in the game's setting. For instance, a group of people neighboring a specific type of water body may relate if the management of a similar resource is simulated in the experiment, but this may not be the case of other groups of people who are not familiar with it because they live in a different environment or have no information about it.

If designed properly, the RPG should allow players to rapidly engage in the play and have their capabilities called for in the simulated decision-making arena. Such a fast moving apparatus would allow an evaluation workshop to fit into a time frame of two hours at most. This would in turn allow the evaluator to mobilize more easily the stakeholders than is the case with classical evaluation methods which often require one or several half-days.

This practical flexibility combined with the controlled settings of the RPG make it adaptable to various contexts and types of players (Biggeri and Ferrannini 2014).

4.4. THE LINK BETWEEN REAL-LIFE FREEDOMS AND GAME-RELATED FREEDOMS

Fourth, a social experiment based on a RPG gives players the opportunity to interact thanks to an intermediary device and to distance themselves from reality, while at the same time serving as a support to discuss real-world issues and mobilize elements from players' habitus (Daré 2005).

Indeed, a RPG offers to participants a simulated working environment that is not found in any other measurement tool. Toth (1988a) noted two crucial features that should characterize policy exercises workshops and that remarkably apply to a RPG designed to evaluate group capabilities.

(1) The RPG should remove participants from their daily routine and, by so doing, lead them to focus on longer-term and wider perspective strategic issues.

In a game tackling WRM, players may rely less on their short-term and personal considerations concerning the most appropriate ways to manage a socio-ecosystem and, instead, think at a more abstract level. Biggeri and Ferranninni (2014, 74), who also used a RPG to capture individual capabilities, point out the potential of a RPG to make participants reflect on their opportunities and the value they give them. In their words, an evaluation methodology based on mixed data like theirs and by extension like ours "*stimulates the debate on specific questions and it also reduces, for instance, the adaptive preferences issue relying on role games to help*

participants partially detach their preferences from own experiences in order to think as "quasi-impartial spectators." "

(2) At the same time, the RPG should be realistic enough not to become disconnected from the participatory process that is being evaluated or from participants' real life.

A social experiment based on a RPG *"entails participants to get experience through simulation of interaction behavioural patterns"* (Richard-Ferroudji and Barreteau 2007, 7). Indeed, when properly designed, a RPG can furnish a simulation so that players can act and behave as they would in reality (Watson and Sharrock 1990; in Barreteau, Le Page, and Perez 2007). Daré (2005, 301) demonstrated that, when properly designed and facilitated, a RPG can serve as an "*investigative tool of [society] moved in a playful atmosphere*", as long as players consider it sufficiently legitimate to discuss real-world issues and mobilize elements belonging to their habitus.

That is why considerable attention will be given to the design of the socio-ecosystem represented in the game, as well as to the formulation of the roles played by the participants, their objectives and the rules of the game regulating their interactions. CAPPWAG is a simplified model, or a *reduction*, of a real-world situation (Figure 8) and players should be able to relate to the socio-environmental issues that they face in it.

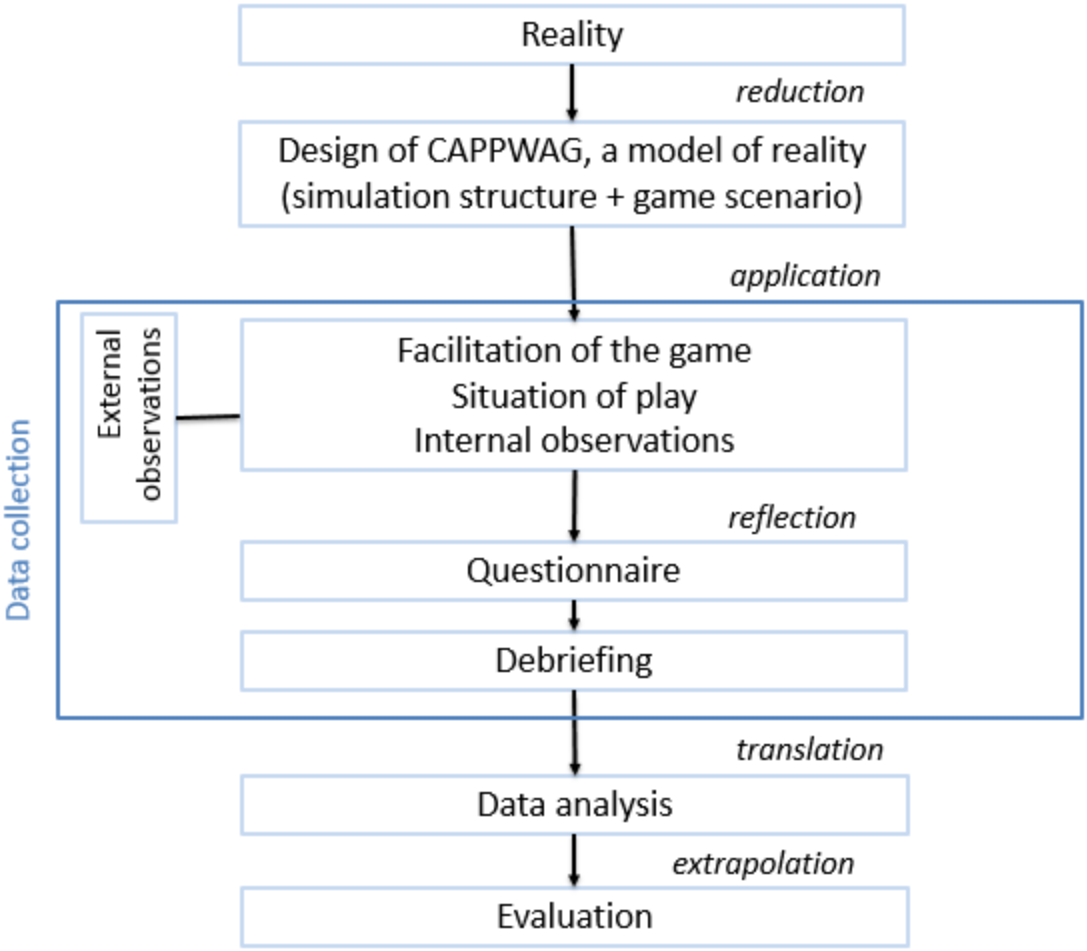

Figure 8: A role-playing game as an artifact to measure real-life capabilities (adapted from (Kriz 2003).

The play is the response of the group when they engage with CAPPWAG. It corresponds to the *application* of the artefact on them. We consider that if the game mirrors a realistic participatory process for NRM, players will interact with one another as they would in real life if confronted by similar issues. The outcome of this assumption is that we consider in this contribution that the play mirrors a real group of stakeholders participating into a real process (Daré and Barreteau 2003; Daré 2005). From this stems the initial assumption behind our research that there is a strong relationship between the capabilities of the players in the game context and the capabilities of the participants in a real-life context. The RPG thus provides a proxy of the state of the observed collective capability among the group of players. The *extrapolation* phase of our evaluation will consist in transforming the analyses of the data collected during the experiment (which corresponds to our *translation* phase) in a measure of participants' real-life capability space.

During the extrapolation phase, and despite the assumed relationship between participants' real-life capabilities and game capabilities, elements external to the evaluated participatory process will also be taken into account. Indeed, these elements (e.g. game fatigue, game disinterest, contextual specificities such as the cultural, social, political context in which the evaluated participatory process takes place) may influence the behaviors of the players during the game.

The degree of responsibility of the participatory process in the observed *ex ante ex post* discrepancies must consequently be the subject of a thorough analysis. Because the assumption discussed above is crucial to the validity of our results, additional data will be collected specifically via individual interviews with the participants in the experiment. Interviews should give the evaluator the point of view of participants themselves on the relationships between their behavior in the game and their behavior in real life, thus confirming or infirming the representativeness of the results.

5. A SOCIAL EXPERIMENT TO EVALUATE CAPABILITIES IN PRACTICE: CONSTRAINTS AND CHALLENGES

In order to take advantage of the assets of a social experiment in terms of measure, a series of challenges will be dealt with during the design process of the experiment. We list them in this section, as well as the main constraints that must be integrated to the final evaluation tool and the first limitations envisioned.

5.1. THE CHALLENGE OF AN *EX ANTE EX POST* EVALUATION

Our evaluation strategy is twofold. First, it should serve to measure the capabilities of participants at any given moment of the participatory process. It should be independent from the course of the participatory process and be implementable without any change in its content at the beginning, in the middle or at the end.

Second, our tool should serve to make an *ex ante ex post* evaluation and allow for identifying the evolution of the three capabilities of the participants over time (whether their emergence, their strengthening or on the contrary, their disappearance in case of tensions or conflicts). In this case, the evaluation is implemented twice during the participatory process, ideally, at the beginning and at the end of a given period (Figure 9).

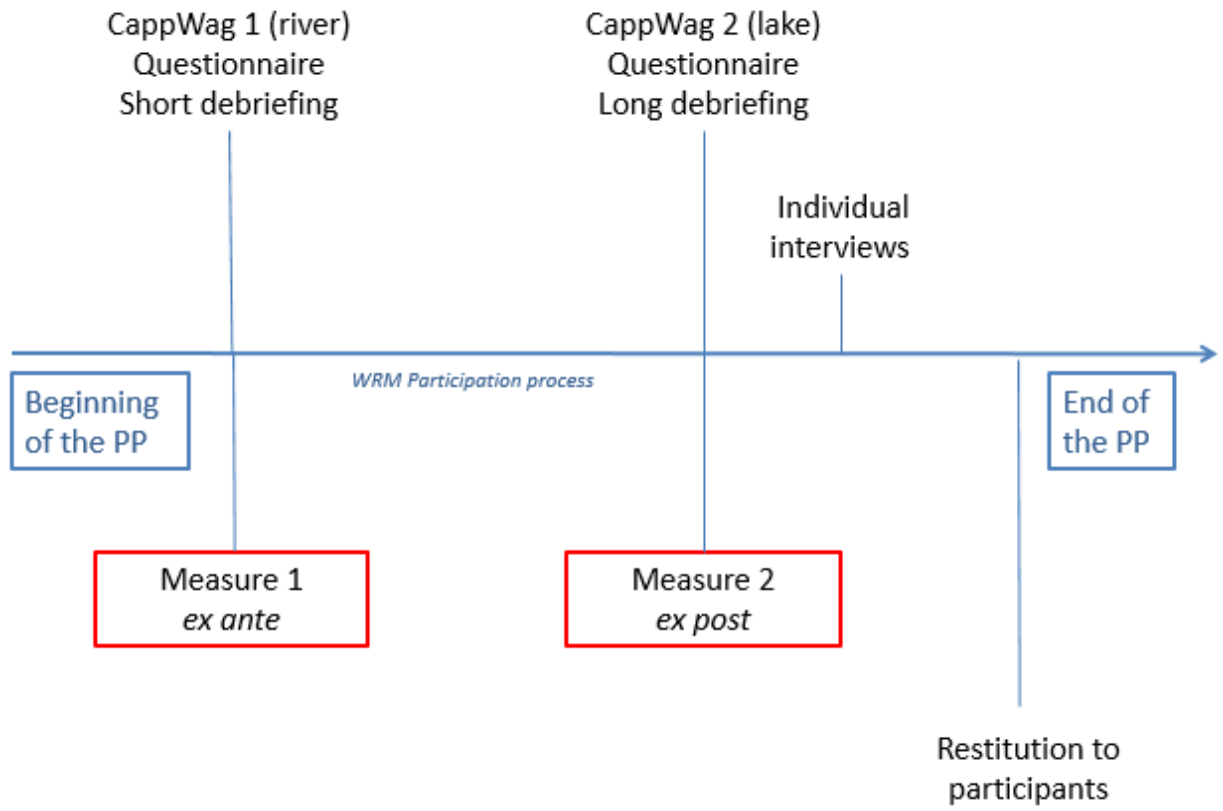

Figure 9: The timeline of an ex ante ex post evaluation using the CappWag tool.

The beginning of a participatory process ideally corresponds to its first day(s). Similarly, for a complete overview of the impacts of the process or training on people's capabilities, the *ex post* workshop should ideally be implemented at the end of the participatory process. The beginning or the end of a participatory process is not always clear and time limitations can be blurred. That is why the temporal conditions of implementation of CappWag are flexible, as long as there is a minimal amount of time between the two workshops (at least several days in the case of an intensive participation training or participatory process, otherwise several weeks or months).

The use of a second role-playing game at the center of the *ex post* evaluation CappWag workshop allows the evaluator to compare the results from two similar situations of action and observe potential changes in participants' behaviors related to the participatory process that took part in between the two workshops. However, this also entails several design challenges, such as taking into consideration the possible fatigue that could result among participants from the use of two RPGs, or the learning of the experiment's mechanisms or of the evaluator's expectations, which could influence participants' behaviors. We will discuss these challenges and their impact on the experiment design further in the following Chapter 3.

5.2. OTHER CHALLENGES TO BE TACKLED DURING THE DESIGN OF THE EVALUATION TOOL

We identify two other challenges that must be dealt with during the design process of the CappWag experiment:

(1) The influence of the measurement methods on the measures themselves

The evaluation tool should disrupt the evaluated variables as little as possible. A risk inherent to the use of a RPG to make an *ex ante ex post* evaluation of a participatory process is that the changes observed between the two experiments might be related both to the measuring and the measured process. Indeed, a board RPG is a support for discussion and debates between players, who may learn during the duration of the game itself how to know and interact with each other. Because of this, the RPG can lead itself to the strengthening of participants' individual and collective capabilities. For example, a group of players may learn during the course of an experiment how to organize their discussions and what type of information they need to make a collective diagnosis of the socio-ecosystem. The RPG is not the only tool that is a subject of learning for the players. The rest of the experiment is made up of a questionnaire and a focus group, in which participants are asked to reflect upon their own behavior and that of their group. By making them take a reflexive look at their actions in and outside the game during the *ex ante* experiment, the two tools may lead participants to learn about their conduct and act accordingly the second time they participate in the *ex post* experiment (Guérin-Schneider et al. 2010).

(2) The scale of evaluation

The evaluation of the participatory process and of the existence and development of individual and collective capabilities among the group of participants should be undertaken on the scale of a group of several participants, with a special attention given to the individual scale. It is certainly essential to understand the changes occurring on the individual scale and in the capability space of individual participants, in complement to the collective scale, since the two levels are interdependent.

There is not a typical or average number of participants that may be involved in participatory processes, since so many types exist (Reed 2008; Kaner 2014; Dionnet et al. 2017). This variability applies to the type of participatory processes we focus on in this thesis, where participants are given the opportunity to have a meaningful and tangible impact on the process of WRM.

Because of the challenge of measuring individual and collective capabilities over time, we decided to design a small-scale social experiment to be implemented with a small number of

participants. It is consequently likely that not all of the real participants in a participatory process would be able to be evaluated together through the CappWag evaluation tool. This small scale of evaluation prevents the evaluator from extending the results of the evaluation made with a handful of participants to the entire group of participants (e.g. the evaluation tool might show that the participants who took part in the experiment do possess a collective capability, but this does not mean that the larger group of participants in the real participatory process possess it as well).

5.3. LIMITATIONS OF THE USE OF A SOCIAL EXPERIMENT TO EVALUATE CAPABILITIES

Despite the above-discussed benefits of social experiments for our evaluation, they also have limitations:

(1) engaging in an experiment requires stakeholders' time and effort for implementation (which would be the case of any evaluation workshop implemented, except that this one puts the participants in an active situation);

(2) Just as only a handful of transformative effects related to public participation can be measured, some changes that occur as a result of the assessed participatory process will not be identified by the evaluation tool impacts, whose effects are felt in the medium or the long-term and cannot be measured in the course of a two-year project (Guérin-Schneider et al. 2010).

6. CONCLUSION

Researchers have tackled the evaluation of participatory processes for NRM for several years now, but the need to develop a reliable and practicable method tackling the values and the capacities of participants as well as their evolution over time, persists. The use of a social experiment based on a RPG, a questionnaire and a debriefing provides a desirable compromise between controllability and the transferability of the experiment on various case studies. Using mixed methods of evaluation also ensures the triangulation of the data. The behaviors and actions of players observed during the course of the game will be either validated or invalidated by the data from the two other devices. Finally, the mirror effect provided by the game should allow researchers to grasp participants' actions related to the three capabilities observed, and hence achieved functionings. We stressed in this chapter the particular attention that should be brought to the link between participant's behaviors and actions in the game and in real life, which is why individual interviews will also be conducted in the framework of this doctoral research. The design of this experiment will build on existing methodologies developed in the literature, but it will also comprise an *ad hoc* aspect related to the measurement of valued counterfactuals. We relate in Chapter 3 the challenges and proceedings related to it.

CHAPTER 3 – THE DESIGN OF THE EVALUATION APPARATUS CAPPWAG

1. INTRODUCTION

The design of our evaluation tool presents a series of challenges that we discuss in this chapter.

The first challenge that we faced during the design process was the innovative aspect of our evaluation tool and the quasi-absence in the literature of games designed for the measurement of valued freedoms. Only one precedent was found: the O-gap Walk developed within the "O-gap Analysis" of Biggeri and Ferranninni (2014). The "O-gap Analysis" is a participatory methodology initially designed to assess development initiatives. It relies on two interrelated tools: a focus group discussion and a RPG called O-gap Walk. The game is based on the Power Walk method developed by UNICEF and is specifically adapted to the context in which it is implemented. Before the workshop, role cards representing local characters are designed by researchers with the staff of the assessed project and through interviews with stakeholders. It is complemented by visits to the community where the game takes place. Participants are then invited to join a game workshop: "*After the secret assignation and explanation of the role cards to each participant, they are invited to join at an open space and to take position standing in a row below a line, considered as the starting point. At this stage, the proper exercise is then conducted: taking into consideration the most valuable capabilities/opportunities for people within the local society, participants are asked to react to one-by-one statements by indicating the capability freedom enjoyed by the individual character they represent*" (Biggeri and Ferrannini 2014, 67). The spatial organization of the game enables researchers, practitioners and participants to visualize the opportunity gaps existing among characters in a community context. After the game, people can react to the results and adjust the position of the characters; this leads to an "*intuitive assessment*" of the discussed capabilities in the community (in other words, to collective self-evaluation). The "O-gap Analysis" provides quantitative and qualitative data to researchers, which enables their triangulation and strengthen the analysis. The advantages of such a methodology are numerous and similar to those identified with the CappWag tool (see Chapter 2 section 4). However, we identify one main limitation to the "O-gap Walk". We understand from the game description that the amount of time required to design the contextualized role cards is high (at least several days), which is a drawback when working with a limited amount of time and resources. That is why a main objective of our evaluation tool is its adaptability to various participatory contexts and its limited demand in participants and practitioners' time, and this without compromising the validity of the measure. The lack of precedents in the field of gaming for capability measurement led us to take particular care concerning the design process of the game and the whole evaluation tool, especially in terms of internal and external validity.

The second challenge that we faced during the design process of the CappWag evaluation relates to the very subject of measurement of the game: the freedoms of being and doing that may not be actuated by players during the game, that is to say, counterfactuals.

We list in section 2 the assumptions that underlie the design of CAPPWAG and present the resulting game in section 3. In section 4, we will discuss how we tackled this measurement challenge by designing this *ad hoc* tool specifically conceived to allow the observation of the three capabilities presented in Chapter 1 and we present the two tools we associate to CAPPWAG and that together form the CappWag evaluation tool.

2. OBJECTIVES AND CONSTRAINTS: TURNING A GAME INTO A MEASUREMENT TOOL

The CappWag experiment aims at measuring the degree of individual and collective freedoms owned by players. In order to achieve this measure, we needed to design a tool that would give players the opportunity to act in multiple ways, depending on their values and interests (including intending to act but not following through).

The game was designed *ad hoc* to support the measurement of our three specific capabilities. It had to allow players to talk, discuss together and deliberate, but also not to do any of this if they so preferred. The game had to give them subjects to talk about and reasons to engage in discussions about the way the socio-ecosystem works and its regulation. It should not influence players to act in a specific way but instead, give them the freedom to decide what the best moves are for them individually or for the collective. The game and its complementary measurement tools should also allow the capture of counterfactual actions, a condition to the evaluation of capabilities. The process of decision behind the functionings, whether they are achieved, potential or non-existent, but also valued or not valued, should be understood in order to qualify the stance of capabilities (as discussed in Chapter 1 section 3.3.2) players find themselves in.

In order to allow for discussions and debates, the game must contain matter for bounded conflicts, tensions and dependencies between anthropic activities and environmental dynamics. For instance, hidden or unknown information in the game can give players a reason to discuss how the system works and what those unknown variables are, and try to understand them. Yet players should be able to play the game without having to decipher the hidden information. Players should not be forced to discuss this specific subject but do so out of choice, if they feel like to. In the same way, the game should include possibilities of regulation for players. Players should be able to play the game without implementing additional management rules. Yet the game should offer them reasons to discuss and craft new rules of various types, if they consider that useful and valuable.

Finally, the evaluator should be able to perform the evaluation using the CappWag tool one time only (to evaluate at a given time the capability space of players) or, in the case of *ex ante ex post* evaluation, twice (to observe the evolution of this capability space).

Because of these objectives and of the mixed methods chosen to be part of our evaluation tool, special attention was given to internal and external validity issues.

2.1. ENSURING THE INTERNAL VALIDITY OF THE EVALUATION TOOL

The internal validity of a research corresponds to "*whether the findings or results of the research relate to and are caused by the phenomena under investigation and not other unaccounted for influences*" (Winter 2000, 11). Applied to our research, internal validity means that the behaviors and actions of players that take place in the game accurately relate to the situation of socio-ecosystem management simulated in the game. Prior to the design of the experiment, we identified six factors that posed a threat to the internal validity of our evaluation tool. We list them below and discuss how to overcome them.

(1) The uncontrollability of the game setting

To ensure the reliability of the measure, the experiment must be as controlled as possible (see Chapter 2). We consequently built the CappWag experiment around a protocol that must be followed with precision in order to avoid interferences from variables other than the capabilities of participants. The role of the facilitator is crucial in this because he must ensure that players respect the protocol throughout the experiment, but also that his own facilitation respects the indications set by the evaluator. Ideally, facilitators should be trained to facilitation and used to minimize their personal influence in the protocol (e.g. by avoiding to give their personal opinion during discussions, by re-orientating discussions on the game if they are off-topic for too long, by ensuring that players respect each other, etc.). We also took into account the possibility that a facilitator may not be entirely familiar with such an experimental workshop, and hence, tried to design clear instructions for him to follow (see Annex II).

(2) Players' lack of interest in the game and lack of seriousness given to the simulation;

Because we use a RPG as a support for the measurement of three capabilities, we must ensure that players are sufficiently interested in it for a correlation to exist between how they behave and act together in the game and how they would behave and act in a real-life similar dilemma situation (see Chapter 2 section 4.4)[7]. That is why it is essential that the experiment is engaging and interesting enough not to repel participants (Toth 1988b). For the same reasons, because the evaluation should be implemented with any type of stakeholder who takes part to a

[7] This is especially true since, for practical reasons, we did not realize an additional and complementary evaluation of players' capabilities through another method (apart from individual interviews with several players), which would have allowed to confirm or disconfirm this correlation.

participatory process (including citizens), the setting up and the implementation of the evaluation workshops should not take too much time (i.e. no more than half a day, which corresponds to the maximum acceptable time from participants in local administrations and other organizations).

In terms of game design, this means that the RPG should confront players with an appropriate level of difficulty and be neither too easy nor too hard (Salen, Tekinbaş, and Zimmerman 2004). The RPG should tackle a subject that players may find worth thinking about and discussing.

In the same way, the internal validity of the measures exposes itself to the lack of seriousness of players about the RPG because of its very nature. Being a playful tool, the RPG should nevertheless be taken seriously by all players so that they may interact and act in a way that is similar to reality (Daré 2005). People who are usually resistant to games (e.g. those not used to playing games or who are not delft with the manipulation of game tokens, people who do not like to play games, etc.) should, if they wish so, be particularly accompanied by the facilitator. These difficulties could either be voiced by participants themselves before the beginning of the game, but also observed by the facilitator during the course of the game. In this case, the facilitator should ensure that his help influences as little as possible the behavior of the players with the rest of the group. The seriousness given by players to the RPG is indeed crucial to ensure the validity of the measurement. If players do not take the game seriously, they may want to withdraw from the play and decide not to engage in discussions or in actions with other players or, very much on the contrary, adopt behavior that is very different from their real values and beliefs because they consider the game as futile or on the contrary as fun.

(3) wrong understanding or lack of respect of the game rules or the experiment set-up;
(4) missing data (unanswered questions by participants, the facilitators or the observers) (Winter 2000);

Because the experiment is controlled, it requires the presence of at least one facilitator. If it is possible, the presence of at least one observer helping the facilitator to collect external observations of players' behaviors and actions during the game is desirable. The facilitator is in charge of (1) facilitating the experiment, particularly the RPG (e.g. reading the game rules to players, answering their questions, facilitating the focus group, etc.) and (2) ensuring the data collection (e.g. ensuring that players fill in their monitoring forms and the survey, observing behaviors and actions of players and reporting them). The facilitation itself is controlled. The facilitator must respect the protocol in order to ensure the validity of the measurement. For instance, facilitators are asked to share with players only a specific amount of information, in order to influence their behavior as little as possible (even if players themselves require more information – the facilitator should then find a certain balance between "not saying too much" and "saying too less", which might discourage players. We discuss in Chapter 5 section 4.3 how this balance is inherent to the use of a controlled social experiment in a participatory context).

(5) The discrepancies in the composition of the *ex ante* and the *ex post* groups;

In order to compare changes in group dynamics and collective work over time, the composition of a group taking part in an *ex ante ex post* evaluation should remain identical. This means that all the players taking part in the *ex ante* experiment should be present for the *ex post* experiment. No additional players should attend an *ex post* experiment. If players who were present during the *ex ante* experiment but are missing during the *ex post* experiment should not be replaced.

(6) learning processes related to the rules and mechanisms of the RPG;

The participants in a CappWag experiment learn about the game mechanisms while the game is being played. Consequently, it is likely that if they play the same game twice, even with a gap of several weeks or several months in between, they may remember the *ex ante* game and play accordingly (this assumption is based on discussions with practitioners and researchers and was evoked by some players during their interviews). For example, they may adopt the very same behaviors and actions during the *ex post* game because they associate them with a successful *ex ante* play, or they may, on the contrary avoid acting in a similar way because they want to try new moves in the game. They may also lose interest in an *ex post* RPG that is identical to the *ex ante* one that they already know. Because our experiment aims at evaluating the impact of external variables (the influence of a participatory process) on the individual or collective behaviors of players, the influence of their learning the game rules is not desirable and is considered as a bias in the measurement. In order to avoid this bias, we designed two different games for the *ex ante* and the *ex post* evaluation: CAPPWAG-RIVER and CAPPWAG-LAKE. Even if they share similarities (e.g. their animation) in order to ensure the comparison between the two workshops, their structures differ (see section 3 below)[8].

2.2. ENSURING THE EXTERNAL VALIDITY OF THE EVALUATION TOOL

The external validity of a research corresponds to "*the extent to which the results can be generalised and thus applied to other populations*" (Winter 2000, 11). In our research, this corresponds to the extent to which the CappWag experiment is transferable from one case study to another and can be adapted various types of participants and contexts. According to Winter (2000, 11), "*threats to external validity are similar to those for internal validity, except that the test itself is more likely to pose a threat as an alternative explanation for similar results"*. This definition does not entirely fit our experiment because of its mixed-method composition. Indeed, if external validity is commonly a subject of attention for quantitative methods, it does

[8] We will discuss in Chapter 5 section 4.3.2 how players may also learn about game mechanisms in between the two CappWag evaluation workshops, when they participate in the evaluated process. Indeed, it may involve another role-playing game, used as a tool for participatory modeling or educational purposes.

not apply as such to qualitative methods. Hence, we will rather talk about the transferability of the CappWag evaluation tool to other case study. We identified four factors that posed a threat to its transferability:

(1) The contextualization of the game setting

The universality of the experiment is at the heart of the design features. Indeed, it is what ensures its implementation in various contexts (as Désolé (2011, 64) puts it: "*the experimental methodology consisting of an accumulation of data to be compared with each other requires the use of the same protocol for each observation*" and hence an increase in abstraction). Following dilemmas traditionally explored in common-pool resources games (Crawford and Ostrom 1995), this objective translates into the semi-abstract socio-environmental dilemma chosen to be part of the RPG, rather than a contextualized one.

(2) The complexity of the game

The experiment, particularly the RPG, should not be too complex or too difficult to understand so that players of any background and profession, knowledgeable on WRM or not, are able to engage with it. At the same time, it should include a sufficient amount of hidden information and "mysteries" so that players have a reason to discuss how it works and explore its dynamics (which is why traditional common-pool resources game were not used to serve as a support for evaluation).

(3) A time-consuming experiment

Finally, the experiment must be time-efficient in order to facilitate its implementation in participatory processes. If its implementation takes too much time (e.g. more than half a day), it may be difficult to transpose to certain participatory processes where time or human resources are scarce. Moreover, a lengthy experiment may cause a certain game fatigue among participants, especially since it is made up of two workshops. The CappWag experiment was consequently designed to fit into a two-hour-thirty-minute time frame (including all of its components: game, questionnaire and focus group).

(4) A non-adaptable experiment

Because participatory processes can take various forms, the number of participants taking part in them can vary greatly. We consequently made sure during the design phase that our experiment could accommodate various group sizes. The amount of players that can play the game hence ranges from four to ten. A number of players superior to ten was considered prohibitive in terms of opportunity for the players to speak up in a large group and interact together or with the game facilitator. A number of players inferior to four was considered prohibitive for contrary reasons, since speaking up would be rendered too easy in a small group.

2.3. ASSUMPTIONS UNDERPINNING THE DESIGN PROCESS

The design of the CappWag experiment relies on several assumptions concerning the cognition and socialization of participants, as well as its practical implementation.

First, we assume that inhibitions will be relatively marginal and that a majority of players will engage in playing the game because, as Huizinga and Caillois discussed it, it holds a central role in human nature (Huizinga 1938; Caillois 1958; in Rodriguez 2006)

Second, we assume that participants have sufficient cognitive capacities to understand the rules of the game and play, but also to understand and fill in the monitoring file and the survey that are part of the measurement process. Similarly, we assume that participants are able to give feedbacks on their behaviors and intentions of actions, the reasons behind the non-achievement of their capabilities when they do possess them, or the self-evaluation of their capacities and their values related to our three capabilities.

Third, we assume that a set of norms, taking the shape of social conventions, structure the behavior of people in real-life (Herskovits 1952) and that they will also structure them in the RPG. For instance, we assume that players, if they are asked to take game seriously, will not cheat (e.g. by consuming less water or polluting less than they should) and will not steal (e.g. each other's cards).

Fourth, we also assume that participants will play and fill in faithfully the forms (monitoring file and survey) and that their self-assessment in terms of capacities of action and values will be reliable. We assume that they will not try to manipulate on purpose the results of the evaluation[9].

Fifth, we assume that the conditions of implementation of the experiment are optimal, that is to say that participants will be attentive during the workshops and attend it until the end. We also assume that players who attend the *ex ante* workshop will be present twice and attend the *ex post* workshop. Both individual and collective capabilities are measured in the specific context of the group as defined during the *ex ante* workshop. A change in the dynamic of the group linked to the absence of one or several players might significantly change this dynamic (e.g. if the missing player was a leader or was blocking collective discussions during the *ex ante* game).

Sixth, we assume that the interference of the measurement tool with the behavior of players will be minimal, that is to say that the external observation process will not be too intrusive and significantly influence the data collected during the experiment.

Seventh, we assume that the position of the player in the game (e.g. upstream or downstream of the river) should not influence deeply the measured capabilities.

[9] In this research, no free consent form nor engagement form were given to participants.

Eighth, we assume that knowledge of the game rules and the mechanisms of players between the *ex ante* and the *ex post* workshops is non-influencing (i.e. that the memory of the *ex ante* game will minimally impact the conduct of players during the *ex post* game), thanks to a change in the game design. In this way, the main variables that would explain a change of players' behaviors and actions during the *ex post* game would be a change in their capability space.

3. CAPPWAG: A GAME TO MEASURE FREEDOMS (ARTICLE "SIMULATION & GAMING". READY-TO-USE SIMULATIONS)

Because we intend to submit & publish this section on the game presentation in a journal, it takes the shape of a "ready-to-use" article (typical from the journal Simulation & Gaming)[10].

Abstract: CAPPWAG is a twofold role-playing game designed and used as a support for the measurement of capabilities, that is to say people's freedoms of being or doing that they have reasons to value (Sen 2000), in a context of participatory water management. Complemented with a semi-structured questionnaire and a debriefing, it forms the CappWag evaluation tool. In order to make an ex ante ex post evaluation of players' capabilities, CAPPWAG is made up of two versions: an ex ante version called CAPPWAG-RIVER and an ex post version called CAPPWAGLAKE. It is a semi-abstract opportunity-generating game, designed so that players are free to exercise their individual and collective agency. It aims at testing how players interact, diagnose and regulate together the simulated socio-ecosystem. We present in this paper its main features and mechanisms.

Keywords: monitoring and evaluation, role-playing game, capability approach, collective capabilities, participatory water management

3.1. BASIC DATA

Evaluation objectives: assess the distribution of individual and collective capabilities among a group of players

- *Evaluation objectives:* assess the distribution of individual and collective capabilities among a group of players
- *Game objectives:* to earn a maximum number of wealth units, considering collective constraints
- *Debriefing formats:* guided discussion based on players' self-evaluation in which they discuss their behaviors during the game and the link between the simulation and reality

[10] The authors of this paper are: Authors: Sarah Loudin*, Pieter Bots°, Nils Ferrand*, Géraldine Abrami* (*: Irstea Montpellier; °: Delft University of Technology.

- *Target audience:* knowledgeable and non-knowledgeable people interested in self-evaluation
- *Briefing and setup time:* 30 minutes of preparation are required to brief the facilitator and set up the game.
- *Playing time:* 90 minutes
- *Survey time:* 20 minutes
- *Debriefing time:* 15 minutes
- *Number of players required:* 4-10 players
- *Material required for players:* A monitoring file and a pencil, an opaque bag containing four WAGs, a questionnaire.
- *Material required for facilitators:* Rules of the game, one observation file per facilitator and observer, debriefing instructions.
- *Equipment/room setup required*: Table and chairs for the role-playing game, the questionnaire and the debriefing. A board or a wall to display printed copies of the rules to players.

3.2. INTRODUCTION

CAPPWAG is a role-playing game used as an evaluation support and designed to measure capabilities, that is to say people's freedoms of being or doing (Sen 2000a), applied to participatory water management. We detail in Loudin et al (2019) how the use of a serious game coupled to two complementary measurement tools (a semi-structured questionnaire and a debriefing) offers an innovation for the evaluation of individual and collective capabilities.

We present here the details of the CAPPWAG features. We designed it to specifically target the *ex ante* and the *ex post* measurement of three capabilities: (1) the individual capability to express oneself in front of a group, (2) the collective capability to make a diagnosis out of a problematic situation and (3) the collective capability to make and implement management rules.

Because of its evaluative objective, CAPPWAG simulates a socio-ecosystem where players are given multiple opportunities to act in one way or another in terms of collective environmental management. There lies the specificity of CAPPWAG: it does not aim at teaching an environmental lesson to players or how to work together. Instead, it provides the evaluator with a support for observing their individual and collective behaviors and actions when coping with a management dilemma.

The structure and the gaming simulation are rather classic and inspired by an already existing modeling and simulation toolkit called Wat-A-Game (WAG) (Abrami et al. 2012). From the WAG umbrella toolkit, several games were derived (such as CREAWAG or INIWAG), each with a

specific set of tokens, cards and rules adapted to their educational objectives. They served as a basis during the design of CAPPWAG.

Because CAPPWAG is designed to support the measurement of capabilities, it incorporates several features that are not usually found in serious games, such as silent phases of gaming during which players are asked not to communicate, self-monitoring of individual and collective deliberation and a highly controlled facilitation. An essential feature of CAPPWAG is its capacity to elicit and collect information on players' counterfactual behaviors. Indeed, it permits the tracking of intended individual or collective actions, including the ones that are not enacted eventually.

3.3. CAPPWAG SETTING

CAPPWAG is made up of an ex ante version called CAPPWAG-RIVER and an ex post version called CAPPWAG-LAKE. The two versions share similar features in terms of structure and simulation and the same animation protocol. They are designed to address similar issues while avoiding learning effects that would negatively impact the evaluation process (in the sense that learning how to play the game better would be an uncontrolled variable that would negatively affect the validity of the ex ante ex post evaluation). We will describe them in this paper as a single game and mention discrepancies when necessary.

3.4. THE GAME STRUCTURE

CAPPWAG simulates the management of a socio-ecosystem built around a generic water body. It involves realistic interactions between four resources: water, environmental pollution, money and social interactions between players, also called social capital.

- Water and the environmental pollution

The water body is represented on the board by a blue line (the river) or a blue piece of paper (the lake). Blue marbles in a transparent bag represent the stock of water units available in the river or the lake. The amount of blue marbles in the stock is visible to players.

Black marbles stored in an opaque bag represent the stock of pollution units in the game. Players cannot see during the game how many pollution units are stocked in the system.

- Human resources: money and social capital

Yellow marbles represent money in the game. One money unit is named a WAG.

The social capital of players corresponds to their simulated social network and the amount of social interactions they have built. Marbles shaped as “smileys” represent a unit of social capital in the game. Every collective decision or action involving two or more players is rewarded by the facilitator with a unit of social capital, given to every involved player. As long as the collective decision or action is related to the game, its content (i.e. whether it consists in a short-term agreement or a long-term rule, or the subject of the decision or the action) is not taken into account for the reward, which will remain the same for any situation.

During the game, players can chose to display to other players the amount of money and social capital they possess or keep this information secret by using an opaque bag to store their marbles (as it may be considered by some as a valuable information that should not be shared with the group in order to win the game).

- Activities

Players impact and have access to the four resources through their activities. These are embodied in the game by Activity cards (an example is provided by Figure 10).

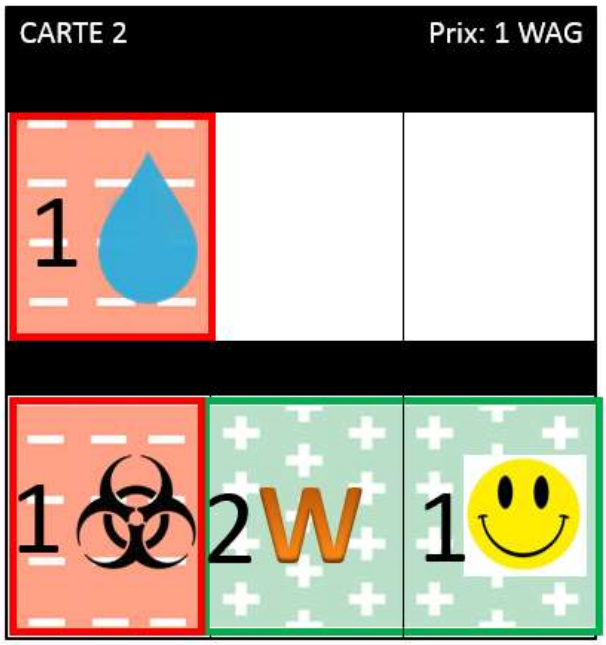

Figure 10: An Activity card in CAPPWAG.

Each activity consumes and produces specific amounts of water and pollution, money and social capital units.

An activity can either pump or reject water into the water flow. Similarly, it can either pollute the environment or clean it. It can yield or cause loss of money and finally, it can also yield social capital.

Fourteen different activities are available to players in the game. Ten activities (numbered from 1 to 10) are either initially distributed at the beginning of the game or mixed and hidden in a deck. Every player starts the game with one activity assigned to his location (see Annex II). This ensures that:

(i) there is a variety of Activity cards along or around the water body, more or less beneficial in terms of wealth, social capital and impact on the water resource and pollution;

(ii) activities are evenly spread along and around the water body (e.g. in the case of the river, it ensures that activities pumping the highest amounts of water are not all located upstream or downstream, which may impact players' motivation and understanding of the simulated socio-ecosystem).

These ten Activity cards were designed to balance environmental and social impacts, while four extra activities, called the "Innovation" activities (numbered from 11 to 14), were designed to represent improved activities, either in terms of water or pollution impact on the system, or in terms of social capital or wealth yields.

"Innovation" activities are known to players (see Figure 11 for an example). They are more beneficial than other Activity cards in terms of environmental impact, wealth and social capital earnings. For this reason, they are also more expansive to procure.

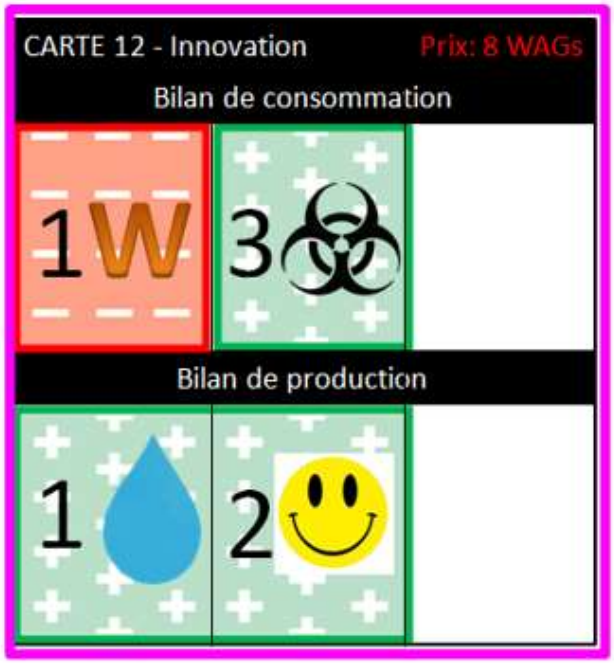

Figure 11: An "Innovation" Activity card in CAPPWAG.

An activity is linked to an access social threshold. This threshold is applied to every activity a player would like to see and/or buy. To access an Activity card numbered from 1 to 10, the social threshold is equal or superior to one unit of social capital. In this case, the number of activities that can randomly be picked in the deck and seen by players is equal to the social capital of a player. Players do not have to pay for the activities distributed at the beginning of the game. To access an "Innovation" Activity card numbered from 11 to 14, there is no social threshold. Everyone knows the content of these four "Innovation" activities. Posters are displayed on the walls of the room or on boards so that every player can see them.

There are no constraints on the number of activities that one player can possess and implement, as long as they are grouped and have access to the water body.

- Rules of the game

For players, the goal of the game is to accumulate as many wealth units as possible and the single winner of the game is the player who collects the highest number of wealth units. Further information on the rules of the game is available in Annex 2. For evaluators, the goal of the game is to provide a support where players may call for the three capabilities, if they wishes so.

3.5. THE SIMULATION

Players themselves have the possibility to manage and regulate the water body and the process of deliberation they can take part in during the game.

- Initial settings

Players are randomly assigned to a position along or around the water body they manage by blindly picking a number corresponding to a seat around the board.

Figure 12: Photo of the ex ante board game CAPPWAG-RIVER before the arrival of players (Loudin, 2017)

The initial settings are designed as follow: at the beginning of the first round of the game, each player possesses one pre-determined Activity card (see Annex II for the list), as well as four units of wealth. Players do not possess social capital at the beginning of the game.

- Gaming sequence

A round corresponds to a climatic year, which is humid, normal or dry. Depending on the climate scenario, the exogenous water quantity available in the water body and the level of environmental pollution in the system vary. These predefined changes introduce a realistic uncertainty concerning unpredictable climatic conditions.

A round is divided into two phases (see Figure 13).

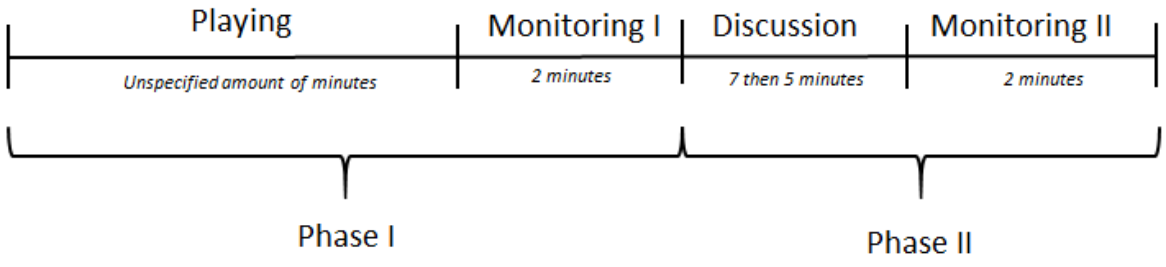

Figure 13: Flow sequence of a game round.

During the playing time (Phase I on Figure 13), a sequence of turns is determined. During a game round, a turn is equal to the number of players taking part in the game. In CAPPWAG-RIVER, the sequence is fixed and the farthest upstream player (called “Player 1”) is always the first player to play, followed by the rest of the group in the order of their numbers (Player 2 plays second, then Player 3, etc.). The furthest downstream player is the last one to play. In CAPPWAG-LAKE, the identity of the first player to play is randomly assigned at the beginning of every round by the facilitator. Players play next in a clockwise direction. The playing time is implemented in silence. We introduced this specificity for practical reasons (one objective of the game is to serve practitioners as an evaluation tool that they can replicate in the field without having to record and then analyze hours of entangled discussions).

A player can play one, several or no activities at all during the game. If he possesses several activities, they are played on a fixed order. In CAPPWAG-RIVER, the uppermost activity is always played first and in CAPPWAG-LAKE, the activity on the right is always played first.

Players must play all the activities they possess and that are installed on the table.

When a round starts, the cups of marbles representing water, pollution, money and social capital circulate from player to player in the above-described order.

- Climate scenarios

The exogenous amount of water flowing in the system at the beginning of a round depends on a fixed sequence set by the game manager (see Annex II).

The water resource level at a given time consequently corresponds to the exogenous amount of water, minus the impact of players’ activities before this time.

The players’ impact can be negative (pumping water from the water body) or positive (returning water to the water body). There is no retention of water at the end of a round for the next round. As soon as there is no more water left in the river or the lake, the round stops.

In CAPPWAG-RIVER, the amount of exogenous pollution at the beginning of a round depends on a fixed sequence set by the game manager (see Annex II). The environmental pollution is flushed from the system after each round.

In CAPPWAG-LAKE, when there are between four and seven players, the amount of exogenous pollution is constant. However, when there are between 8 and 10 players, the amount of exogenous pollution at the beginning of a round depends on the amount of pollution produced during the previous round multiplied by a coefficient γ. Instead of being flushed, the environmental pollution accumulates in the system round after round.

The amount of pollution in the system at a given time consequently corresponds to the exogenous amount of pollution, minus the impact of players' activities before this time.

- Environmental assessment

When the last player has played, or when there is no more water in the river or lake, players stop playing and the facilitator assesses the amount of water and environmental pollution present in the system.

At the end of a round, the facilitator imposes a fine on all players if they cross one of two environmental thresholds: a water threshold and a pollution threshold. The fine initially equals one smiley and one WAG per player. If both thresholds are crossed during the same round, players only pay one fine. The environmental fine increases round after round. Thus, a second environmental fine would correspond to two smileys and two WAGs per players, a third to three smileys and three WAGs per players, etc.

- Selling, buying, exchanging activities

During phase II of a round (Figure 13), a player can sell, buy or exchange Activity cards on his own or in association with at least one other player. This takes place during the time of discussion let to players, so that they can interact among them or with the facilitator in order to do so.

To buy new cards, players first choose an activity to procure and add to their set of activities (consisting of one card at the beginning of the game). Once players possess the activity of their choice, they must install it in order to play it. To get rid of or to sell an activity that is installed, players must first uninstall it.

- Financial and social assessment

At the end of a round, the amount of money possessed by a player corresponds to the sum of his initial reserve of four WAGs and the amount of WAGs earned through his activities, minus the possible environmental fines previously paid and the price of procuring, installing and uninstalling activities.

Similarly, at the end of a round, the amount of social capital possessed by a player corresponds to the sum of the smileys earned through his activities and through collective decision-making and collective actions, minus the possible environmental fines previously paid and the price of installing and uninstalling activities.

3.6. ANIMATION AND MONITORING

The first phase of a game round ends with the assessment by the players themselves of the round with the help of a monitoring file (Monitoring I on Figure 13; see Annex IV).

This first monitoring moment is followed by a second phase, which starts with a free collective discussion. During this moment, players have time to discuss together and with the facilitator.

During the moment of discussion, players can buy, sell, install or uninstall Activity cards but also discuss and deliberate on the way they want to manage the socio-ecosystem. The facilitator sees that the initial game rules are respected, but does not influence or oversee players' discussions, decisions and actions.

This neutrality is essential to ensure that the game furnishes a support for the measurement of capabilities[11]. Indeed, players in the game are not encouraged to behave or act in a specific way (e.g. to manage collectively the water body) but instead, can choose for themselves how they prefer to cope with the management dilemma they face. There are free to call for their capabilities to play the game (i.e. their capabilities to speak in front of the group of players, to make together a diagnosis of the situation and to make and implement together management rules for the water body), if they wish so.

[11] With similar facilitation, the game structure and simulation could vary and serve the same purpose of capability measurement, applied to different capabilities and even other type of natural resources, on condition that elements of dilemma and individual and collective tensions were incorporated.

Figure 14: Photo of a discussion moment during a CAPPWAG-RIVER game in Bizerte, Tunisia (Loudin, 2017)

For the same reason, the discussion period is quasi-simultaneous in terms of interactions and follows a "first come, first served" pattern, so that players are free to interact together or not, depending on their objectives and capabilities.

The discussion phase is followed by a second phase of monitoring (Monitoring II on Figure 13; see Annex IV). This allows to track players' actions and intentions of actions, especially in terms of rule-making and implementation. In this way, the evaluator can understand whether these actions or absence of actions are the results of a choice, that is to say a capability (e.g. a group of players discussing a possible rule but eventually deciding not to implement it because they do not consider it sufficiently beneficial) or the results of a lack of choice (e.g. a group of players discussing a possible rule who would be prevented to validate and implement it because another player is blocking the deliberating process).

We note here that even though there is a counting phase at the very end of the game to find out which player has won the game, the identity of this player and the ranking of other players is not part of the data collected during the game that serve the capability evaluation. The game furnishes the support to observe achieved actions from players, but the reasons underlying these actions or lack of actions, which are at the core of the capability evaluation, are understood through the monitoring file and the complementary measurement apparatuses (a questionnaire and a debriefing).

3.7. FACILITATOR'S GUIDE

The facilitator explains the rules of the game in two parts. He explains the first part at the beginning of the game, before the first round. The second part of the rules is explained in the middle of the first round, when the last player has played, just before participants fill in their monitoring document and have the opportunity to discuss together for the first time. The two-part rules' reading aims at facilitating the understanding of them by the participants. It should avoid giving them the feeling of being "drawn" into the complexity of the rules and therefore avoid potential loss of interest in the game, right from the beginning.

4. THE DESIGN PROCESS

In this section we discuss the design of the CappWag RPG in view of the objectives and constraints we listed in section 1.

4.1. A ROLE-PLAYING GAME AS A SPACE OF FREEDOM

The main objective and challenge of the design process was to ensure that players would be free to elicit and call on their capabilities or on the contrary not to do so, depending on their choices and their personal objectives. This space of freedom available in the game and concerning the three capabilities we observed meant that many options had to be available to players in the game and that they should be equally incentivized to choose, or not to choose, one or another.

4.1.1. DESIGNING A SCOPE OF OPPORTUNITIES

In the game, players must have the possibility to act in different ways concerning the three capabilities we observe. The game gives players opportunities to act (to talk, to discuss the simulated socio-ecosystem and its rules, to change these rules and make their own) if they feel like it, without their being forced to do so. The measurement tool itself should not impel players to use their capabilities if they have them or on the contrary, to keep it silent. The play should reveal these choices through players' actions and behaviors, or through self-declaration (in the monitoring file filled in during the game). This feature is at the core of the design process.

We summarize in Table 2 the options available to players in terms of functioning' actuation or non-actuation.

Capability	Functionings' opportunities available to players in the game
Being able to express oneself in front of a group	• Being silent • Talking with other players, expressing one's emotions and

	one's opinions, listening to other players talking • Leading the group discussions • Hushing other players, not listening when they are talking
Being able to collectively make a diagnosis	At the individual level: • Exploring ideas concerning the way the socio-ecosystem works • Formulating assumptions, sharing information • Debating on the way the socio-ecosystem works and how to improve it
	At the collective level: • The group of players can share a similar understanding of the socio-ecosystem's mechanisms • The group of players can identify management issues in the game and the reasons behind them • The group of players can identify actions to improve the management situation and set management goals and strategies • The group of players can track the impact of their actions on the dynamics of the socio-ecosystem
Being able to collectively make and implement a management rule	At the individual level: • Thinking of a new management rule, formulating it and putting it into words (on the monitoring file) • Thinking of a new management rule, formulating it and suggesting it to other players • Discussing the implementation of a new management rule with other players, modifying a new management rule with other players • Deliberating over a proposition of rule, accepting or refusing the new management rules proposed by other players • Asking other players to accept or refuse one's new management rule • Implementing a new management rule • Respecting a new management rule
	At the collective level: • The group of players discuss/debate the implementation of a new management rule, they negotiate an initial proposition and modify or reject it. • The group of players agree to implement a new management rule and formulate this agreement • The group of players implement a new management rule • The group of players respect a new management rule

Table 2: Available opportunities in CAPPWAG related to the three observed capabilities.

Ostrom et al. (1994, 41) identify seven types of rules that "*affect the structure of an action situation*" in a context of game simulation: (1) position rules, (2) boundary rules, (3) authority rules, (4) aggregation rules, (5) scope rules, (6) information rules and (7) payoff rules. The authors list these rules in a context of institutional analysis, which is particularly suited to the WRM dilemma that players face in the two games and to the types of rules they should have the possibility to design and implement. Based on this typology, we list in the Table 3 below which of these rules could be implemented by players themselves in CAPPWAG, depending on their individual and collective interests and strategies (hence in addition to the already existing game rules that constitute the game initial structure). We give for each type of rule one example that can be found during a game session.

Types of new rules that can be implemented in CAPPWAG	• *Position rules* which specify roles players can take within a defined set of roles among the group, in addition to pre-defined positions set by the initial RPG rules e.g. the designation of a group leader • *Boundary rules* which specify how players access or exit these roles e.g. the group leader is elected • *Authority rules* which specify the set of actions associated with roles e.g. If there is a conflict, the group leader must arbitrate the conflict • *Aggregation rules* which specify how a set of actions are transformed into intermediate or final outcomes e.g. players vote to decide on the implementation of a new management rule. If the group is equally divided between those in favor and those against the implementation of this rule, players' votes are weighted depending on the amount of Activity cards they possess. • *Scope rules* which specify the set of outcomes that may be affected by the rules e.g. all players must uninstall their Activity cards or pay a fine to the rest of the group if they go over one of the two environmental thresholds. • *Information rules* which specify the information available to each player

	e.g. all players must be transparent and unveil their activities to other players by showing them the content of their Activity cards or the amount of wealth or social capital units they possess. • *Payoff rules* which specify "*how benefits and costs are required, permitted or forbidden based on the full set of actions taken and outcomes reached*" (Ostrom, Gardner, and Walker 1994, 42) e.g. players who earn more than 3 WAGs per round must contribute to a common funding pot which is used to help poorer players to change their activities.

Table 3: Examples of new management rules that can be implemented by players in CAPPWAG, based on the typology developed by Ostrom et al (1994).

Offering a wide range of opportunities to players goes hand in hand with offering them reasons to act in different ways. Indeed, without dilemmas to face in the game, players could opt for the status quo and never be confronted with situations where they must make choices related to their capabilities. That is why we also included in CAPPWAG a series of individual and collective incentives to create a situation of dilemma where players are incentivized to making choices.

4.1.2. THE INCENTIVES

The motivations of players to engage in a game are twofold: intrinsic and extrinsic. Intrinsic motivation corresponds to the motives of players to act in the game which are derived from their very participation in it, such as enjoyment or curiosity, but also overcoming a challenge (Malone 1981; Malone and Lepper 1987; in Garris, Ahlers, and Driskell 2002). Caillois (1958, 27; in Groot 2003) called these "*paidia*" (the "*primary power of improvisation and joy*") and "*ludus*" ("*the taste for gratuitus difficulty*"), two poles between which games gravitate. He also classified games in four categories, depending on the importance of competition ("*agôn"*), chance ("*alea"*), simulation ("*mimicry"*) and vertigo ("*ilinx"*) (Caillois 1958, 12; in Groot 2003). As a RPG simulating the management of a socio-ecosystem, CAPPWAG is part of the "*mimicry*" category (it also involves elements of "*competition*" and "*chance*") (Daré 2005). In the context of a participatory process for water management, participants may be particularly interested in such a simulation because they may recognize in it elements from their own environment. In the context of our experiment, intrinsic motivation also corresponds to players' values and beliefs related to democracy and environmental conservation. We noted during the design process of CAPPWAG that regardless of their professional activity, the intrinsic motivation of players, when they played the game, often tended towards protecting the water resource and the environment and favoring collective work. During the game tests, participants often prioritized the conservation of the environment and the water resource over other objectives. There was consequently no strong dilemma for them to discuss and debate in the game because they often

consensually agreed on protecting the environment and helping each other. These behaviors are coherent with findings from experimental studies of social dilemmas (especially the ones presented in common-pool resource games), which demonstrated how face-to-face communication and the possibility to develop trust and reciprocity during the course of an experiment, increased cooperation among players (Sally 1995; Poteete, Janssen, and Ostrom 2010; in Ostrom 2010).

On the other hand, extrinsic motivation corresponds to the engagement of someone in an activity "*as a means to an end*" (Vallerand, Fortier, and Guay 1997, 1162). The person who is extrinsically motivated values and desires to achieve the outcome of the game (i.e. winning the game) because he considers it important for himself, but also because he may want to demonstrate something through it to his fellow players (Deci and Ryan 1985; in Garris, Ahlers, and Driskell 2002). The extrinsic motivation of players is related to the design of the game, its rules and most importantly, its goal and how to reach it.

There are three types of incentives in CAPPWAG: (1) incentives designed to balance individual and collective objectives; (2) incentives designed to encourage discussions on the game mechanisms (3) incentives designed to encourage discussions on the regulation of the game.

(1) incentives designed to balance individual and collective objectives

In order to create a dilemma and give players reasons to discuss social and environmental issues related to water management during the experiment, we included in CAPPWAG a series of individual incentives to create a balance with the collaborative tendency of participants when they play a game on environmental and collective management with face-to-face communication. Nevertheless, we also included collective incentives in CAPPWAG in order to perfect this balance. Indeed, pursuing individualist objectives in the game should not turn players away from discussing management issues. These individual and collective incentives integrated in the game and detailed below stem from one main objective of CAPPWAG: that players act like stakeholders rather than "gamers".

We assumed during the design process that in a face-to-face board game tackling environmental issues, players would tend to play collectively and cooperate if they could in order to protect the environmental resources. The game tests showed that this tendency was particularly present among players who did not know each other and wanted to demonstrate their good will through their behavior in the game. Great attention was given to this type of behavior because the CappWag tool aims at evaluating groups of non-competitive participants that are taking part in participatory processes where a certain level of cooperation between people is asked for. Similarly, the game tests ran during the design phase of the game showed that players who knew each other very well before the CappWag workshop (e.g. long-time colleagues or groups of close friends) had a tendency to play in a rather selfish and individualistic way. Several players who discussed this subject during a test debriefing found this type of behavior more "fun" or had no

problem with challenging each other in the game because they knew each other's real values and skills and could discuss the game further after the workshop.

These two types of behavior are related to a certain lack of seriousness given to the game. In order to avoid this, CAPPWAG is based on a subtle balance between competition and cooperation. Players have the opportunity to play competitively and individualistically or to cooperate with other players and play collectively. The game gives equal reasons to act in either way, so that players may feel free to act in one way or another.

To achieve this objective, we included in the game a series of incentives to encourage players to take their individual interests into account as well as the interests of the group or of the environment. We list them in Table 4.

Incentives to compete
• The goal of the game is individual. • There is only one winner at the end of the game. • Personal information (resources, activities) can be hidden from other players
Incentives to cooperate
• An environmental fine must be paid when at least one of the two environmental thresholds is reached. • Units of social capital reward a collective decision or action in which at least two players are involved. • The access to certain cards (the "Innovation cards") requires a high amount of resources (wealth and social capital) that can (most of the time) only be gathered if players team up. • Personal information (resources, activities) can be unveiled to other players • Players' behaviors and actions are visible to the rest of the group

Table 4: Individual and collective incentives creating a balance between competition and cooperation.

Competition and cooperation are not mutually exclusive and players can adopt multiple strategies during the game.

Additionally, the game was designed so that the dynamic of the play would be kept interesting no matter what choices players made. For example, if players played collectively, divesting polluting or water-consuming activities and investing in equally benefiting cards in terms of environmental and social gains, the individual goal of the game would maintain an interest in them to take into account their self-interests. On the contrary, a highly individualistic group in which players would all play for them and not cooperate would lead to sanctions (through the environmental fines) and would hence maintain an interest in them to take into account collective organization for environmental conservation and hence self-interest protection.

Finally, we note that there was no monetary or non-monetary rewards (such as presents) used as an incentive for players. We considered that it would destabilize too much the balance between individual and collective interests that we tried to create in the game.

(2) incentives designed to encourage discussions of the game mechanisms

In order to give players reasons to make a diagnosis of the socio-ecosystem simulated in the game, several incentives were integrated into it.

Some information is hidden from the players. The climate scenario that determines the variations of water quantity and pollution round after round is known only to the facilitator[12] . At the beginning of the game, each player is also the only one who knows the content of his or her Activity cards. Players have the possibility to share this information with other players or to keep it secret. The possibility given to players to hide information from other players allows for the integration of uncertainty elements into the play. Some players may want to discuss the content of other players' activities or resources bags in order to understand better the link between their activities and the environment (water resource and pollution) or whether these players are likely to win the game or not. The opposite possibility given to players to show information to their peers allows them to cooperate more easily because these information can serve as a basis of discussion on managing the water resource or environmental pollution together.

(3) incentives designed to encourage discussions on the regulation of the game.

In order to give players reasons to regulate the socio-ecosystem, the game was designed so that there would be a number of inequalities between players that they could modify only if they wanted to. For instance, at the beginning of the game each player possesses a card whose content varies depending on his or her location along the river or around the lake.

[12] These variations take place at the beginning of each round. Additional variations that would take place during the course of the rounds (e.g. the loss of water in the middle of a round or the addition of an unknown amount of pollution units in the system to simulate uncertainty) were considered but eventually not retained. We deemed them too difficult to implement for one single facilitator.

Moreover, the game scenario involves rounds of water shortages or high pollution. Players can cope with those environmental uncertainties by coordinating their actions during the game and making and implementing their own regulation system. Just like in a common-pool resources game, the collective environmental fine and the collective rewards (the smileys) given to players when they work together also acts as an incentive to discuss the regulation of the game (and hence, to limit the fines and earn smileys).

4.2. THE DESIGN PROCESS OF THE GAME SETTINGS

The design process of the CappWag experiment started in June 2016 and ended in January 2018. Nineteen tests gathering together one hundred seventeen participants from various background (researchers from various research units and fields of study, water professionals, local elected representatives and citizens with no knowledge of NRM) were conducted. The design process was iterative, as illustrated on Figure 15.

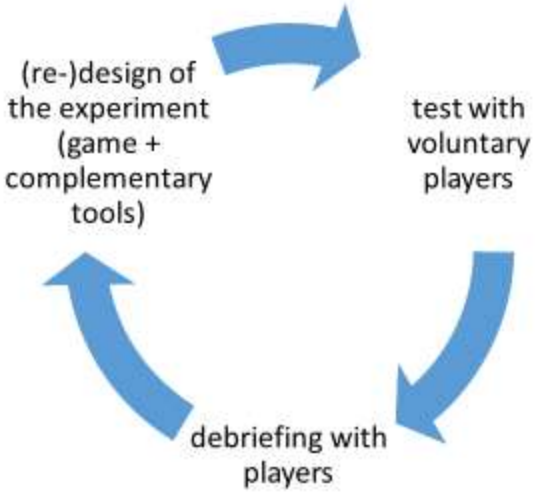

Figure 15: The design process of the CappWag experiment.

After a first design phase, we conducted one test session where we asked participants to play the game and fill in the questionnaire. A post-test debriefing allowed us to collect the feedback of participants on the game and on its difficulty and complexity, playfulness and realism, as well as on the questionnaire, its length and the clarity of the questions. This information and the observations collected during the tests were taken into account during a new phase of design during which the experimental tools were improved. The game tests allowed trying out various design options and deciding afterwards which ones to keep and which ones to reject. We

summarized in Table 5 the main design options that were either suppressed or added throughout the test process.

Examples of design evolutions
• In CAPPWAG-RIVER, simplify the socio-ecosystem (e.g. a one-stream river, no dams or irrigation systems, etc.) in order to save time and be able to play several rounds
• Progressively complicate the game rules (e.g. scatter the information on all possible game actions over the first three rounds) in order to (i) ensure players understand and remember them (ii) sustain the interest of players in the game, round after round.
• Sequence strictly the experiment phases and the time allocated to each part to keep enough time for players to fill in the questionnaire and debrief the game.
• Lighten the monitoring apparatuses. Suppress the « proposition cards » and the « decision cards » that were initially used to track players' ideas and intentions in terms of rule-making and implementation (they were too tedious to fill in); merge them with the monitoring file.
• Insert hidden dynamics between resources to give players a reason to discuss and understand together the socio-ecosystem, if they wishes so.
• During the discussion phase, let players organize themselves in terms of interactions among them and with the facilitator.
• In CAPPWAG-LAKE, in order to save time for discussion and for practical reasons, the facilitator is the one to manage which player plays first, instead of making players prioritize it themselves
• In CAPPWAG-LAKE, players play one after the other instead of playing simultaneously (an option simulating simultaneity was tested: players would draw a unit of water from the lake one after the other until they would have enough of them to implement their activities. It proved highly impractical and was consequently abandoned).

Table 5: Main examples of the design evolution of the games CAPPWAG-RIVER and CAPPWAG-LAKE.

4.2.1. A SEMI-ABSTRACT ROLE-PLAYING GAME

A specific feature of CAPPWAG is its medium level of abstraction. Indeed, the water systems represented in CAPPWAG-RIVER and CAPPWAG-LAKE are realistic, while players' activities and roles are abstract. This abstraction stems from the association that players may make between contextualized role positions (e.g. farmer, city manager, environmentalist, etc.) and norms and expectations perceived by players as specific to these roles (Scharpf 1997). For example, an industrial farmer may be perceived as an actor who would opt for maximizing his income to the detriment of the environment through pollution, and an environmentalist may, on the contrary, be perceived as an actor who would prioritize the conservation of the water resource and alleviation of environmental pollution over money. In such a situation, individual self-interests or collective interests may become secondary compared to the behavior players would prefer or may feel expected to adopt because of the roles they were assigned, which would prevent the comparison between their behaviors and capabilities as observed in the game and their real-life

ones. That is why we decided to make the activities abstract and only mention on the cards the final resource transactions and their price.

Moreover, an abstract situation of water management can speak to the highest number of players. For example, the river of CAPPWAG-RIVER could be located in an urban or rural area, on a mountain or on a plain, etc. These rather general settings allow all players to appropriate the game, according to the real-life context they evolve in.

Nevertheless, abstraction does not equal misrepresentation. Special care was taken with the definition of the environmental and social issues simulated in the game so that despite their lack of contextual anchoring, players would find them sufficiently interesting and realistic to to be discussed. Moreover, the abstraction should not prevent people from making a connection between the game structure and to real-life natural management issues, which is why resources were generically named and represented by tokens in the game. This connection is particularly important for players who would not have any knowledge in hydrology or NRM.

4.2.2. THE PHYSICAL FEATURES OF THE GAME

We chose to design CAPPWAG as a board game rather than a computerized game for two reasons. First, we considered that the implementation of a board game would require fewer resources (such as computers or electricity) from the practitioners and the researchers. Additionally, players who may not be at ease with computers would not feel lost or uneasy during the game. We argue that the physical structure of the game, its colorful cards, marbles, cups and bags, and the acts of grabbing, moving, touching them, gives players an “active” role in the facilitation of the game and helps them visualize more easily the way resources evolve and are interconnected (especially in the case of environmental resources) (Delomier 2013).

Second, we considered that the use of a face-to-face board game would be the best setting to observe collective capabilities and all the subtleties of collective action and agency that they involve. Even if a computerized experiment would allow a better tracking of players’ actions, their behaviors toward each other and all the subtleties of the group’s dynamics during the game would not be captured, which would negatively impact the evaluation of capabilities.

Moreover, special attention was brought to the spatial location of players around the water body represented in the game. We considered that the randomized allocation of the spatial position of players (thanks to a random draw) was preferable than letting them choose their own positions. With the latter method, risk existed that they would favor specific positions along the river or around the lake, or ones that depended on their previous acquaintances with each other (e.g. players who already know each other before the *ex ante* workshop could sit next to or apart one from another depending on their relationship). We consider that the association of the physical location with the real level of sociability of players may negatively affect the measures. For example, the presence of one player who does not know the others, in a group of already

acquainted people. Without a randomized location and in the case of the river setting, these players could be positioned to the end of the table and this location may make it even more difficult to integrate the conversation. This variable may become the main explanation for his relegation, instead of his lack of capability to express himself in front of the group or the lack of integration of the rest of the group (which strongly jeopardizes their two collective capabilities).

4.2.3. A ROLE-PLAYING GAME DESIGNED TO MEASURE CAPABILITIES

The game is made up of a succession of silence and discussion phases. We introduced the silence phases in the game for practical reasons. Indeed, one objective of the game is to serve practitioners as an evaluation tool that they can replicate in the field without having to record and then analyze hours of entangled discussions. This compromise was initially counterbalanced by the introduction of colored signs (green, yellow and red) given to every player as a way to express their emotions. This feature was nevertheless deemed inefficient by several facilitators during the *ex ante* workshops because it was seldom used by players, who focused more on the passing of the cups between them during the silence phases. Moreover, they often kept non-verbally communicating during these phases (e.g. through gesture or facial expressions). We considered that the removal of these signs from the *ex post* experiments would not significantly impact the measurement and hence suppressed them to simplify the game. We will discuss further in Chapter 5 section 3.3.1 the interests of the silence phases for the measure, but also the drawbacks that we observed during our experiments.

The other game feature specifically designed to measure capabilities is the monitoring file that each player fills in between game rounds. In addition to a game sheet, the monitoring file collects data round by round on the evolution of players' social and monetary resources (section 1: "Resources"), as well as their perception of the game (section 2: "What do you think?"), the emergence of ideas and intentions among each player and the way they will discuss them or not with the rest of the group (section 3: "Proposals you wish to make to the group"). Finally, players must indicate whether groups of players made a collective decision and what it consists in (section 3: "If you participated in the process of making a collective decision (which involves at least two persons)"). Section 3 allows the collection of information on the collective capability of players to make new management rules. This part of the monitoring file was designed so that players would fill in every collective decision they take, whether these concern the long-term management of the game or simple short-term agreements. It allows the evaluator to track the process of decision-making and, when it happens, of rule-making.

The number of rounds is left unknown to players, so that they will not adopt highly competitive behaviors towards the end of the game just so that they can win. As a result, the number of pages of the monitoring file (one page corresponds to one round) is deliberately higher than the amount of rounds that can fit into a workshop.

4.2.4. DESIGN TRADE-OFFS

The design process of the CappWag experiment consisted in a succession of arbitrations between several design options. Indeed, the collection of data related to players' capabilities, the practical implementation of the experiment on the field and its engaging aspect for players required at times to make tradeoffs and prioritize certain design features over others. We list these tradeoffs in the Table 6 below.

Constraint taken into account during the design phase of the CappWag experiment	Tradeoffs
External constraints	• Time-constrained experiment to make its implementation on the field easier vs. intensity of the experiment for the players • Adaptability of the evaluation tool on various contexts vs. uncontrollability of the groups of participants
Evaluative constraints	• Imposed silence phases during the RPG and self-monitoring vs playfulness of the game • Playfulness of the game vs. use of a sole RPG as a measurement tool and need for complementary apparatuses • Compulsory presence of a facilitator to ensure the respect of the experiment protocol vs autonomy of players and objectives of self-evaluation • Adaptability and transferability vs realism of the RPG: heavy simplification of natural and social mechanisms so that any type of stakeholders can engage in the game • Choice of a board game to ensure players feel as comfortable as possible with the support vs. practicability of the board (high number of cups and papers) • Capacity to read and write required to fill in the evaluative forms vs. the implementation of the tool with non-literate stakeholders
Facilitation constraints	• Single-handed facilitation vs. complexity of the game rules (e.g. impossibility to integrate too many variables into the game that would be controlled by the facilitator) • Single-handed facilitation vs. amount of people that can participate in the experiment (no more than ten)

Table 6: List of tradeoffs made during the design process of the CappWag experiment.

4.3. DATA COLLECTION: THE OBSERVATION PROCESS AND COMPLEMENTARY TRACKING APPARATUSES

Because the CAPPWAG games alone are not sufficient tools to capture all of the dimensions of a capability, let alone a collective capability, they are complemented with other measuring tools (see Figure 16). Their assembly forms a CappWag workshop.

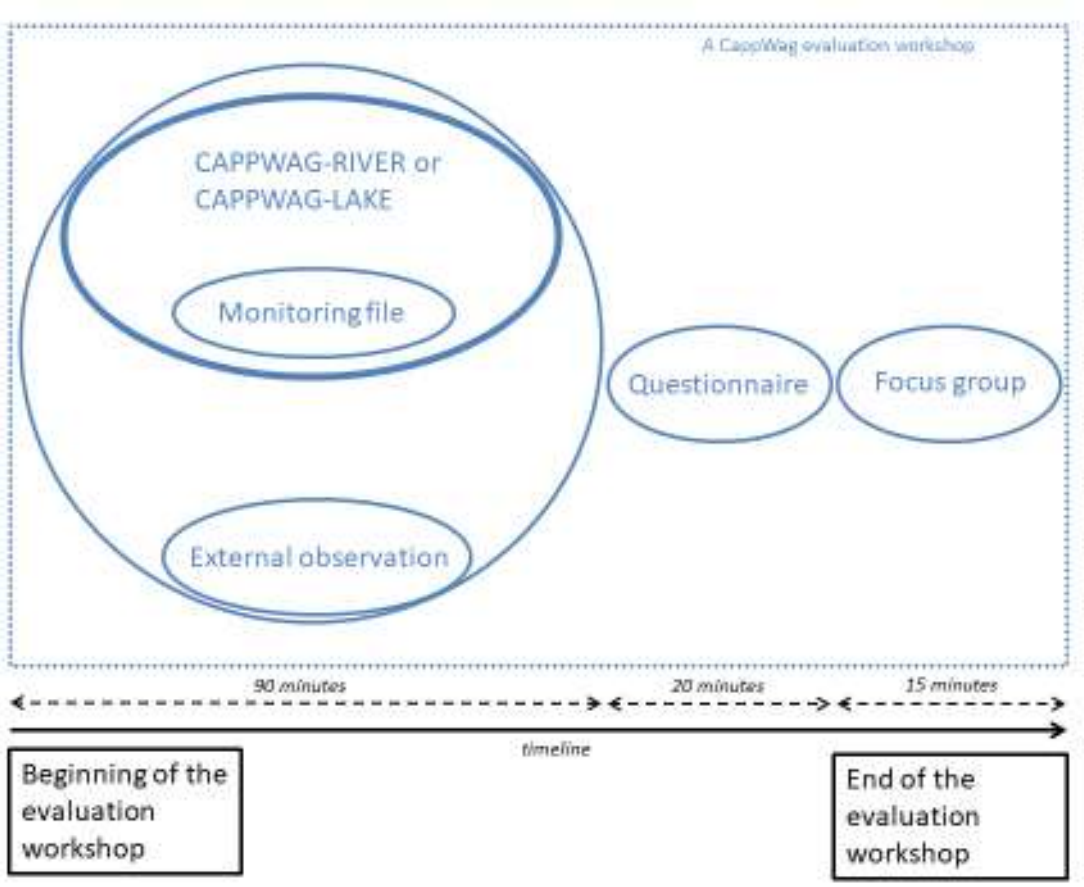

Figure 16: Design and outline of an ex ante or ex post CappWag evaluation workshop.

4.3.1. THE EXTERNAL OBSERVATIONS

Two types of observation are made during the RPG: internal observations (or "self-observation") through the monitoring files that players fill in themselves, and external observations. In every CappWag experiment, the facilitator is in charge of gathering external observations. However, as discussed in section 2.1 of this chapter, it is preferable for data triangulation that he is assisted during the experiment by a second facilitator or by one or several external observers. Indeed, when he is alone, the facilitator may miss important details concerning the group dynamics, the behaviors of players, the content of the management rules made and implemented by players and their duration or scope, etc.

While a second facilitator should be knowledgeable about the specificities of the CappWag experiment and facilitation, as well as the game rules, an external observer may not be knowledgeable at all about these subjects and instead, asked to stick to the structure that guides the external observation process (see Annex V). Facilitators and observers were asked to take notes on the main specificities of the group dynamic, as well as individual behaviors standing out from the rest of the group (e.g. a leader, a player who did not speak at all, etc.). They were also asked to note the content of the discussions among players, in order to know whether a collective diagnosis of the system or new management rules were being discussed, made and/or implemented.

To make the external observations, the facilitator and the observers take notes following a pre-structured thread. For practical reasons, no audio or video recording of the discussions is planned in order not to extend the duration required for the analysis of the data. We discuss further in Chapter 5 section 5.2.2 the drawback of such a trade-off in terms of data triangulation[13].

We assumed that the observation process is moderately intrusive, in the sense that the behavior of players is little, or only just impacted by the presence of an observer taking notes during the game. Indeed, the game requires all of the players' attention and it is likely that they do not give the observer a significant attention. If, in fact, they did give attention the observers should estimate the extent to which their presence affected the behaviors of the players (Olivier de Sardan 1995).

4.3.2. THE QUESTIONNAIRE

The semi-structured CappWag questionnaire (available in Annex VI) is articulated around five main parts:

(1) the first part addresses the individual capability "being able to express oneself in front of a group";
(2) the second part addresses the collective capability "being able to make a diagnosis of a problematic situation";
(3) the third part addresses the collective capability "being able to make and implement management rules";
(4) the fourth part addresses the resources and the conversation factors call for by players during the game
(5) the fifth part, which is only present in the *ex post* questionnaire, addresses the comparison between the *ex ante* and the *ex post* behaviors and actions of the players

[13] We note that an audio recording was nevertheless made during one workshop with Group T2 in Tunisia in order to translate the discussions from Arabic to French and ease the comprehension of the group dynamics for the evaluator.

and their link with the participatory process or participation training they followed in between.

The questionnaire collects quantitative and qualitative information through open-ended and closed-ended questions. The information obtained from the questionnaire is treated as the main complement to the external observation collected during the RPG. The data should provide information on the intentions and motives of players and explain their behaviors and actions, hence explaining whether they are related to capabilities or not, and if their absence is explained by a lack of capability or by a capability simply not actuated.

4.3.3. THE DEBRIEFING

While the individual questionnaire allows for grasping capabilities, that is to say potential functionings that have not been achieved and thus have not been revealed through the RPG; the debriefing serves as a moment to discuss collectively and comment on the events that happened in the game.

According to Lederman (1992, 146), debriefing is "*a process in which people who have had an experience are led through a purposive discussion of that experience*". Indeed, a debriefing consists in a discussion moment after the RPG session. It allows players to express their feelings and their strategy during the game, to collectively assess the game dynamics and to address the link between the simulated situation and reality (Barnaud 2008; Daré et al. 2010; in Moreau 2019).

The CappWag debriefing takes the shape of a focus group implemented at the final stage of the workshop (see Figure 16 above). A focus group is a form of "*group interview intended to exploit group dynamics*" (Freeman 2006, 491). The discussion is guided by one facilitator who also takes notes (supported by a second facilitator if available). The focus group gathers the whole group of players together and follows a strict sequence (see Annex VII).

In our experiment, the "*experience*" evoked by Lederman corresponds to the involvement of people in the RPG where their capabilities are observed and the "*purposive discussion*" he associates with a debriefing corresponds to a guided conversation among players and between players and the facilitator about their behaviors and actions during the game and its relationship with their external involvement in a participation process. Like so, one player is first asked to summarize what happened in the game and to qualify his view of the interactions of players during this period. This furnishes an additional set of observation on the collective behavior of participants. Because players are asked to summarize their conduct during the game, the focus group first informs the evaluator as to whether the group is consensual or not and share a similar appreciation and vision of what just happened. Second, all the players can answer the facilitator's questions and discuss together, as long as they listen to each other. During this time, the subject of discussion is the link between the game and reality. Because this subject is of

critical importance for the internal validity of the experiment, it is also part of the individual interviews that some of players participate in after the *ex post* workshop.

Lederman (1992, 146) states that one assumption underlying the implementation of a debriefing is that the experience affects participants "*in a meaningful way*". It corresponds indeed to the expected effect of our RPG, in which players are put under pressure and must act and behave in a pressuring socio-ecosystem (Daré and Barreteau 2003; Daré 2005). A second assumption is that discussing the experience is "*necessary*" so that people will understand the meaning and the impact of the experience. This second assumption is shown to be partly true in our research. Indeed, a processing is necessary to provide insights for people. The game itself only provides a support for reflection. The questionnaire can feed people's understanding of the game and its objective in terms of evaluation because of the very subject of its questions, but it never directly addresses the concept of a capability. That is why we distinguish the *ex ante* debriefing where people are provided with minimal information on the capability approach and the precise objective of the evaluation process, and the *ex post* debriefing where people are provided with more information on this subject.

In both workshops, the debriefing also provides further insights on the experience to facilitators. Similarly to debriefings used in educational settings, the debriefing is the moment of the workshop where the relation between the simulation and the real world can be debated. The debriefing is also the moment where collective learning is elicited or takes place and where facilitators can communicate information to participants concerning the detailed objectives of the evaluation and even discuss the capability concept. Because of this and the experimental setting and the controlled protocol on which the CappWag experiment is built, it also shares similarities with debriefings used in psychological studies (Lederman 1992; Barreteau, Le Page, and Perez 2007; Crookall 2010).

4.3.4. THE INDIVIDUAL INTERVIEWS

In order to confirm or infirm the information collected during the CappWag workshops, we interview players individually. The data collected through the interviews is not part of the capability reading, but it is used instead to ensure that the measurement tool is efficient.

These interviews should take place after the *ex post* workshop, once the evaluator has an overview of potential changes in the capabilities of participants and their link with the participatory process or participation training that people have attended.

The subjects covered by the individual interviews were not or not entirely covered by the measurement tool. Two questions explore the link between the game and reality and the extent to which the behaviors and actions that take place in the game are representative of real behaviors and actions. The questionnaire filled in by players immediately after the game partly covered this subject but, since it is considered as the cornerstone of the internal validity of the

experiment, it was considered judicious to double-check players' answers during the interview. One question is dedicated to the impact of the participatory process or participation training on players' capabilities and the influence of the actual shape of the evaluation tool on their *ex post* behaviors. Depending on the quality of the data collected on players, one or two additional questions adapted to individual players can be added to the list (e.g. in case of contradictory or missing data).

5. CONCLUSION

During the design process of the CappWag experiment, we faced several challenges related to its evaluative objectives. Its internal and external validity were thought through the prism of its practical implementation, and in addition to the collection of valid data on participants' capabilities, it also took into account playfulness and engagement issues. The design process of the experiment subsequently relied on a series of assumptions that we listed in this chapter, among which: the assumption that inhibitions for players to engage in the game would be relatively marginal; the assumption that participants would play and fill in reliably the forms; or the assumption that the interference of the measurement tool with the behavior of players would be minimally intrusive.

We consequently designed an evaluation experiment based on two semi-abstract role-playing games: CAPPWAG-RIVER and CAPPWAG-LAKE. We designed the two workshops as independent evaluation apparatuses that can be used separately one from each other and provide evaluators and participants with a measure of their individual and collective capabilities at a given time, but also capture the evolutions of these freedoms through. Despite its multiple borrowing to already existing tools (such as the WAG methodology), the CappWag experiment is an innovative *ad hoc* evaluation apparatus. The two semi-abstract opportunity-generating games represent an NRM dilemma situation. They are designed so that players are free to exercise their collective agency and discuss together, make a diagnosis of the situation and make and implement management rules, if they so choose. Particular attention was given to creating a balance between individual and collective incentives. Complemented with additional measurement tools (a questionnaire and a debriefing), they allow for observing participants' achieved functionings in a simulated situation of management, but also of non-achieved ones.

Once the CappWag experiment was completed, we implemented it on two case studies: once only as a one-time evaluation tool and once as an *ex ante ex post* tool. We present the results in the following Chapter.

CHAPTER 4 – THE IMPLEMENTATION OF CAPPWAG: RESULTS AND ANALYSES OF TWO CASE STUDIES

1. INTRODUCTION

The CappWag tool aims at evaluating the impacts of participatory processes for water management on its participants. It was consequently designed to be implemented with various types of stakeholders, from water managers to citizens. Two participatory processes taking place in France were initially targeted as case studies for this doctoral research. However, because of a series of internal constraints independent from this thesis work (e.g. calendar and organization issues within the targeted case studies, changes in the envisioned program of participation…), they had to be abandoned during the first and second year of this doctoral research. Two new case studies were consequently found to replace them: (1) one with local government officers in Tunisia, in the frame of the PR-OSCAR project; and (2) one with first-year Master's students in France, in the frame of a three-month course on IWRM. Despite this change in the context of implementation and in the content of the process taking place before and during the two CappWag workshop, they serve as interesting examples to implement our evaluation tool because they call for similar resources, conversion factors and eventually capabilities. We present the results of the twelve workshops implemented in this chapter.

First, we detail the methodology used to monitor and analyze the data collected during the experiment and the individual interviews of players. Second, we present and discuss the results of two case studies, starting with the one-time evaluation undertaken in Tunisia and following with the *ex ante ex post* evaluation made with the students.

2. METHODOLOGY OF ANALYSIS

As discussed previously in Chapter 3, CAPPWAG serves as a situational exercise where a group of players is put in a simulated situation of WRM. Thanks to the game, people will act in a certain way: they will or will not talk and discuss with each other; they will or will not discuss their understanding of the game and their management ideas; and they will or will not debate and deliberate together in order to influence the game scenarios in what they consider a desirable way.

These visible actions or absence of actions correspond to the tip of the capability iceberg, that is to say the achievement or non-achievement of functionings. The RPG itself does not provide information on the hidden part of the capability iceberg, which is not only invisible to external observers but also the most difficult part to track and qualify: the capacity and the opportunity to act in a certain way that player have or do not and the value they give to this freedom of action.

The following section presents the conceptual untangling required to identify which aspects of a capability the evaluation should focus on, as well as the complementary tools that were coupled to the RPG to create the complete evaluation tool CappWag.

2.1. THE SCALE OF MEASUREMENT OF A COLLECTIVE CAPABILITY

In this experiment groups are artificially created and their initial boundaries are set up by the facilitator (i.e. between four and ten players can participate in a CappWag experiment and the composition of the group should remain the same between the *ex ante* and the *ex post* workshops). In some cases, several participants who already knew each other (e.g. in the case of the Master's case study, from previous joint courses at the very beginning of the Master 1's first semester or from previous Bachelor's studies) decided to join the same group.

The measurement of the two collective capabilities is made on the scale of the artificially constituted group of players. Indeed, participatory processes gather people from various directions who may not know each other at all when they start attending meetings and yet must work together if they want to have an impact on the course of WRM on their territories.

The structure and the dynamics of a group are not fixed and evolve over time (whether this is the time of the experiment itself or the time in between an *ex ante* and an *ex post* workshop). The facilitators and the external observers are consequently asked to report these evolutions, when they observe them.

Such a condition implies that the lack of value for one of the two observed collective freedom from a single player negatively impacts the existence of a "collective value" on the scale of the whole group, and hence of a collective capability on the same scale. In such a case, we consider that the collective capability exists on the scale of the group minus this one individual, that is to say on the scale of a subgroup of players.

Indeed, the behavior of one individual or more not engaging in the realization of a collective functioning because of his or their lack of value for it should not overshadow the willingness of the rest of the group to do so or the importance they give to the observed collective freedoms. Moreover, the lack of value given by an individual to a collective freedom to do something does not mean that he cannot benefit from it and take advantage of it.

We will consequently analyze in this chapter collective capabilities on both scales, the entire group of players participating in the experiment and potential sub-groups of players, that is to say smaller groups of interest and cooperation that would constitute themselves within a formal and larger group (e.g. two teams of four players in a formal group of eight).

2.2. THE THREE DIMENSIONS OF A CAPABILITY

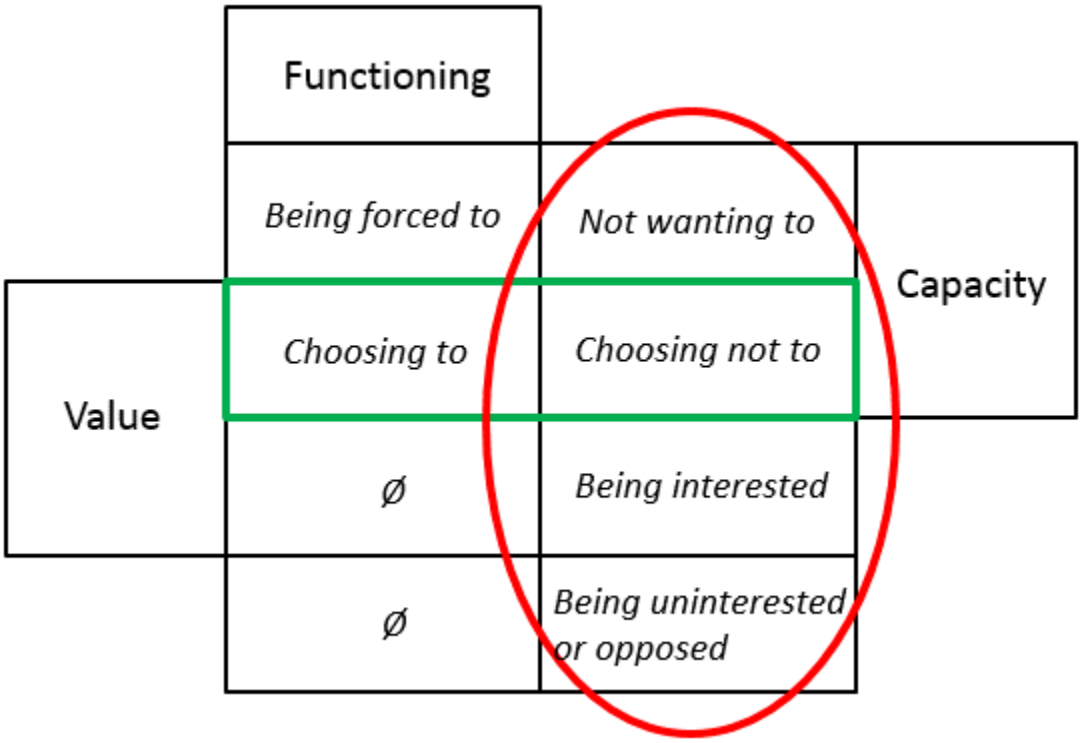

Figure 17: The three dimensions of a capability and its six possible stances. In red is circled the four dimensions that can only be observed through additional monitoring and evaluation tools; and in green the two combinations that correspond to a capability.

Envisioning a capability through these three dimensions allows us to differentiate which aspect we can reliably understand through the game itself, and which one requires additional information that can be collected only by directly asking the participants about the state of their capabilities. The three dimensions are constitutive of both individual and collective capabilities. Hence we will not differentiate them in the following paragraphs. The three dimensions we work with are the following:

(1) *The value given to a freedom to do something*. Are the three capabilities we observe valuable to individual participants? How important is it for each one of them that they or the other members of their group possess these three different freedoms? Because a freedom to do something that is not valued is not considered as a capability, it is essential that the evaluator grasp this "invisible" dimension.

(2) *The capacity of doing something*. Because possessing a capacity does not necessarily transform into an action, the evaluator cannot completely rely on players' actions in the game to understand whether they possess the three capacities we focus on. When an individual possesses a capacity to perform a certain action and value it, he or she possesses a capability and the associated potential functioning that they can then choose to actualize or not. In the case of a group of people, we consider that it is not necessary for every single member of the group to possess the capacity to do or be something, as long as one or several members of the group possess it and can make the entire group benefit from it.

(3) The *functioning of a capability*. This corresponds to the realization of a valued capacity and can be either potential or achieved. Achieved functionings are the only dimension of a capability observable by an external observer. An actualized functioning is proof of the existence of its related capacity. For example, when the observer sees a player discussing with other players during the game, he would conclude that he has the capacity to express himself in front of other people, since he *sees him doing it*. Nevertheless, the absence of an actualized functioning does not mean that the related capacity does not exist, since it could be a choice from the observed player or group not to actualize it. We will differentiate here a functioning, which stems from the capability approach theory, and the realization of a non-valued capacity, that, in the following pages, we will simply call a realized action.

When they cross each other, these three capability dimensions produce six possible stances for people to adopt during the game (Figure 17):

(1) *"Being forced to" do something:* A player could feel group pressure to act in a certain way, or a group could act according to the supposed expectations of external actors (e.g. the game facilitator or observers).

(2) *"Choosing to" do something*: This could for example translate into a player actively participating in the group discussions because he thinks it is important to make his voice heard, or a group or a sub-group of players regulating the management of the water resource because they believe it should be collectively handled.

(3) *"Not wanting to" do something*: This could for example translate into a player who would choose not to participate in group discussions because he does not want to do so, but also does not value in general this freedom in a participatory context. At the sub-group or group level, it would translate in the group as players being able together to do something, but not considering the associated freedoms as valuable for them.

(4) *"Choosing not to" do something*: This could for example translate into a group or a sub-group of players deciding together not to design and implement collective rules to

manage the game socio-ecosystem, even though they value the freedom to be able to do so and could very well do it if only they collectively decided to.

(5) *"Being interested" in doing something:* Such a capability state can be associated with a will to learn how to possess the capability (e.g. a player who would gain confidence and learn how to speak in front of his peers, or a group of players who would want to create its own collective rules and learn to work together until they eventually design and implement one).

(6) *"Being uninterested or opposed" in doing something:* This could translate into a player who would not have the capacity to speak up in front of other people but also not consider it a valuable freedom for himself or his peers; or into a group of players not valuing collective rule-making, a capacity considered by some people as prerogative only of a government.

2.3. THE CONSTRUCTION OF THE READING GRID

The evaluation of the evolution of the three capabilities among the CappWag groups over time is based on a two-step approach:

(1) The first step of the evaluation process corresponds to the separate analysis of the *ex ante* and the *ex post* data. Within a group of players, we observe and compare individual behaviors, as well as collective dynamics. When several groups were participating in a similar context to the CappWag workshops, we were able to them with each other.

(2) The second step in the evaluation is to eventually compare the results of the *ex ante* and the *ex post* workshops. From this comparison, we derive an evaluation of the capabilities of individual players and the group itself over time.

We will assume in this chapter in which we present our results that the data collected during the CappWag workshops are reliable. We will discuss in Chapter 5 (section 5.2) the actual reliability of these data and their impact on the internal and external validity of the CappWag evaluation tool.

2.3.1. DATA SELECTION AND HIERARCHY

Building on the three capability dimensions previously described, we follow a two-step analysis sequence to identify the presence or absence of one of the three capabilities we want to observe. A dual analysis allows us to relate the actual happenings observed during the game with the intentions and preferences behind these and stated by the players themselves.

(1) First, we look at the presence or absence of achieved functionings or realized actions during the game. Functionings and behaviors are the only part of the capability iceberg that we are able to observe empirically (Scharpf 1997). The facilitator and, when they exist, external observers, provides direct observations. The observation of an action should equate to the existence of a capacity, whether that capacity is valued or not. We can derive from the absence of achieved functionings or realized actions the absence neither of capacities nor of capabilities; this requires a second stage of data collection. External observations are the most reliable source of information concerning actualized functionings/realized actions because these are visible and can hardly be contested (except if two observers report different observations for a same group of players).

(2) Second, we rely on self-reported information provided by players, individually (thanks to a monitoring file filled in during the game and a questionnaire with both open and closed questions filled in right after it), and collectively (thanks to a collective debriefing). Self-reports allow the evaluator to collect information on the way players perceive their capacities to perform certain actions and whether they value them, but also which resources and conversion factors lie behind them. Self-reporting present flaws that may affect the outcome of the analysis and will be discussed later in section 5.2, Chapter 5. This is nevertheless the only way to gather sufficient information to discuss the presence or absence of capabilities among players.

In addition, we conducted individual interviews with thirteen participants at the end of the last CappWag workshop (a period of several months had passed for the Tunisian players while a period of several days or weeks had passed for the students). During these interviews (see the interview guide in Annex VIII), players are asked to discuss their behaviors and, when necessary, their answers to several questions during the experiment, as well as their participation experiences outside of the CappWag experiment. The declarations that players make during their interview allow for counter-checking the validity of the data collected during the evaluation experiment.

The four complementary evaluation tools provide the evaluator with qualitative data and two of them (the monitoring file and the questionnaire) provide quantitative data as well.

2.3.2. QUALITATIVE DATA

As summarized in Table 7, qualitative material provides in-depth information on individual reasoning, as well as the structure and the dynamics of a group.

	Being able to express oneself in front of a group	Being able to make a collective diagnosis of a problematic situation	Being able to collectively make and implement management rules
External	Achieved functionings		

observations	Identification of players who do not talk a lot and players who lead the discussions	Identification of players who engaged in discussions concerning a diagnosis, content of the discussions	Identification of players who engaged in discussions concerning rule-making and implementation, information on the decision-making and implementation process of the rules, content of the rules
Monitoring file	Ø	Ø	Design process of management rules
Questionnaire	Achieved and potential functionings		
	Frequency of discussions, capacity and value given to the capacity to express oneself in front of a group, associated resources and conversation factors	Content of the discussions concerning the diagnosis of the socio-ecosystem, individual and collective capacity and individual value given to the capacity to make a diagnosis, associated resources and conversation factors	Content of the discussions concerning the rule-making and implementation processes, the individual and collective capacity and individual value given to the capacity to make and implement management rules, associated resources and conversation factors
Focus group	Achieved and potential functionings		

Table 7: Qualitative data collected during a CappWag workshop with four different means.

2.3.3. QUANTITATIVE DATA

The presence or absence of a functioning provides indication of the existence of the corresponding capacity, but is not sufficient to confirm whether it exists or not. This is why in order to measure a capability, we focus on two out of the three dimensions we have previously identified (Figure 17 above): the *capacity* and the *value* given by a person or the group to the freedom to turn this capacity into a functioning, depending on people's free will and choice.

Information on these two dimensions mainly comes from the questionnaire that is filled in by participants right after they finish playing the game. The questionnaire is made up of 25 questions. Four of these directly deal with the individual capability "being able to express oneself amongst a group", seven of them directly tackle the collective capability "being able to make a collective diagnosis out of a complex situation" and thirteen of them directly tackle the collective capability "being able to design and implement management rules".

Most of the questions tackling the capabilities of participants were three or four-level closed questions. Questions 4, 10 and 20 tackling the self-evaluated capacity of participants or the groups were six-level questions and questions 25.1, 25.2 and 25.3 tackling the value given by participants to the three capabilities were five-level Likert items. Answers to the closed questions were normalized on a [0;1] scale in order to obtain a score for each question and facilitate the comparison between several answers from the same player, between players from the same group and between different groups.

The values obtained concerning the three self-reported capacities by players and the ones concerning the value given to these capacities were crossed into two-dimension charts.

Because the number of participants who can play together and participate in the evaluation process as a group cannot exceed ten, the analysis of the quantitative data was limited to a handful of statistical methods ("*shortcut statistics*") that could be applied to small amounts of observation (Dean and Dixon 1951).

Three measures recommended by these two authors were mainly used during the analysis. We detail them in Table 8.

Measure	Description and use
The mean $\overline{x}$	The mean is an estimate of the central value of a set of data, corresponding to the average of the number of observations n in this set, such as: $$\bar{x} = \frac{\sum x_i}{n}$$ The mean $\overline{x}$ is used to analyze data extracted from questions tackling the self-evaluation by players of their own capabilities, both as an individual ("being able to express oneself in front of a group) and as part of a group (making a collective diagnosis and collective rule-making and implementation). Even though the mean is more sensitive than the median presented below to "errors" or extreme values, it was favored to describe the self-rated capabilities of players for this very reason. Its higher sensitivity to individual data standing out from the mass was considered as more appropriate to understanding the subtlety of group behavior, when the choices of one can influence the choices of the whole group.
The median Med_x	The median is another estimate of the central value of a set of data. It corresponds to the number in the middle of the set of data in which the values have been arranged in order of increasing magnitude, from the lowest value to the highest value. The median Med_x of an ordered sample $(x_1, x_2, \dots, x_n)$ of n measured values is:

	$$Med_x = \begin{cases} x_{\frac{n+1}{2}} & n\ uneven \\ \frac{1}{2}\left(x_{\frac{n}{2}} + x_{\frac{x}{2}+1}\right) & n\ even \end{cases}$$ The median Med_x is used to analyze the data related to the functionings of the players. Because it is less influenced by "extreme" values or error than the average (Dean and Dixon 1951), it gives a more accurate account of the central distribution of players' behavior.
The standard deviation s	The standard deviation indicates the dispersion of n. When s is low, it indicates that the values are close to the mean x. When s is high, it indicates that the values are spread out over a wide range. $$s = \sqrt{\frac{\sum(x_i - x)^2}{n-1}}$$ The standard deviation is used to analyze capabilities at the collective level. It gives information on whether players share the same point of view on the group actions and capacities and whether they value them in a similar way. SD will stand for "standard deviation" in the following pages.

Table 8: Description of the three statistical measures used to analyze the CappWag data.

The three measures were interpreted based on a reading grid build for this specific purpose (Table 9). The thresholds retained to read the data and presented in Table 9 were based on empirical considerations.

Measure (X) and associated thresholds	Reading
Mean or median equal or inferior to 0,20 ($X \leq 0{,}20$)	The variable described by the measure is considered as *very low or non-existent*.
Mean or median Between 0,20 and 0,40 ($0{,}2 < X < 0{,}4$)	The variable described by the measure is considered as *low*.
Mean or median Between 0,40 and 0,60 ($0{,}4 < X < 0{,}6$)	The variable described by the measure is considered as *medium (neither low nor high)*.
Mean or median Between 0,60 and 0,80 ($0{,}6 < X < 0{,}8$)	The variable described by the measure is considered as *high*.
Mean or median equal or superior to 0,80 ($X \geq 0{,}80$)	The variable described by the measure is considered as *very high*.
Standard deviation inferior to 0,20 ($X < 0{,}20$)	The data dispersion is considered as low and the contrast between players' answers non-negligible so that a *consensus* exists among the group.
Standard deviation equal or superior to 0,20 ($X \geq 0{,}20$)	The data dispersion and the contrast between players' answers are considered as significant enough so that *no consensus* exists among the group.

Table 9: Reading of the three measures used to analyze the data: the mean, the median and the standard deviation. All values belong to a [0;1] scale.

2.4. THE DIFFERENCES EXPECTED BETWEEN THE *EX ANTE* AND *EX POST* PHASES

The individual capability "being able to express oneself in front of a group" is tracked through direct observations and the questionnaire. Direct observations from the facilitator or external observers allow us to single out specific behaviors of players: *Which players talked a lot and which ones did not? Were some players prevented from talking by other players? Were players splitting the time allotted to discussion equally between them?* The questionnaire allows for cross-checking the discussion frequency from every individual (observed vs. perceived) and for players to self-evaluate their own capacity to express themselves in front of the group during the CappWag workshop. They are also asked to value a statement related to the freedom of expressing oneself, in the context of real-life collective management of a water resource.

The analysis of the collective capability "being able to design and implement management rules" relies on the information provided by direct observations, as well as on the individual monitoring file filled in after every game tour by participants, and the questionnaire. The external observation tells us whether there was discussions going on about potential NMR and if one or more of them were implemented by players (the whole group or sub-groups of players). The monitoring file allows a detailed account of players' ideas of proposals to influence the game and whether they would have liked to discuss these with the group, and also if they did discuss them; if not, why not and, if so, did it turn into a collective action. The evaluator is then in charge of identifying which proposals correspond to a management rule and which ones are mere punctual agreements.

We build on the ADICO grammar (Crawford and Ostrom 1995) to define what a common good's management rule is. In the ADICO format, a rule encompasses: (A) people onto which the rule applies; (D) a deontic logic related to a permission (may), an obligation (must) or an interdiction (must not); (I) an aim; (C) conditions defining its scope; (O) sanctions, explicit or implicit, to be imposed on those not following the rule. Because of the game's features and rhythm (limited moments of discussions, short duration, evolving external scenario to which players have to adapt at every new turn), we specifically focus on the ADIC part of the grammar and do not take into account the presence or absence of sanctions (implicit or explicit) to define whether a rule exists or not.

The type of rule we focus specifically on in this paper concerns the management of the socio-ecosystem of the game. These rules correspond to long-term decisions or actions (*e.g. sharing information on players' activity cards, dividing collective environmental fines depending on players' earnings, etc.*). We consequently differentiate a rule, that is to say, an understood regulation or principle governing the conduct of at least two players or the procedure within the

game, from a collective agreement, that is to say a one-time agreement between at least two players.

We therefore consider that a group has made a new management rule (NMR) when the group members validate it or are neutral about it (in the sense that they do not voice their opposition and their refusal to validate the rule to other players). This implies that the rule had previously been formulated and presented to the group by at least one player, and had been discussed by the group members. We consider that a rule is implemented when players who validated it followed and respected the rule.

The questionnaire allows for cross-checking players' own self-reporting in the monitoring file by asking them for detailed information on the formulation, validation and implementation process of management rules during the game, as well as having players' own ratings concerning the collective capacity of their CappWag group to implement one or several management rules, as well as knowing the value they give, this time, as an individual, to the freedom for a group to implement its own management rules, in the context of the collective management of a water resource.

The analysis of the collective capability "being able to make a diagnosis" relies on the information provided by direct observations, as well as on the questionnaire. External observations allow us to know whether a diagnosis was made at the group level by players, or rather by sub-groups, or not at all. The questionnaire allows us to obtain detailed information concerning the frequency of the discussions concerning the game, the identification of problems in the game and actions by players to solve these. The questionnaire also lets players rate the collective capacity of the group to make a diagnosis and the value they give to this freedom, in the context of the collective management of a water resource.

We look at two main variables to observe the realization of a collective diagnosis:

- Sharing a common understanding of the socio-ecosystem and the way it works;
- Discussing together actions to impact the management of the water resource;
- Identifying actions together to impact the management of the water resource.

For a collective diagnosis to be made, a consensus must be reached by the whole group. This does not necessarily mean that the understanding of the socio-ecosystem is correct or that ideas of change thought about by the group are efficient or even doable.

The comparison of the *ex ante* and *ex post* data should allow the evaluator to observe differences, if they exist, in the way players act together. *Do individual and group dynamics evolve over time, and if so, how? Was cooperation between group members reinforced or, on the contrary, have their initial differences diverged even more?* An exhaustive list of the main changes that may occur at the group level is proposed in Table 10 below.

	Variables that could impact	Observable change in CappWag *ex post*,

	players' behaviors	compared to CappWag *ex ante*
Variables related to the real-life participatory process taking place between two CappWag workshops	A better knowledge of each other's personalities and interests (social learning)	Better cooperation, players will be more likely and willing to talk together, to deliberate together. Discussions are likely to be more complex because of a higher level of respect and friendship between players.
		Conflict, mistrust, less cooperation. Players will play in a more individualistic manner in order to win or take revenge after a first game they did not enjoy (unsatisfactory results, anger at some players' behavior, dissatisfaction with the rules of the game). Players will play more individually during the *ex post* workshop than during the *ex ante* workshop.
	A stronger sensitivity to deliberative and democratic issues	Players will participate more during the game, discussions will be more inclusive.
	A stronger sensitivity given to various participatory steps (collective diagnosis-making, regulation proposals and collective deliberation)	Players will take more time during the second workshop to discuss together how the game socio-ecosystem works and make sure they agree on it. Players will want to regulate the game in their own way and the way resources are obtained and shared between players.
	A stronger sensitivity to environmental issues	Players will demonstrate individual behavior during the *ex ante* workshop but a more collective behavior during the *ex post* workshop.
Variables related to the content of the two CappWag workshops and implementation constraints	The repetition of two similar RPGs in a short time (within a few months or even a few weeks)	Increased weariness and boredom among the players. Players will demonstrate a sincere behavior during the *ex ante* workshop but an "insincere" behavior during the *ex post* workshop. The curiosity of players will lead them to (try to) implement new options in the game and to play differently to observe differences ("*explorer behavior*").
	The learning and mastering of the rules of the game	Players will "play better", think quicker and go further into exploring the rules'

		possibilities because they remember them from the first workshop.
	The external and non-controllable constraints related to the workshop implementation (e.g. the available time left for the evaluator to implement the workshop, the change in the number of participants in the workshop, etc.)	Changes will take place in the group dynamics because one or more players are missing. The addition of players during the *ex post* workshop is excluded.

Table 10: Changes that might happen between the ex ante and the ex post CappWag workshops.

Depending on the objectives and content of the participatory process and how it goes, several changes listed on Table 10 are expected to take place by the participatory process' organizers.

If their priority is to favor group work and create or strengthen a collective spirit among the group, they could focus on the strengthening of the capability "being able to speak in front of a group", or on the amount of group discussions that took place during the game (by comparison with the amount of sub-group discussions). If their priority is to favor the autonomy of the group and their capacity to take initiatives, they could focus on the strengthening of the collective capabilities "being able to make a collective diagnosis of a situation" or "being able to collectively design and implement management rules". If their priority is to raise awareness of the importance of protecting natural resources, they could focus on the enhancement of players' water and pollution management (e.g. less environmental fines during the *ex post* game compared to the *ex ante* game, more discussions about pollution and water quantity issues during the *ex post* game compared to the *ex ante* game, etc.). We will observe with attention whether the observed changes in people's capabilities are specific to one single group of players or whether they are shared by all groups of players.

Depending on how the participatory process goes, it is also possible that undesirable changes take place during the *ex post* workshop. A participatory process where there are strong tensions between participants or where a conflict takes place during its course could worsen the relationships of the participants, and consequently of the players during the CappWag workshop. During the *ex post* workshop, players could, for example, cooperate less and play more individualistically. The three capabilities could either not emerge (if they were nonexistent during the *ex ante* workshop) or be weakened.

Despite the efforts made to design two RPGs that would follow the same rules in a different environment (see Chapter 3), it cannot be excluded that the evaluation tool itself might unintentionally impact players' behaviors and provoke changes in the way they act during the *ex post* workshop. Unintentional impacts include the learning of game rules, which could lead

during the *ex post* workshop to the exploration of new options in the game to "keep the fun going or to a certain weariness in the face of a game which has lost its appeal because it is not completely new anymore, as was the *ex ante* game.

2.5. ANALYSIS READING (ABBREVIATIONS, LEGEND, PLAYERS' TRACKING AND ANONYMITY)

In order to facilitate the reading of the following results' analysis, the participants who took part in the CappWag workshops are designated as "Players", followed by their number during the game and the Group they belonged to (e.g. "$P1_{T1}$" for Player 1 from Group T1). The assigned number of the players during the *ex post* workshop implemented with the M1 students (see part 2.2) correspond to their initial number during the *ex ante* workshop. Like this, it is easier to track changes happening at the individual and the collective level between the first and second workshop.

Moreover, we display on the graphs presented in the rest of this chapter:

(i) information concerning the mean of the self-reported individual and collective capacities and individual values of all the members of a group. In the case of collective capabilities, we take into account (when it happens) the lack of value given by players to one of the two observed freedoms. This information is designated by "Group", followed by the group identity (e.g. Group S1). The symbol "Group T1", for example, is therefore based on the mean of the individual value given by players to the measured capacity while taking into account the fact that at least one player did not value it. This is based on the definition of a collective capability that we discussed in Chapter 1, section 3.2.

(ii) In the case of collective capabilities, information concerning the mean of the self-reported collective capacities and individual values of all the members of a group, without taking into account the lack of value given to the observed freedom by one or more players. This information will be designated by "Group bis", including the group identity (e.g. Group S1 bis). The symbol "Group T1 bis", for example, is therefore based on the sole mean of the individual value given by players to the capacity. The representation of this information on the graphs is meant to give participants and practitioners who may not be familiar with the capability approach a symbol they may more easily understand and put in discussion.

In order to ensure the readability of the graphs, values are vertically jittered for better graphic clarity. Players whose symbol has been moved out of the graph have not answered at least one of the two question tackling their capacity (or that of their group) and values. When an *ex ante ex post* evaluation could be realized, arrows on the graphs indicate the evolution of players'

capabilities between the two workshops: plain arrows represent the evolution of the capabilities when it could be properly measured in both workshops; dashed arrows represent the evolution of the capabilities when it could not be properly measured in one of the two workshops (i.e. when data was missing and hence only one of the two dimensions of a capability, or none at all, was measured).

The change in players' numbers for the analysis of the *ex post* workshop does not prevent the understanding of the group dynamics. Unlike the *ex ante* game which represented a management situation with a fixed location of players along the river and an upstream-downstream dynamic, there is no permanent location of players around the lake. In the *ex post* game, any players may be the first one to start playing (see Chapter 3). Their location around the water body is consequently not essential to understanding their behavior.

In order to maintain players' anonymity, they will all be described as male subjects and the pronouns "he" and its derivatives "his" or "him" will be used for every one of them.

2.6. CAPPWAG IN ACTION: THE IMPLEMENTATION OF CAPPWAG ON TWO CASE STUDIES

The CappWag tool was created to evaluate the impacts of participatory processes for water management. It is this objective that has led to its very specific design and content. Several reasons that will be discussed in detail in Chapter 5 (section 4.3) led us to test the CappWag evaluation tool on two case studies that, instead of being participatory processes, are training courses in participatory methods. In the first project, Tunisian environmental officers were trained to use participation tools and methods based on the CoOPLAage methodology (section 3.1). In the second project, an Integrated Water Resources Management (IWRM) course was carried out with first-year Master's students from the University of Montpellier, France (section 4.1).

Even though these two case studies present noteworthy discrepancies, they also share major features that make them interesting case studies for the CappWag evaluation tool (Figure 18).

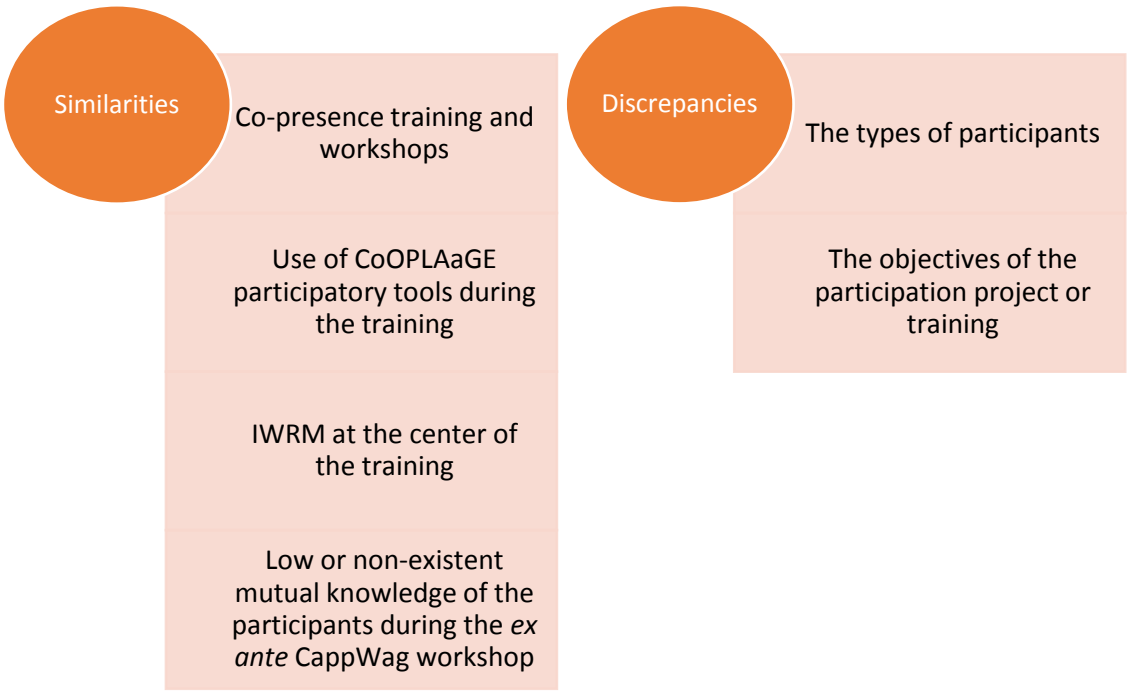

Figure 18: Similarities and discrepancies between the two case studies where the CappWag evaluation tool was implemented.

The types of participants taking part in these projects are notably dissimilar. Local government officers and civil servants attended the CappWag workshop in Tunisia and students attended the workshops in the framework of their course. The content of these projects is also quite different: the PR-OSCAR project aims at professionally training future facilitators of participatory processes, and the Master's course provides theoretical training to students who are then formally graded depending on the results of their practical examination.

The objectives of the participatory processes that were the initial target of the CappWag evaluation tool are the creation of partnerships among local stakeholders, among which are citizens. They would also consist in giving these stakeholders input into the decision-making process.

Because the number of similarities outweighs the number of discrepancies, the two case studies were considered as efficient proxies to allow the researcher to derive general conclusions on the evaluation tool from the results. Indeed, most of the members of our two case studies, just as in a classic participatory process, follow a training course in "co-presence", attending together the same workshops before and/or after the CappWag workshops. The CoOPLAage participatory tools were in both cases at the heart of the training, just as they are used during participatory processes to initiate participants into environmental and social issues related to IWRM. Finally, participants in the two case studies presented mixed levels of knowledge of each other (some

had met and worked together before the first workshop and others had not), but also of participatory issues and tools, just as may be expected in a classic participatory process.

3. THE TUNISIAN CASE STUDY

The first case study was carried out as a single *ex ante* CappWag workshop. It provides information on the measurability of the three individual and collective capabilities at a given time. Their evolution over time will be analyzed with the second case study (section 2.2).

3.1. PRESENTATION OF THE TUNISIAN CONTEXT

This first case study was conducted in the framework of the PR-OSCAR project (Monitoring and applied research program for the development and conservation of agricultural land[14]), implemented in Tunisia between 2016 and 2017.

The program corresponds to the first step in the establishment of a network of observatories supporting the local development of areas targeted by the Tunisian DG-ACTA[15] (the Directorate general for land use and conservation of agricultural land, attached to the Tunisian Ministry of agriculture, water resources and fisheries). This network has been implemented through a national management program for natural resources in the vulnerable territories of six Tunisian governorates (Bizerte, Kairouan, Kef, Sidi Bouzid, and Siliana).

The PR-OSCAR project more specifically aimed at (1) "*assessing the long-term impacts of development actions in [Tunisian] rural areas"*; and (2) "*developing new capacities of innovation concerning the sustainable management and development of natural resources at the local, regional and national level*"("PR-OSCAR" 2018).

In order to reach these two objectives, participatory diagnoses, the construction of a monitoring framework for the targeted territories, the emergence of shared objectives for future planning as well as the strengthening of local actors' capacities were at the center of the project. At the same time, the project aimed at strengthening the cooperation and the autonomy of local farmers and members of the local administration through their participation and their involvement in the above-listed actions.

The last tool included the training of national and local government officers in capacity-building methods and participatory tools. In this context, a one-week training workshop was organized in

[14] PR-OSCAR : « Programme pilote d'observatoire et de recherche appliquée pour l'aménagement et la conservation des terres agricoles »
[15] DG-ACTA : « Direction Générale de l'Aménagement et de la Conservation des Terres Agricoles »

the city of Bizerte, located in northern Tunisia in the eponymous governorate, from 28th of August to 1st of September 2017. It consisted of the training of seven PR-OSCAR participants in participatory planning methods. Among these seven participants, two were members of the DG-ACTA (they will later be named $P4_{T1}$ and $P7_{T1}$, members of the Group T1 during the CappWag workshop). The five other participants were local government officers (engineers, a project officer and a technician). They would be in charge of implementing participatory meetings and workshops with farmers in their respective governorates.

The CappWag workshop was organized on the second day of this training week, on 29th of August. For this occasion, six external participants joined the workshop. These external participants were also local government officers from the governorate of Bizerte or from neighboring governorates (Ariana, Kairouan).

Two CappWag groups were formed. The first one gathered together seven players and the second one six players (see Table 11 for more details). Participants in the one-week training and external newcomers were mixed and divided in two groups. Four researchers were present to facilitate the CappWag workshop: two PhD students (Mr Houssem Braiki and Ms Sarah Loudin) and two senior researchers (Mr Julien Burte, coordinator of the PR-OSCAR project; and Mr Nils Ferrand, in charge of the week of training).

Ex ante workshops (28/08/17)			
Group configuration	Workshop configuration	Facilitator	Winner of the game
Group T1: 7 players	Classic*	Ms Sarah Loudin & Mr Julien Burte	The association of players 4_{T1} and 6_{T1}
Group T2: 6 players	Classic*	Mr Nils Ferrand & Mr Houssem Braiki	Player 2_{T2}

Table 11: Description of the composition of the two CappWag workshops undertaken with the Tunisian participants. *The "classic" configuration corresponds to the structure described in Chapter 3: a game, a 25-question questionnaire and a 10-minute collective debriefing.

The two workshops each lasted about 2h30. The configuration of the workshops was similar for both groups. They were divided into a play of 1h40, followed by 25 to 35 minutes to complete the questionnaire and 30 minutes of collective debriefing. The collective debriefing gathered the two groups together.

3.2. A SYNTHESIS OF THE STATE OF THE CAPABILITIES IN THE TWO GROUPS

In order to facilitate the reading of the following data collected during the CappWag workshops implemented in Bizerte, we summarized the main results in the following Table 12.

	Main information concerning the *ex ante* CappWag workshop
Group T1	• *Winner of the game:* The association of players 4_{T1} and 6_{T1} • *Group dynamic and individual specificities:* collective dynamic with the creation of three "associations" of players. One leader emerged: $P5_{T1}$. • *Individual capability "being able to express oneself in front of a group"*: four players ($P4_{T1}$, $P5_{T1}$, $P6_{T1}$ and $P7_{T1}$) possess it; two players ($P1_{T1}$ and $P3_{T1}$) do not. • *Collective capability "being able to make and implement a management rule"*: one NMR designed and implemented by the whole group (transparency); one NMR designed at the very end of the game (creating a river management committee). No collective capability exists on the scale of the whole group because two players ($P1_{T1}$ and $P3_{T1}$) did not value it. • *Collective capability "making a diagnosis of a problematic situation"*: no collective capability exists on the scale of the whole group. • *Resources and conversion factors*: knowledge about environmental management and participation, work experience; collective spirit.
Group T2	• *Winner of the game*: Player 2_{T2} • *Group dynamic and individual specificities:* collective dynamic despite tensions between the group and $P2_{T2}$ who decided to play to win and the rest of the group. One leader emerged: $P1_{T2}$; one player had difficulties understanding the game: $P3_{T2}$. • *Individual capability "being able to express oneself in front of a group"*: three players ($P1_{T2}$, $P2_{T2}$ and $P4_{T2}$) possessed; $P3_{T2}$ did not. The capability of $P5_{T2}$ is unknown. • *Collective capability "being able to make and implement a management rule"*: one NMR designed and implemented by five out of six players (transparency). Nevertheless, the collective capability exists on the scale of the whole group. • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists. • *Resources and conversion factors*: knowledge about environmental management, empathy and collective spirit.

Table 12: Main observations and analyses derived from the two CappWag workshops held in Bizerte, Tunisia, in August 2017.

3.3. ANALYSIS OF THE *EX ANTE* WORKSHOPS

Is the measurement tool working as a capability-thermometer at a given time? Can we say with certainty that there is or there is not, at the individual or at the group level, a capability?

In the following pages, we will present the three observed capabilities one after another. This structure will allow us to discuss the level of capabilities among each group, and then to compare them.

3.3.1. BEING ABLE TO EXPRESS ONESELF IN FRONT OF A GROUP

GROUP T1

In the first group, the external observations show that two players ($P2_{T1}$ and $P3_{T1}$) did not talk much during the game and stayed in the background during the collective discussions. $P5_{T1}$, however, led the discussions.

This is partly confirmed by the data extracted from the questionnaire. Most of the players report a fairly high or high participation in group discussion, except two of them ($P2_{T1}$ and $P7_{T1}$). These two players explain that they did not talk a lot because "*other persons had the same ideas and discussed them with the group before [they] did*", which we relate to a choice made out of free will. In contrast with the external observations, $P3_{T1}$ reports the highest level of participation in the group discussion, but then states that he "*did not formulate a proposition elaborated enough to be discussed with the group*". We interpret this answer as a sign that he probably discussed other players' ideas instead of his own.

The rating that players gave to their capacity to express themselves in front of the group is rather consensual, as shown on Figure 19. Only one player ($P3_{T1}$) reported a low capacity to express himself in front of a group (despite a reported high frequency), but did not specify why. Three other players ($P2_{T1}$, $P4_{T1}$ and $P7_{T1}$) reported medium capacities. $P5_{T1}$ is the only player who reported a very good capacity to express himself in front of the group. He stated that he "*had no difficulty to express himself in the group, [he] made proposals, [he] accepted their proposals*". This certainly corresponds to the external observations that described him as the group leader. $P7_{T1}$, who did not talk a lot during the game, explained that "*[he is] not very talkative but [he] can express [himself]*", which shows that he stayed rather quiet on purpose and could have talked if he had wanted to.

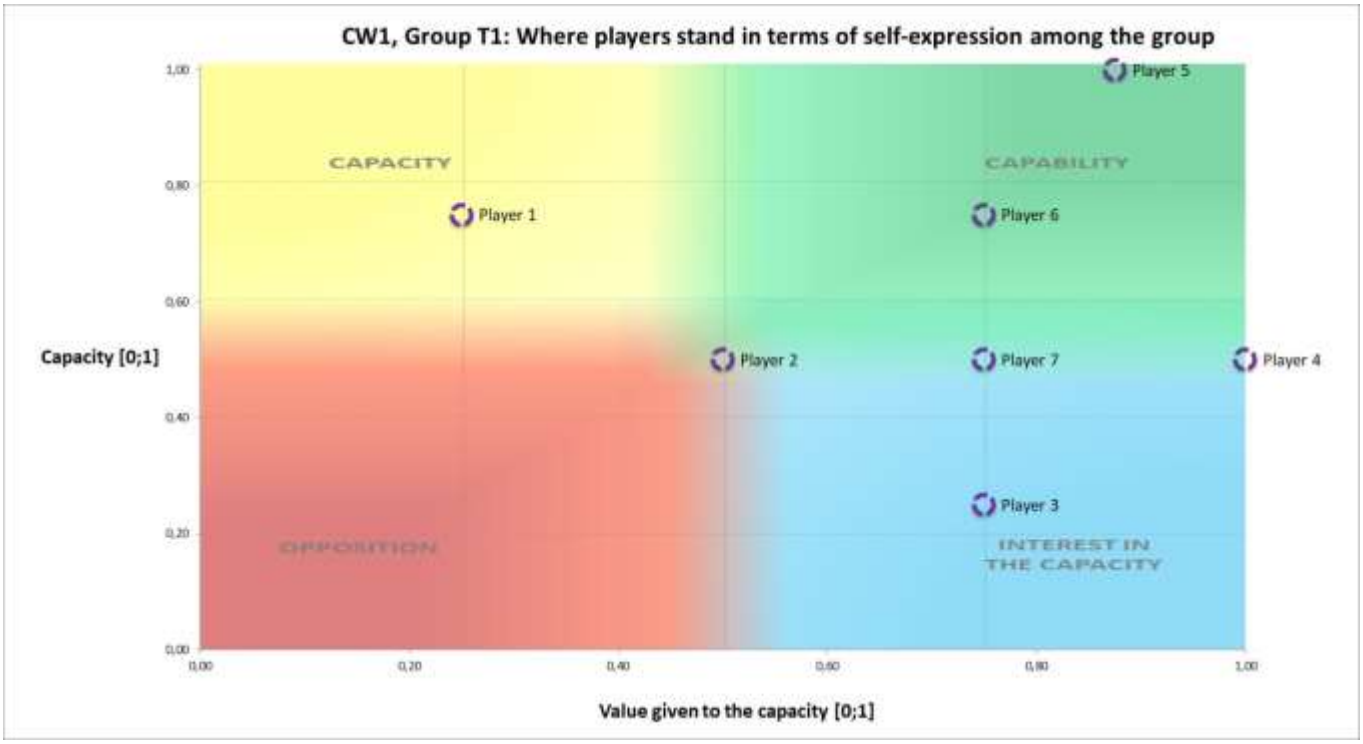

Figure 19: The individual capability "being able to express oneself in a group" of Group T1's players during the *ex ante* workshop.

All players but two ($P1_{T1}$ and to a certain extent $P2_{T1}$) valued the freedom to express themselves in public in the context of the collective management of a water resource such as a river.

According to these measures, we argue that four players ($P4_{T1}$, $P5_{T1}$, $P6_{T1}$ and $P7_{T1}$) did possess the individual capability "being able to express oneself among a group". We similarly argue that $P1_{T1}$ and $P3_{T1}$ do not possess it. In the case of $P1_{T1}$, this is related to the lack of value he gave to the freedom to express himself. In the case of $P3_{T1}$, it is related to his low capacity to do so, even if he thinks it an important capacity to possess in a participatory process. We nevertheless note that his contradictory answer (high functioning, low capacity) is either the sign of (i) a mistake or a lack of understanding of the question in the questionnaire; or (ii) he was forced to speak by other players. No external observation backs this option (ii), we consequently argue that explanation (i) is the most consistent.

In the case of $P2_{T1}$, his answers to the questionnaire do not allow for saying with certainty whether he possessed the capability to express himself in front of the group. The fact that he did not talk much during the game out of choice and not out of constraint, contributes to the unclear state of capability he reports.

GROUP T2

In the second group, the external observations report that all players participated in collective discussions, except $P3_{T2}$ who had difficulties in understanding the game. He was assisted during the game by one of the two facilitators so that he could keep on playing and would not be left behind.

The data extracted from the questionnaire confirm these observations. Most of the players report a high or rather high frequency of discussions with the rest of the group, except $P3_{T2}$, the player who had difficulties understanding the rules. In accordance with the observations of the facilitators, he said that he "*did not sufficiently understand what was happening in the game"* and consequently "*did not formulate a proposition elaborated enough to be discussed with the group*". But he also says "*discussions did not interest [him]*". His lack of interest in the game might have come from his difficulties in understanding it and being able to participate fruitfully in the discussions with the other players.

He was, therefore, the only player to evaluate his capacity to express himself in front of a group as low, even if $P5_{T2}$ considered his as medium, as illustrated below on Figure 20. $P5_{T2}$ explained his medium rating by his "*lack of experience with the job and the situation, and sometimes the lack of order within the group*". He took the management situation simulated in the game seriously and did not think he was always qualified to discuss it with other players.

$P4_{T2}$, who already knew $P1_{T2}$ since they had both been participating in the PR-OSCAR training, explains that the professional relationship they shared helped him: "*we have the same general interest. […] In addition, we are friends more than colleagues, we get along well"*. And indeed, $P1_{T2}$ and $P4_{T2}$ were particularly active during the game and initiated many of the collective actions implemented by the group.

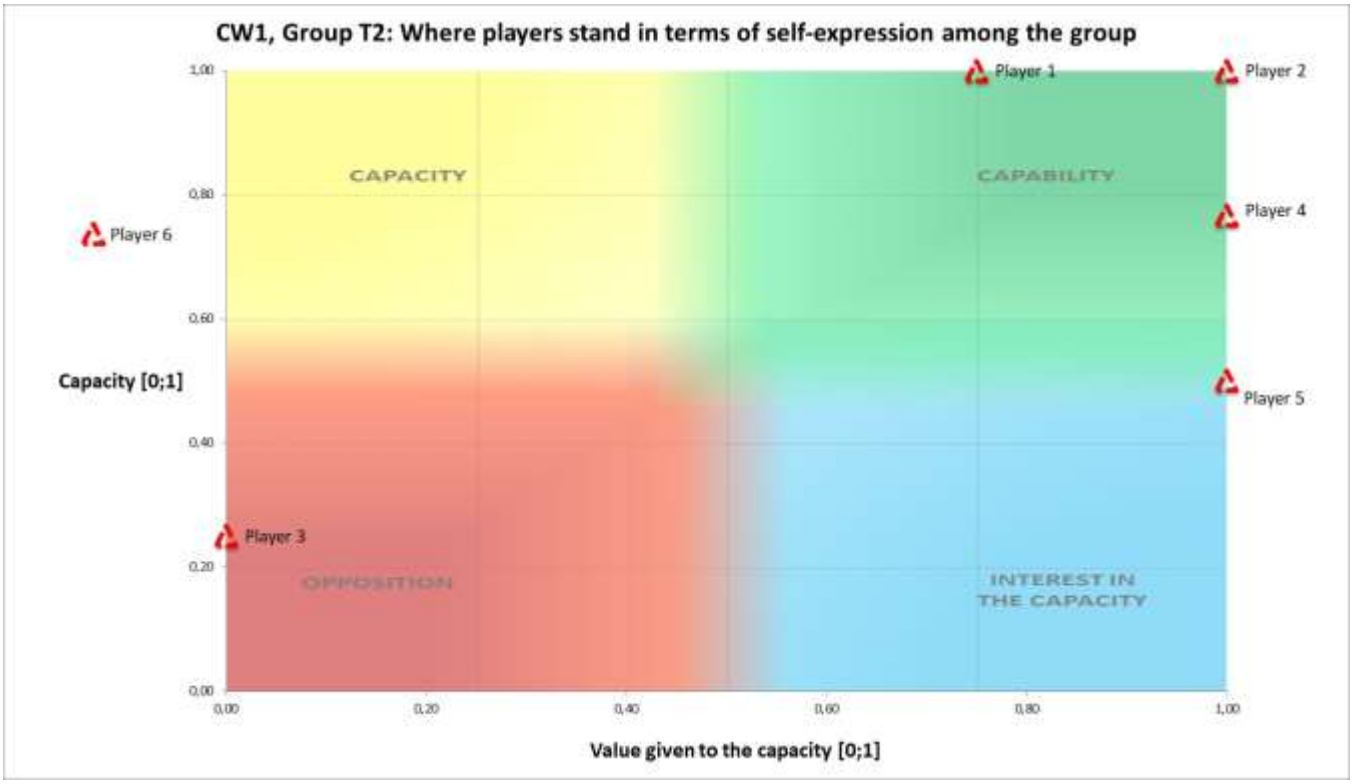

Figure 20: The individual capability "being able to express oneself in a group" of Group T2's players during the *ex ante* workshop.

The value of the freedom to express oneself in a group is contrasted in Group T2. Four players ($P1_{T2}$, P2, $P4_{T2}$ and $P5_{T2}$) valued it. For the three first players ($P1_{T2}$, $P2_{T2}$ and $P4_{T2}$), we can say that they did possess the related individual capability. Moreover, they did choose to turn it into a functioning during the game, since they all often participated in the collective discussions.

In the case of $P5_{T2}$, even if he stated that it was important for him that everyone has a chance to speak in a situation of collective management, he did not himself clearly know if he had the capacity to do so, as demonstrated during the game. We argue that his capability was consequently not "fully developed", even though it mattered to him.

Finally, we state that because of his behavior during the game and his own answers in the questionnaire, $P3_{T2}$ did not possess the capability "being able to express himself in a group". This is related both to his incapacity to do so during the workshop and to his lack of value in the freedom to realize such an action in an environmental management context.

3.3.2. THE COLLECTIVE RULE-MAKING AND RULE-IMPLEMENTATION

GROUP T1

External observations report that two NMRs were implemented on the scale of the whole group of participants.

(1) The first rule is the transparency of their activities: every player had to show its cards to the rest of the group by turning them face down on the table (they were hidden at the beginning of the game).

(2) The second rule is the creation towards the end of the game of a "river management committee" gathering together all the players. This committee brought together the three "associations" that had been created during the game in two sub-groups of two players ($P5_{T1}$ and $P7_{T1}$; $P4_{T1}$ and $P6_{T1}$) and one group of three players ($P1_{T1}$, $P2_{T1}$ and $P3_{T1}$). It is unclear though how players were planning to make this committee work, since the decision took place at the very end of the game.

We relate the creation of "associations" by all the players to the context in which the workshop took place. Indeed, the participants were either working in the field with associations of farmers or in the administration for land planning and natural resource management. They reproduced in the game a management that they work with in their "real-life job". This is also particularly prominent because these associations did not appear in any of the groups of students during their *ex ante* and their *ex post* CappWag workshops.

Data from the monitoring file shows that the transparency rule was initiated by $P1_{T1}$. In addition to the above-mentioned agreements and the two rules that were collectively implemented by the group, several players thought of proposals that were discussed but did not result in a rule. Three of them ($P1_{T1}$, $P4_{T1}$ and $P5_{T1}$) reported discussing a "*polluter pays principle*", which would make players who pollute the most pay the environmental fines. $P1_{T1}$ evoked "*equality*" and $P4_{T1}$ "*social justice*" to explain their idea. These concepts are typically discussed in participatory management and show that these players already have some knowledge of participatory issues and theory. Unsurprisingly, these three players happened to be long-term participants in the PR-OSCAR project and had already taken part in workshops together on participation and innovation issues. It is very likely that they applied in the game this knowledge that they had acquired during previous meetings. $P5_{T1}$ also reported discussing with the group his idea: "*exonerating those who did not play during a tour from paying the fine*". He explained that his proposal was rejected by the group because despite "*numerous negotiations, […] agreements were made two by two*", that is to say among the "associations". At the very end of the game, players merged the three associations into a single "river management committee". The reasons they mentioned to explain their choices are various: "*equality*" ($P1_{T1}$ and $P2_{T1}$), protecting the environment, limiting the pollution level ($P3_{T1}$, $P4_{T1}$ and $P5_{T1}$) and avoiding fines ($P4_{T1}$ and $P6_{T1}$).

Data from the questionnaire show that the group is not homogenous concerning the formulation of NMRs. This is illustrated by a high SD of 0,33. Three players ($P3_{T1}$, $P6_{T1}$ and $P7_{T1}$) stated that they thought of NMRs only once or twice and formulated them while the other players reported

having had many ideas and having present them quite often to the rest of the group. Only $P7_{T1}$ stated that he had no ideas whatsoever, but he did not justify his behavior in the questionnaire. $P5_{T1}$, who was described by the external observations as the group leader, is consistently the player who reported the highest level of formulation and presentation of NMRs of the whole group. In the same way, players reported various levels of acceptance of NMRs when they were discussed with the group, as shown by a SD of 0,24. Only four players ($P1_{T1}$, $P2_{T1}$, $P3_{T1}$ and $P6_{T1}$) stated that they "always" accepted them, while two of them ($P4_{T1}$ and $P5_{T1}$) said they only 'sometimes" did so.

All players except $P2_{T1}$ explained that they validated the NMRs by "*spontaneously giving [their] agreement to the group*". $P2_{T1}$ explained that he did so when he was asked to. He was also the only player to mention a vote, which questions the real existence of such a process. $P5_{T1}$, the group leader, consistently stated that he was "*the one who asked the group to validate the rule*", but also that he "*did not want to confront the collective will of the group*". He explained his statement in details: "*once I decided to do a very polluting and rewarding individual activity because the group did not want to make a collective association*". We understand from this explanation that when the group did not want to invest collectively into cards, $P5_{T1}$ did so by himself. This decision is not related to the design or implementation of NMRs but rather to the pursuit of the goal of the game (gathering the highest amount of wealth units).

Only five players stated that they applied NMRs during the game. The negative answer of $P2_{T1}$ and $P7_{T1}$ contradicts the external observations and their own statements in their monitoring files. We deduce that they probably understood "new management rule" differently from what was explained in the questionnaire (despite the explanation paragraph). This misunderstanding is confirmed by their statement concerning the respect of the NMRs: they explained they respected them, which once again contradicts their previous answer. Among the players who stated they always respected NMRs, one ($P3_{T1}$) explained that he "*did not agree with every rules, but […] followed them because they were collectively chosen*". This demonstrates a high value of collective work.

Three players ($P2_{T1}$, $P5_{T1}$ and $P6_{T1}$) gave reasons for the non-respecting of NMRs, but their arguments actually show that they consider short-term agreements as a "rule". For example, $P5_{T1}$ detailed his statement and said that he "*frankly explained that [he] bought a polluting and lucrative activity in order to intensify [his] activities*". In the same way, $P6_{T1}$ explained that he "*refused once to associate with all players and […] kept [his] association with $P4_{T1}$ because [he] was satisfied and did not need to invest to buy more innovation cards*".

The perception of the group capacity to make and implement NMRs is rather high and consensual, as illustrated by a mean of 0,77 and a SD of 0,20 (see Figure 21). Only one player ($P7_{T1}$) gave it a low rating. He explained that "*members of the group thought about their personal interest*". Another player ($P1_{T1}$) evoked individualistic behaviors during the game, even though he did not consider that it negatively impacts the capacity of the group to make and implement NMRs.

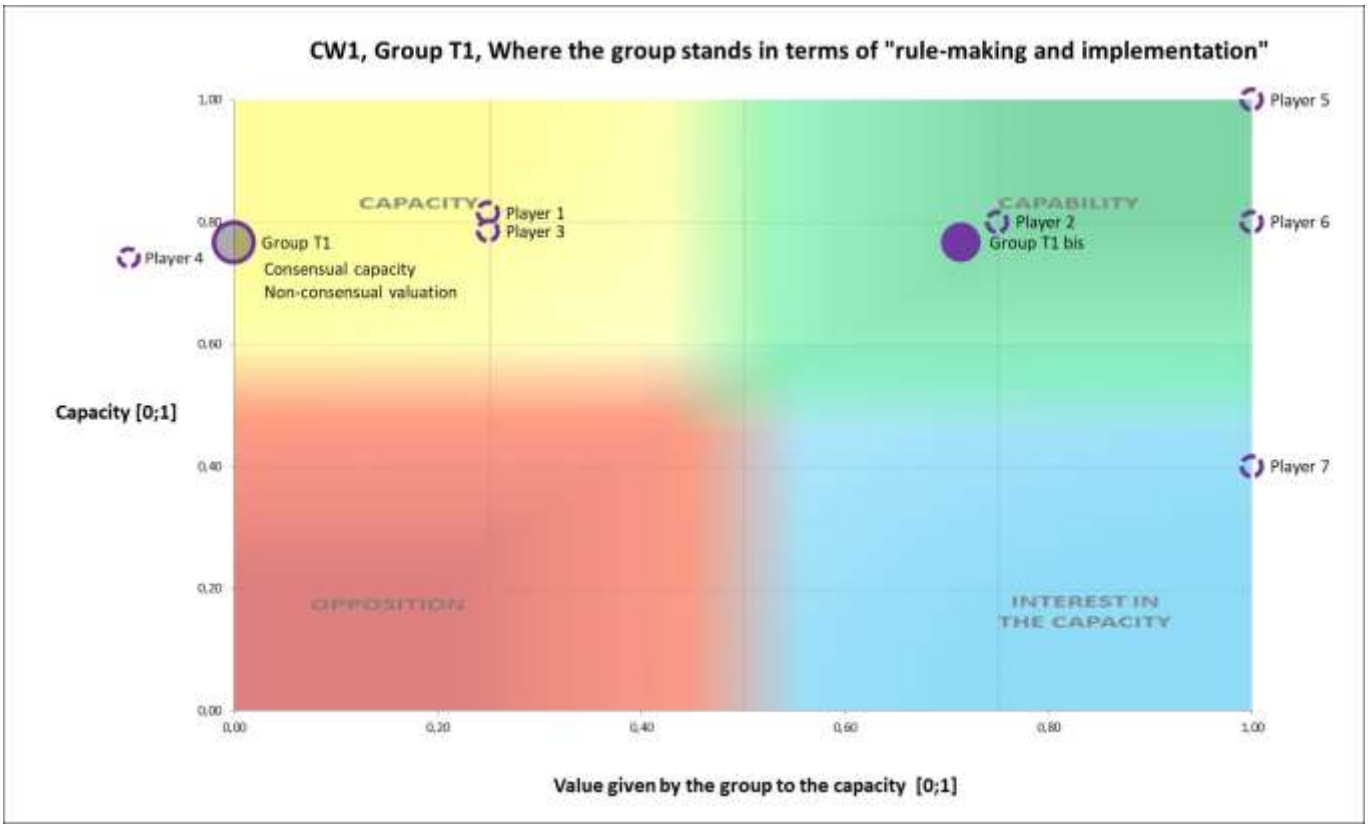

Figure 21: The collective capability “being able to collectively make and implement management rules” of Group T1.

In contrast, the value given to the freedom to perform this capacity in a real context was not consensual among the group, as illustrated by as SD of 0,34. Two players ($P1_{T1}$ and $P3_{T1}$) did not value this freedom, even though the rest of the group did. This is shown by a mean of 0,71. This leads to the impossibility for the collective capability of “being able to make and implement management rules” to exist at the scale of the whole group, even though all the other players answered that they agreed or fully agreed with the proposed statement.

GROUP T2

The external observations show that no NMR was implemented at the scale of the whole group of participants. Instead, many collective agreements involving at least two players took place, and not only between "neighbors" (players sitting side by side or opposite each other at the table). The collective agreements often involved players 1, 4, 5 and 6. $P2_{T2}$ refused to follow the group right from the beginning of the game and $P3_{T2}$ had trouble understanding and even becoming interested in the game. One NMR was implemented by five players: the transparency of their activities. They showed their cards so that they could know how much pollution, water,

wealth and social capital units their activities consumed or produced. $P2_{T2}$ did not join them but participated in the collective agreements made between players concerning the acquisition or suppression of activity cards, or the loan of money between players.

The monitoring files give a better insight into the process of rule-making and implementation that took place in Group T2. $P1_{T2}$, $P4_{T2}$ and $P5_{T2}$ were the three players who thought of the transparency rule. Because $P2_{T2}$ chose not to team up with the other players, he was castigated by the group, even though this collective behavior is only mentioned by one player ($P6_{T2}$). Players did try to discuss with $P2_{T2}$ during the next turns to make him change his mind. The discussions did not go well at the beginning but players progressively found a way to cooperate through other agreements. At the end of the game, the monitoring files show that several players were no longer interested in working together and discussing river management, because they were satisfied with the way they had organized themselves and protected the environment.

The data from the questionnaire show that the group is consensual concerning the amount of rules they thought of and formulated during the game. Two players ($P2_{T2}$ and $P3_{T2}$) did not think of any rule. $P2_{T2}$ was the "rogue player" who opposed the group's only NMR, and $P3_{T2}$ already stated that he was not interested and did not understand the game. All players who had ideas discussed them with the rest of the group "at least once". Both $P2_{T2}$ and $P3_{T2}$ state they remained silent out of choice, because they let other people speak.

The validation of the collective rules by players is not consensual, as shown by a SD of 0,26. Only $P3_{T2}$ states that he never validated these rules, which contradicts the external observations and the statements of other players. The transparency rule was indeed implemented by five players and he was part of that.

Half of the group ($P1_{T2}$, $P4_{T2}$ and $P5_{T2}$) explained that they validated the NMRs by "*spontaneously giving [their] agreement to the group*". Three players mentioned a vote ($P3_{T2}$, $P4_{T2}$ and $P5_{T2}$) – $P4_{T2}$ had indeed mentioned that he wanted to do "a survey" in the group to know other people's mind. This shows the implementation of an elaborated process of collective deliberation and decision-making. $P2_{T2}$ and $P3_{T2}$, the "rogue player" and the "uninterested player", explained that they "*did not want to confront the collective will of the group*", which shows the existence of a collective pressure to make them participate and work together, even if they did not want to. $P4_{T2}$ and $P6_{T2}$ both report that they were the one who asked the group to validate the rule, which shows a certain concern for the formalization of collective agreements and for the one rule that they implemented. It also shows that they took the game seriously.

All players except $P1_{T2}$ (missing data) and $P4_{T2}$ state that they did implement at least one NMR during the game. Even $P2_{T2}$, who did not participate in the one collective rule chosen by the group, answered positively. This leads us to think that there might have been confusion between what a NMR is and what an agreement is. Nevertheless, consistently with the external observations and players' statements from their monitoring file, only $P2_{T2}$ (the rogue player)

stated that he did not often respect all the group rules because he "*wanted to win the game and [...] chose to play in [his] own way*", but he always showed it to other players. $P6_{T2}$ states that he often respected the rules, but that "*[it was possible that] the final balance was stable, so [he] did not necessarily have to respect the rules*" any longer. He was indeed the most downstream player and he could take the liberty to act as he wanted to because he knew how much water was left in the river and how much had to be left for the environment. $P3_{T2}$ (the uninterested player), even though he did respect the NMR, explains that he "*did not give importance to the rules implemented in the game because it is only a game*". This is consistent with his lack of interest in the issues at stake in the game, and also of his difficulties in understanding and playing it.

The perception of the collective capacity to make and implement NMRs is consensual but rather medium. This is shown by a SD of 0,11 and a mean of 0,62 and illustrated on Figure 22. Most of the players gave it a medium rating (2,5 or 3 on a [0;5] scale) because of $P2_{T2}$ who refused to cooperate with the transparency rule. Only $P4_{T2}$ gave it a slightly higher rating because "*the collective opinion is always essential to reach an agreement for the well-being of everyone*". This nevertheless seems more like a general statement and less like an evaluation of the collective capacity.

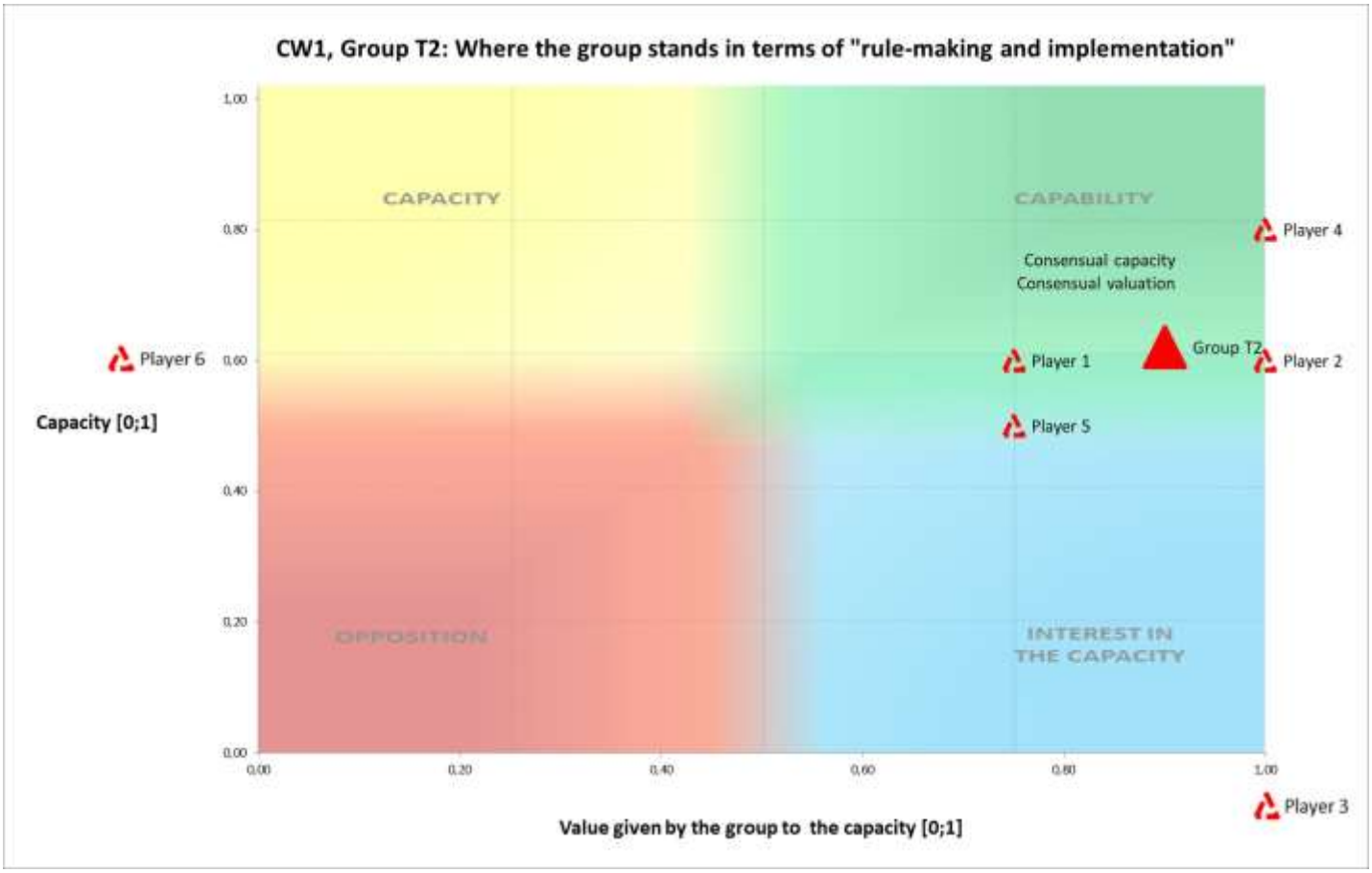

Figure 22: The collective capability "being able to collectively make and implement management rules of Group T2.

The value given to the freedom to perform this capacity in a real context is also consensual among the group but this time, very high. It is shown by a mean of all players' answers equal to 0,90. Only $P6_{T2}$ failed to answer this question.

The medium collective capacity evaluated by players coupled with the high value of the related freedom produced a contrasted indication of the existence of the collective capability "being able to make and implement NMRs". On the one hand, players did value the freedom and their behavior and statements during the workshop show that they thought it was important to work together. All of them, even $P2_{T2}$, tried to live up to this belief. On the other hand, $P2_{T2}$ did prevent the group from fully working together, which is consistently reflected by the mean collective capacity perceived by players. However, we will discuss in Chapter 5 (section 4.1.3) how $P2_{T2}$ acted in such a way only to reproduce what he considers a realistic behavior of Tunisian farmers. To him, the individualistic behavior was a way to make the game more realistic and not a representation of his real beliefs in terms of cooperation in water management.

We consequently consider that the group does possess the collective capability "being able to make and implement its own management rules", even though no NMR at the scale of the whole group was made during the CappWag game and despite the individualistic and non-cooperative behavior of $P2_{T2}$ during the game.

3.3.3. THE COLLECTIVE DIAGNOSIS OF A PROBLEMATIC SITUATION

GROUP T1

External observations do not report that a collective diagnosis involving the whole group was made concerning the way the socio-ecosystem simulated in the game works.

The data extracted from the questionnaire tend to show on the contrary that a collective diagnosis was indeed made during the game, although it does not specify on which scale (the whole group or sub-groups). Players thought they all understood in the same way how the river and its uses work, which is shown by a low SD of 0,13 and a very high median of 1. The frequency of discussions between players is equally high and consensual among the group (median of 1; SD of 0,14). Every single player of the group stated that the discussions helped them to understand how the river works. As $P6_{T1}$ explained, "*when the group paid fines, we discussed during the next round the causes behind it and searched for strategic and social solutions*". This shows that players tried to understand how the games worked and how to solve together the environmental issues while making sure no one was left behind in terms of wealth and social capital units. Another aspect of the collective diagnosis was evoked by $P1_{T1}$, who explained "*depending on the year (dry, wet, normal), we can judge the result concerning the availability of water*". The anticipation of the climate impacts on water availability shows that a collective reasoning took place among the group.

The identification of actions to implement during the game is less consensual among players, which is shown by a median of 0,50 and a SD of 0,24. Two players ($P3_{T1}$ and $P6_{T1}$) stated they never individually identified actions to modify the game situation. Nevertheless, they all recognized that the interactions with other players helped them to do so.

Even more importantly, many players stated that they were involved in the group discussion and the common effort to reduce the pollution and protect the river. Only one player ($P1_{T1}$) stated "*there are players who are not very aware of the water scarcity in the river, especially during dry years*". He consequently gives a medium rating to the capacity of the group to identify potential management problems (along with $P4_{T1}$ and $P5_{T1}$, despite their positive comments). Despite their medium ratings, the global mean of players' answers is overall quite high (0,80) and consensual (SD of 0,11), as shown on Figure 23.

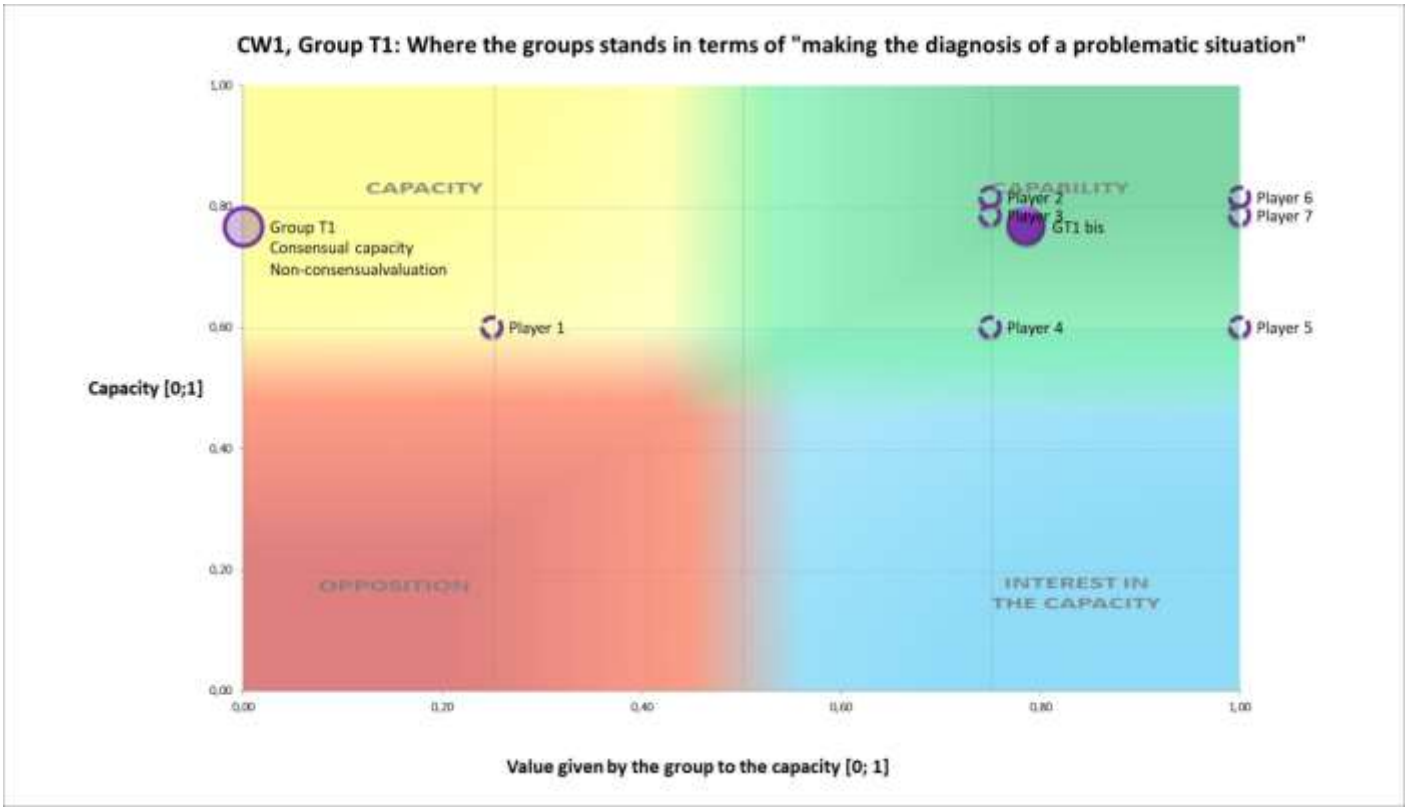

Figure 23: The collective capability "being able to make a diagnosis" of Group T1.

Regardless of the high collective capacity of the group and the fact that they apparently did make a diagnosis together during the game, the mean of the value given by players to the freedom to make a collective diagnosis in order to effectively manage a river is high (0,79) but not consensual. One player ($P1_{T1}$), just as for the collective capability "rule-making", did not think it is a valuable freedom for a group to be able to make a diagnosis together in a water management context. Because of this negative value given by one player, the collective capability at the scale of the whole group cannot exist. However, we note that this did not prevent the group from actually making a collective diagnosis of the situation during the game… or $P1_{T1}$ from benefiting from it.

GROUP T2

External observations do not report that a collective diagnosis involving the whole group was made concerning the way the socio-ecosystem simulated in the game works. On the contrary, the facilitators noted that one player ($P3_{T2}$) clearly had difficulties in understanding the game and they had to help him play. The other players did not sufficiently help him and instead spent time discussing together how to improve their collective management. This tends to show that

there was no collective diagnosis made on the scale of the whole group of players, since one of them was left behind and could not count on the other players for help (even though he did not necessarily ask for it).

The data extracted from the questionnaire show that players have a consensual opinion concerning the shared understanding of the way the river works and that they discussed quite frequently the reasons behind the problems they experienced during the game. This is respectively shown by medians of 0,83 and 1, and SDs of 0,18 and 0,14. Only one player ($P3_{T2}$) did not think the discussions helped him to understand the functioning of the river and its related management issues. This confirms the external observations: $P3_{T2}$ also felt that other players were not helping him. $P2_{T2}$ (the rogue player) for example explains "*to solve the pollution problem, the discussion showed that we must all intervene"* and $P4_{T2}$ that *"the main problem is the "non-agreement" between the uses [of the river] to reach a collective well-being […]*". These remarks show that there was a real interest among the group to understand and manage the game together. The identification of actions to modify the game situation was not done by all the players of Group T2. Two players stated they never identified any actions ($P3_{T2}$ unsurprisingly, but also $P5_{T2}$). Nevertheless, except $P3_{T2}$, all players stated that the interactions with the rest of the group were helpful, which is illustrated by a high median of 1. Because of the lack of help that $P3_{T2}$ received from other players to understand the game, we state that no functioning "diagnosis" was realized, even though this might very well have happened on the scale of smaller groups of players.

In a similar way, all players except $P3_{T2}$ gave a medium rating to their individual capacity to identify potential management problems in the game (five players rate their own capacity with a 3 on a [0;5] scale). $P3_{T2}$, who evaluated his own capacity as non-existent, does recognize that the collective capacity of the group is better than his own (but still medium). Other players consensually and similarly consider it as either medium or good, as illustrated on Figure 24. $P1_{T2}$ explains for example "*the group discusses these management issues during the moments of discussion and tries to find compromises*". $P4_{T2}$ even makes the link between their understanding of the game as players and their real-life profession: "*everyone comes from the agricultural field, engineer and technician, so we meet these problems every day when we contact farmers*". Consequently, the perceived collective capacity of the group is medium.

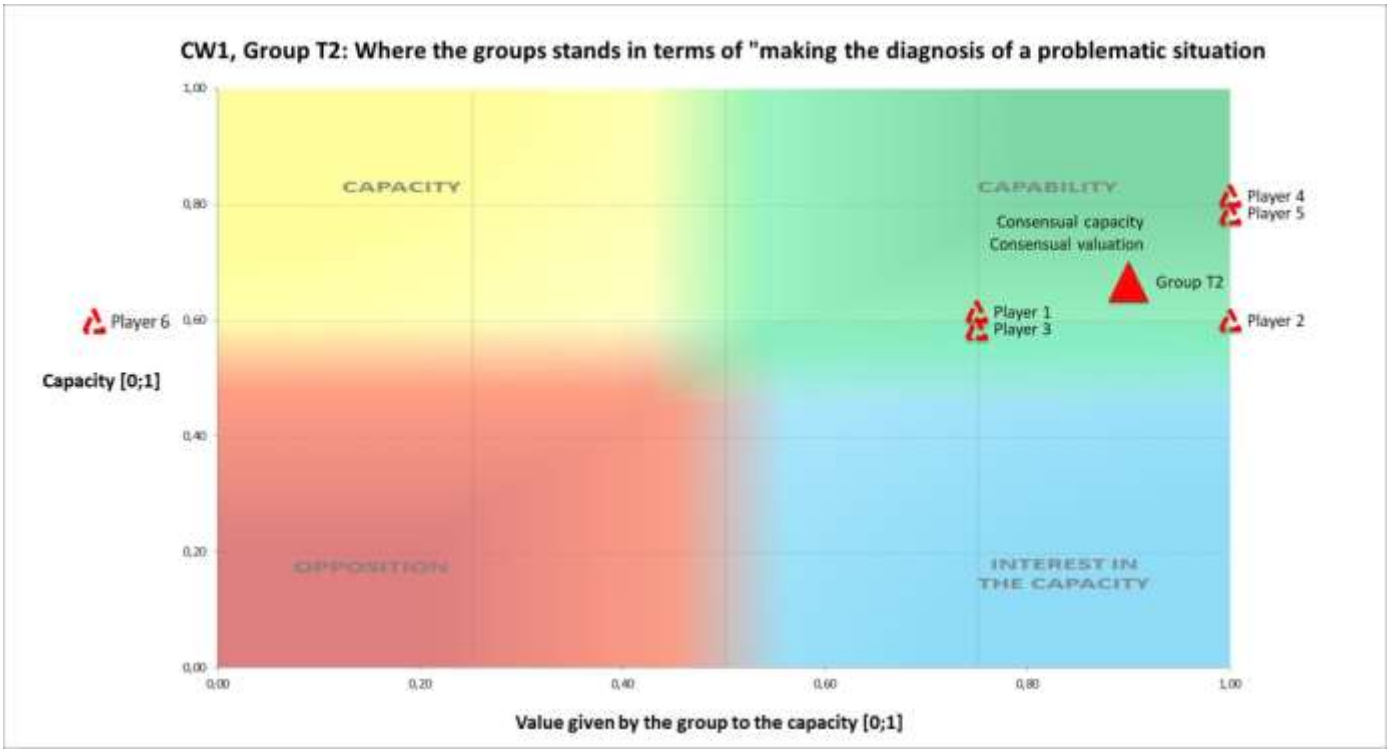

Figure 24: The collective capability "being able to make a diagnosis" of Group T2.

The collective value given by players to the freedom to make a collective diagnosis in order to effectively manage a river is consensual and high. This is illustrated by a low SD of 0,13 and a mean of 0,90. $P6_{T2}$ is the only player who did not answer the question.

Consequently, we argue that, because the group does possess a rather medium but existing collective capacity to make a diagnosis and because its possession is valued by all of the players, Group T2 does possess the collective capability "making a collective diagnosis of a problematic situation". Even though $P3_{T2}$ was left behind during the collective discussions, he did recognize that the group discussions helped him and he did not prevent the group from understanding, discussing and planning ways to change the course of the game. Moreover, the short time dedicated to collective discussions might have forced the players to make a difficult choice and move forward as a group acting together instead of spending time helping $P3_{T2}$, especially since the facilitator was also there for him.

3.3.4. RESOURCES AND CONVERSION FACTORS

As described in Chapter 1, resources correspond to material or non-material goods that are relevant to the agent or the group of agents to possess one of the three capabilities that we observe in the game.

In the case of the CappWag experiment, we argue that material goods are irrelevant. Indeed, participants are confronted with a simulated situation of water management. They consequently did not make use of any kind of material goods (e.g. money, access to building, land or natural resources of any kind, etc.) that they would use outside the game, in a real management situation. We argue that, instead, non-material resources are relevant and will be analyzed below. These correspond to the knowledge that players possessed about the other players (their job, their personality, their interest and values, their network and relationships with other players), their experience (life experience, job experience, especially their habits of working in a group, their education) and their social skills (their empathy, their capacity to handle conflicts and to speak with people, their leadership, their capacity to anticipate people' moves and strategies). These non-material resources were observed at the individual level (players answered saying how much they used them during the game), but also at the collective level. Indeed, players evaluated how much the group had used these types of resources.

The other major asset that we look at among the groups of players is their conversion factors. These can be of different sorts: organizational conversion factors (know-how related to life experiences or professional experiences – these are closely related to the resource above mentioned), social conversion factors (the social norms in effect in the group, the good/bad/collective/individual atmosphere in the group, power relationships among players, gender roles, etc.) and personal conversion factors (cognition, social position, personal objectives in the game). A fourth category of conversion factors, environmental conversion factors, correspond here to the settings of the game and the variation of the environmental variables (pollution, water), depending on the pre-set change in climate years.

GROUP T1

The behavior of the players and their statements (about their individual capabilities and the collective capabilities of the group) show that several of them possessed knowledge of environmental management and participation. Indeed, two players ($P1_{T1}$ and $P4_{T1}$) introduced into the collective discussions the idea of implementing the "*polluter pays principle*" to promote "*equality*" in the group ($P1_{T1}$) and the idea of implementing a tax on a polluter because of "*social justice*". All players also demonstrated this knowledge by quickly gathering into "associations", replicating forms of management applied at the local level in Tunisia to manage land natural resources.

Players consensually rated the atmosphere in the group as good, which is demonstrated by a median of 0,80. Nevertheless, two players ($P3_{T1}$ and $P7_{T1}$) rated it only as medium, without giving a clear explanation for it. $P5_{T1}$, who judged it very good, explained "*at the beginning, it was egoistic*", and "*during the first tour, the atmosphere was 2-4 [out of 10] and then it evolved until it reached 9-10 in the 5th tour*". This evolution from an egoistic and individualistic atmosphere to a more collective one where all players gathered to create a management committee probably

explains the answer of the two other players. $P3_{T1}$ also stated in his evaluation file that he "*did not agree with every rules, but […] followed them because they were collectively chosen*" (see section 3.3.2). This demonstrates a high value given to collective work and to the respect of collective decisions.

This atmosphere among the group was mixed. It was half-focused on winning the game individually or in pairs and half-focused on a group win. All of the players stated that they wanted to win the game. Respect for the environmental objectives is the center of players' concern.

During the CappWag game, the majority of players reported that they were mainly influenced by two resources, as illustrated on Figure 25: their experience at work (especially in participating in group work and their capacity to speak in public, which is a social skill that might also derive from work experience. Indeed, five players explained that they are "development project officer" or "agronomist or hydraulic engineer". All the players were actually working in the field of local development or environment administration, which, once again, is strongly reflected in the way they played and acted together during the game. One major conversion factor appears to have influenced their behavior as well: their collective spirit (as we understand it, especially towards the end of the game).

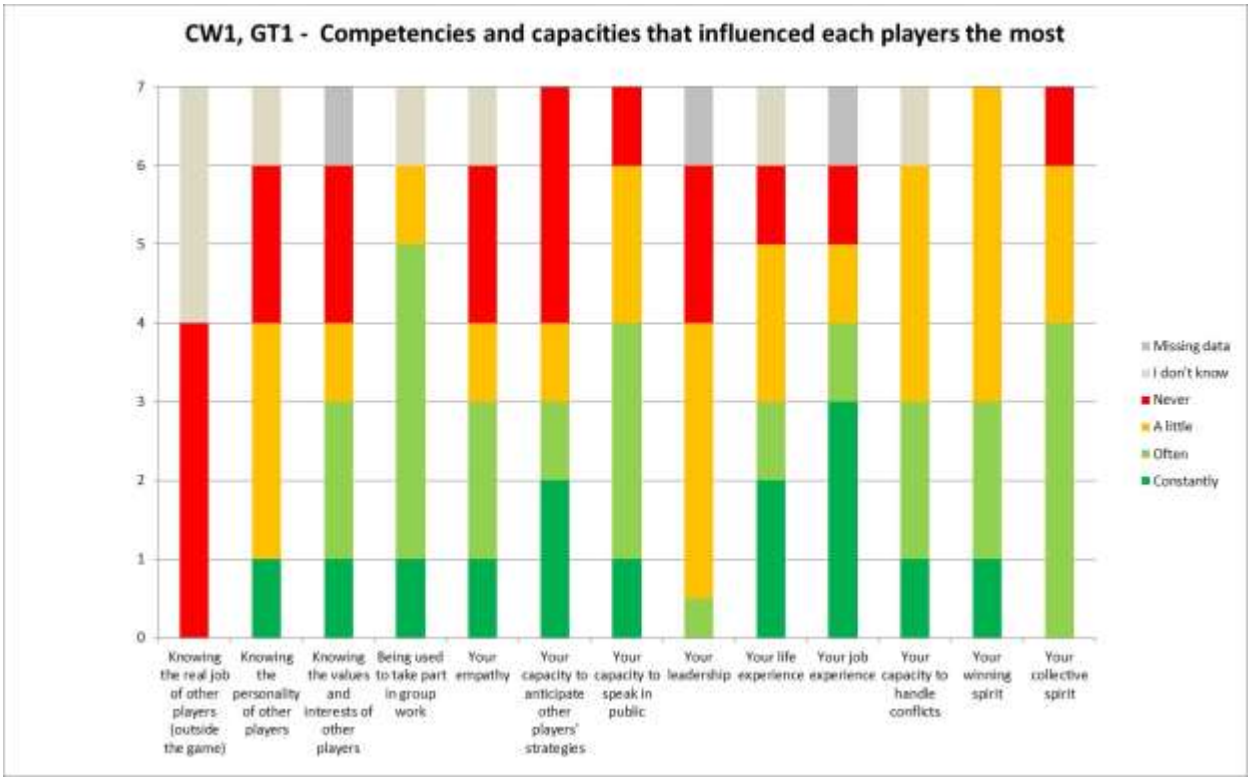

Figure 25: The main resources and conversion factors that influenced the behavior of the players in Group T1 when they played the ex ante CappWag game.

Many players had difficulties in identifying, at the group level, the most influential resources and conversion factors that dictated the way the group worked together. The collective spirit of the group was acknowledged by most of the players as the common conversion factor that linked them. $P1_{T1}$ confirms that their profession as animators (an organizational conversion factor) had a strong influence on their collective game.

GROUP T2

The behavior of the players and their statements show that they all possess knowledge about environmental management, just like the players of Group T1. As $P4_{T2}$ put it, "*everyone comes from the agricultural field, engineer and technician, so we meet these problems every day when we contact farmers*".

The external observations show that the atmosphere in the group was tense at the beginning of the game, mainly because of P2's behavior. As the game advanced, it improved and became more relaxed. Players were even reported to have fun during the game. They consensually rated the atmosphere as good, which is demonstrated by a median of 0,75. Nevertheless, three of them describe it in a mixed way, with both positive and negative qualifying terms. For example, $P5_{T2}$ describes it as egoistic, authoritarian, kind, collaborative and empathetic. P2, the rogue player, goes for "*acceptable, sometimes authoritarian*". This collective atmosphere pressuring players to work together was an important conversion factor for the group, even though it meant that at least two players sometimes felt constrained.

All of the players stated that respect for the environmental objectives during the game was at the center of their concern. $P6_{T2}$ is the only player who attached more importance to environmental and social objectives than to winning the game. The rest of the players often answered that they also cared about these objectives but without giving up on the individual goal of the game. Only two players ($P3_{T2}$ and $P4_{T2}$) stated they were too absorbed by the game and the discussion to actually pay attention to the individual objective to win.

During the CappWag game, the majority of players reported that they were influenced by two main resource and conversion factors, as illustrated on Figure 26: their empathy and their collective spirit. On the contrary, they report never, or very seldom, calling on their knowledge of other people's profession or personality, or their winning spirit. $P6_{T2}$ is the only player who stated that this personal conversion factor strongly influenced him. This was certainly demonstrated by his behavior during the game.

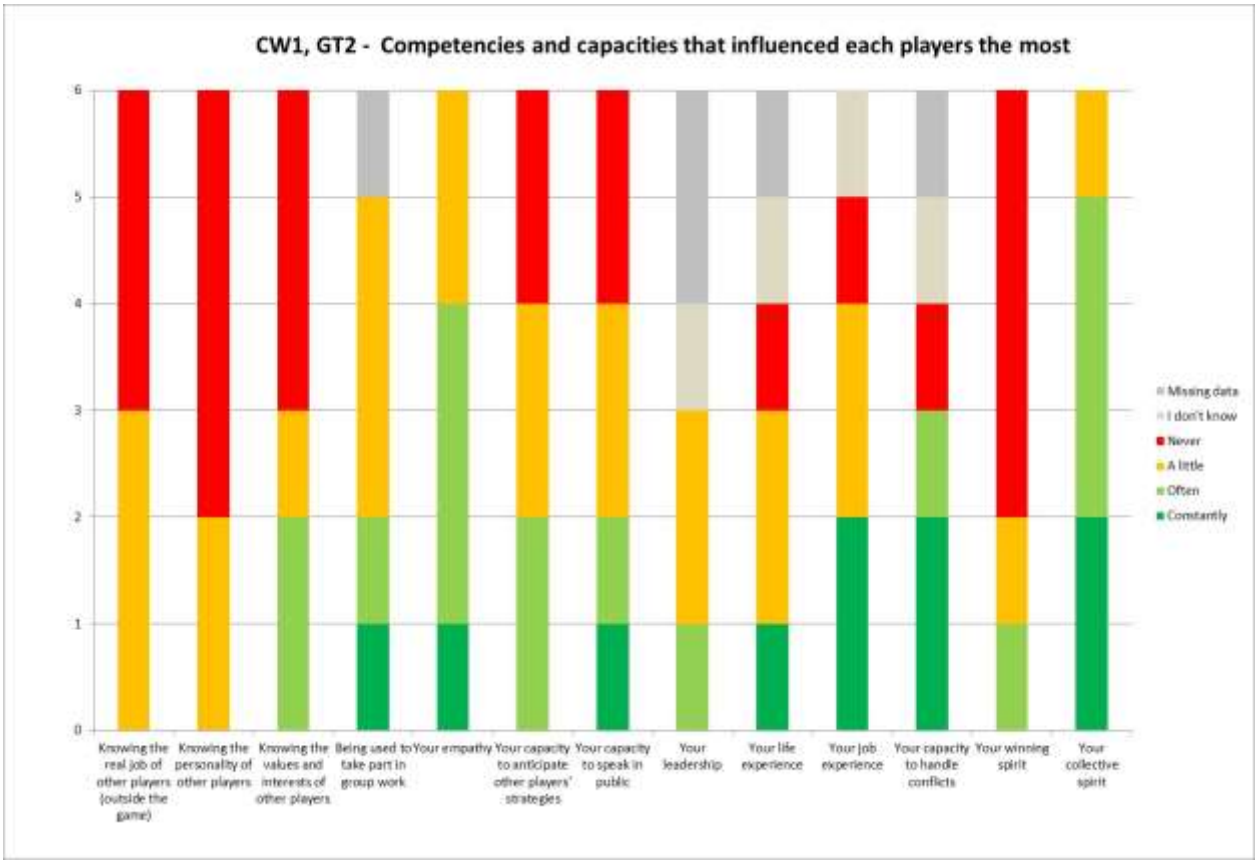

Figure 26: The main resources and conversion factors that influenced the behavior of the players in Group T2 when they played the ex ante CappWag game.

When we asked the players of Group T2 which resources and conversion factors had influenced and helped the group during the game, their experience in participating in group work was the only resource that gained a majority of votes. This is explained by their profession. It is interesting to note that a minority of players thought that knowledge and experience related to their work influenced them during the game, but think that this is the case for the rest of the group.

3.3.5. A COMPARISON OF THE *EX ANTE* COLLECTIVE CAPABILITIES BETWEEN THE TWO GROUPS

The two groups participated in identical and controlled CappWag *ex ante* workshops. It is consequently possible to compare their results in terms of collective capabilities.

The comparison of the results for the two groups (Figure 27) illustrates two different group dynamics related to rule-making and implementation. Even though no NMR was implemented at the scale of the whole Group in T2 and even though their mean collective capacity is lower than

the one of Group T1, only this group possessed the capability to do this. Indeed, all its members valued the freedom to be able to make and implement their own rules in a context of collective resource management.

On the contrary, Group 1 was the most dynamic in terms of long-term agreements and then rules, but two of its members did not value the capability. As visible on Figure 27, players from Group T1 are much more scattered than players from Group T2. This shows that they did not share a similar vision concerning the importance of the capability. Hence, despite a higher mean collective capacity compared to Group T2, they did not possess the collective capability "rule-making and implementation".

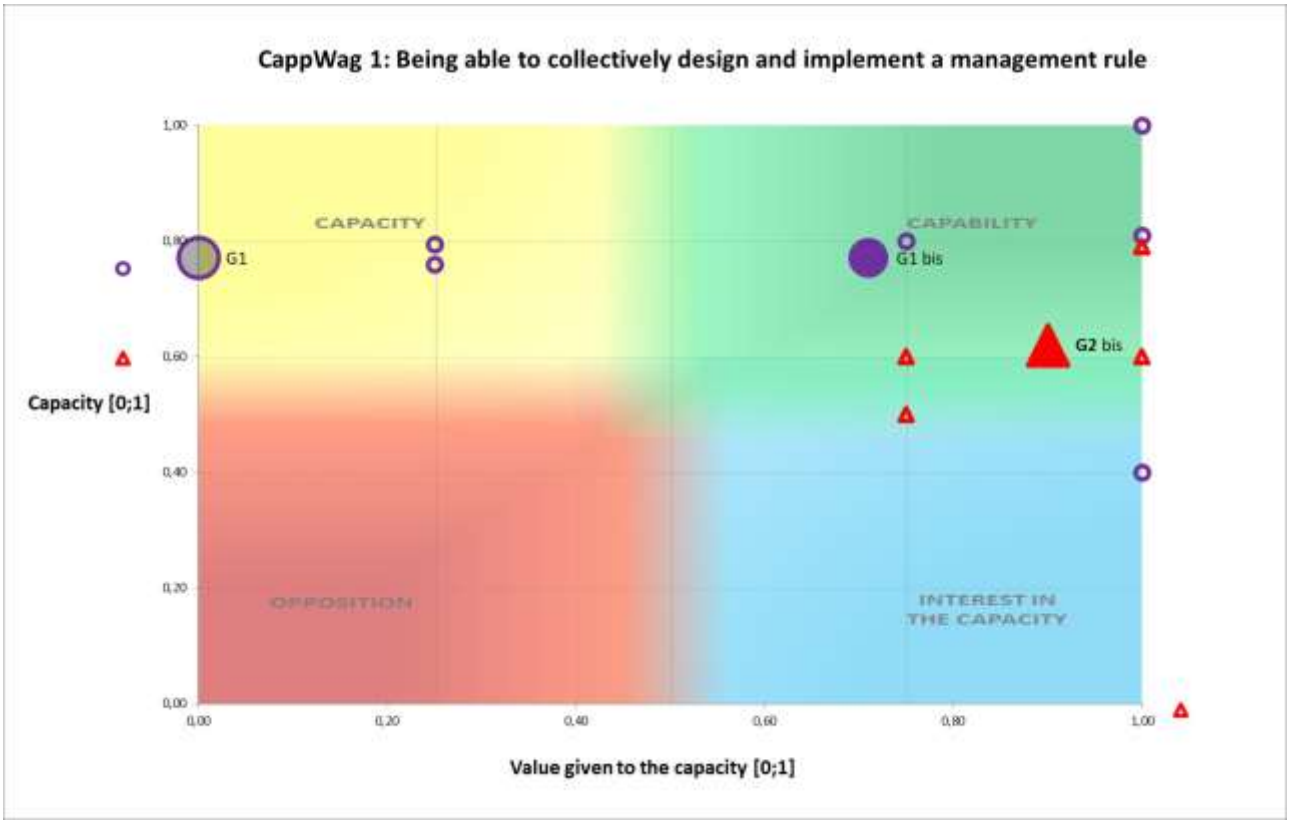

Figure 27: The collective capability "being able to make and implement its own management rules" of Groups T1 and T2.

Groups T1 and T2 show different patterns for the "collective diagnosis" capability that are very close to the ones shown for the other observed collective capability "rule-making and implementation".

Indeed, Group T1 did not possess the capability because one of its members did not value the related freedom, even though they possessed a higher collective capacity than Group T2. Nevertheless, we notice that, apart from this one player, the rest of the group showed less

important variations in their opinions concerning this capability than for the previous one (rule-making and implementation).

Group T2 is the only group to possess the collective capability "being able to make a diagnosis". Once again, its players showed a relatively similar vision of the capability, as visible on Figure 28.

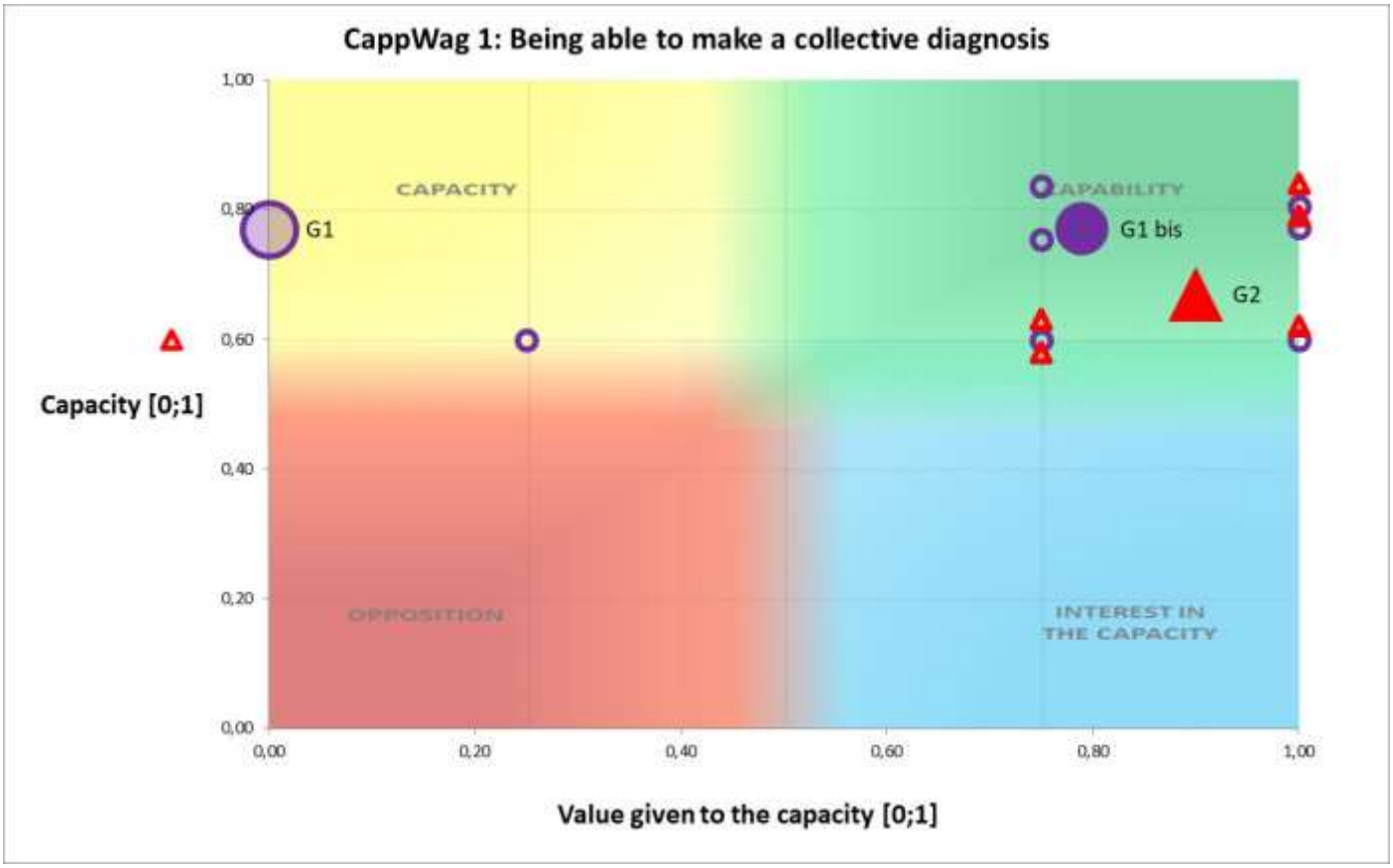

Figure 28: The collective capability "being able to make a diagnosis" of Groups T1 and T2.

Based on the evaluation of both Groups, different objectives could be pursued during the training, after the implementation of the *ex ante* CappWag workshop. In the case of Group T1, it would have been interesting for players and trainers to focus on the importance of rule-making and implementation and diagnosis-making in the context of participatory and collective management of water resources. This would have allowed for a better understanding of why these capabilities are not necessarily considered as important by participants, especially since it may have reflected the opinions of other PR-OSCAR participants who did not take part in the workshop, and also of local stakeholders whom these participants will work with after their training. In the case of Group T2, since both capabilities were already valued, the focus for

trainers and participants could instead be to reinforce their collective capacity to achieve these actions.

4. THE MASTER'S STUDENTS CASE STUDY

This second case-study provides information on the use of two CappWag workshops as an *ex ante ex post* evaluation tool.

4.1. PRESENTATION OF THE STUDENT CONTEXT

This second case study consists of two workshops implemented with first-year Master's students from the Master Eau ("*Water Master*") supervised by the University of Montpellier, France. This two-year Master's degree is divided into five thematic sections: (1) water and coastal zones; (2) hydrogeology and the environment; (3) water and agriculture; (4) hydrology, risks and the environment; (5) contaminants, water and health and (5) water and society ("Master Eau" 2018).

Around forty students coming from every section followed an IWRM course spread over a three-month span. During this course, students followed online theoretical courses on participatory methods and tools through a MOOC[16] called "TerrEau & Co – Deciding and managing water together in our territories"[17]. Courses notably focus on participatory planning, participatory modeling, group facilitation or participation engineering. In addition, students were divided into ten working groups and were assigned practical case studies. These corresponded to management issues on watersheds to analyze with the tools and methods learnt during the course.

The course was overseen by Mr. Nils Ferrand, a researcher from the G-EAU researcher unit (Irstea, Montpellier) and involved several fellow researchers, some of whom contributed to the CappWag workshops by facilitating the games during the *ex ante* and the *ex post* sessions (see Table 13). The five groups of students did not receive the same treatment during the *ex ante* CappWag workshop: two of them took part in a "classic" configuration workshop, which corresponds to the structure described in Chapter 3: a game, a 25-question questionnaire and a 10-minute collective debriefing; two of them took part in a "slightly simplified" configuration workshop, which corresponds to the same structure as the classic configuration, except that the questionnaire has been reduced; finally, one of them took part in a "heavily simplified" configuration workshop, which corresponds to a game directly followed by a collective debriefing and without a questionnaire. Indeed, in addition to the measurements, we wanted to

[16] *Massive open online course*
[17] This MOOC was funded by the Agreencamp project. It is available at https://sites.google.com/site/mseau2013/

know whether the protocol could be simplified for future workshops and hence we tested new treatments with Groups S3, S4 and S5.

Ex ante workshops (11/10/17)				*Ex post* workshops (12/01/18)			
Group configuration	Workshop configuration	Facilitator	Winner of the game	Group configuration	Workshop configuration	Facilitator	Winner of the game
Group S1 : 9 students	Classic*	Ms Raphaëlle Ducrot	Player 6_{S1}	Group S1 : 9 students	Slightly simplified	Ms Raphaëlle Ducrot	Players 3_{S1} and 6_{S1} (joint winners)
Group S2: 8 students	Classic	Mr Nils Ferrand	Player 8_{S2}	Group S2: 8 students	Slightly simplified	Mr Nils Ferrand	Player 3_{S2}
Group S3: 9 students	Heavily simplified*	Mr Patrice Garin	Player 4_{S5}	Group S3: 9 students	Slightly simplified	Mr Patrice Garin	Players 2_{S3} and 5_{S3} (joint winners)
Group S4: 7 students	Slightly simplified*	Ms Sarah Loudin	Player 6_{S4}	Group S4: 6 students	Slightly simplified	Ms Emeline Hassenforder	Player 3_{S4}
Group S5: 8 students	Slightly simplified	Mr Bruno Bonté	Player 4_{S5}	Group S5: 8 students	Slightly simplified	Ms Laura Seguin	Player 6_{S5}

Table 13: Description of the composition of the two CappWag workshops undertaken with the students.

The first CappWag workshop was held on 11th of October 2017 and corresponded to the first class of the students for this course (see Figure 29). This moment of the year also corresponded to the beginning of their first semester as Master's students, the first course having started in September 2017.

Figure 29: The integration of the CappWag workshops (blue cells) to the MOOC-based course.

The Master Eau is a multidisciplinary Master's which brings together students from various disciplines and universities. At the beginning of the first semester, many students did not yet know each other. The second CappWag workshop was held on 12th of January 2018 and corresponded to the last class of this course for the students.

The composition of the groups was initially up to the students who were asked to create five groups of relatively equal size with the assistance of the facilitators. After that, they were randomly dispatched along the river and the lake (see Chapter 3 for more information on the design of the placement strategy). None of the five groups corresponded to the gathering of an entire "IWRM case study group". This means that the group work students had to realize during their three-month training was not necessarily realized with the players of their CappWag group. Hence, each of the five groups of players were homogeneously heterogeneous.

The composition of the student groups was identical between the first and the second workshop, except for two groups (Groups S4 and S5) where two students stopped following the course and were consequently absent for the *ex post* workshop. In order to disrupt the

dynamic of the group as little as possible, the two students were not replaced. The facilitators who attended both workshops kept working with the same groups (Groups 1, 2, 3). The facilitators of Groups S4 and S5 during the first workshops were replaced.

Thirteen students joined the IWRM course along the way and missed the first workshop. Instead of gathering them into two new groups so that they would participate in the experimentation as their classmates did, they were asked to become "observers" and assist with the monitoring of the evaluation process. Two or three observers were allocated per group.

4.1.1. A SYNTHESIS OF THE STATE OF THE CAPABILITIES FOR THE FIVE GROUPS

In order to facilitate the reading of the following data collected during two CappWag workshops implemented with the Master's students, we summarized the main results in the following Table 14.

	Main information concerning the *ex ante* CappWag workshop	Main information concerning the *ex post* CappWag workshop and differences with the *ex ante* workshop
Group S1	• *Winner of the game*: Player 6_{S1} • *Group dynamic and individual specificities:* three foreign students ($P2_{S1}$, $P7_{S1}$ and $P8_{S1}$) participated less in the group discussions and dynamic. No group leader seemed to emerge. • *Individual capability "being able to express oneself in front of a group"*: five players ($P1_{S1}$, $P3_{S1}$, $P4_{S1}$, $P5_{S1}$ and $P6_{S1}$) possess it and two ($P2_{S1}$ and $P7_{S1}$) do not. The capability of $P9_{S1}$ is unknown (missing data). • *Collective capability "being able to make and implement a management rule"*: one NMR designed and implemented by the whole group (transparency). No collective capability exists on the scale of the whole group because two players ($P4_{S1}$ and $P7_{S1}$) do not value it. • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists among Group S1. • *Resources and conversion factors*: social resources (anticipation of each	• *Joint winners of the game*: Players 3_{S1} and 6_{S1} • *Group dynamic and individual specificities:* contentious atmosphere. The three foreign students ($P2_{S1}$, $P7_{S1}$ and $P8_{S1}$) once again participated less in the group discussions and dynamic. • *Individual capability "being able to express oneself in front of a group"*: all players possess the capability except $P8_{S1}$ (missing data). Three players ($P6_{S1}$, $P7_{S1}$ and $P9_{S1}$) report a higher capability and three players ($P1_{S1}$, $P3_{S1}$ and $P4_{S1}$) report a lower one. The evolution over time of the capability of two players ($P2_{S1}$ and $P8_{S1}$) is unknown (missing data). • *Collective capability "being able to make and implement a management rule"*: no NMR was implemented and the collective capability still does not exist on the scale of the whole group because two players ($P4_{S1}$ and $P6_{S1}$) do not value it. • *Collective capability "making a diagnosis of a problematic situation"*:

	other's strategies, public speaking); strong collective spirit.	the collective capability exists among Group S1. • *Resources and conversion factors*: knowledge of the personality and the values and interests of other players, global weakening of the collective spirit of players.
Group S2	• *Winner of the game :* Player 8_{S2} • *Group dynamic and individual specificities: united group playing collectively. One player (*$P7_{S2}$) is a foreign student who did not participate in the discussions because of the language barrier. No group leader seemed to emerge. • *Individual capability "being able to express oneself in front of a group"*: all the players possess it except $P7_{S2}$. • *Collective capability "being able to make and implement a management rule"*: two NMRs designed and implemented by the whole group (transparency and the "polluter pays principle", which led to the creation of a common funding pot). No collective capability exists on the scale of the whole group because one player ($P5_{S2}$) does not value it. • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists among Group S2. • *Resources and conversion factors*: empathy, capacity of several players to speak in public; collective spirit.	• *Winner of the game* : Player 3_{S2} • *Group dynamic and individual specificities:* collective behavior of the group facing a series of environmental fines throughout the game because of pollution levels. • *Individual capability "being able to express oneself in front of a group"*: all players possess the capability except $P7_{S2}$. • *Collective capability "being able to make and implement a management rule"*: one NMR designed and implemented by the whole group (transparency). The collective capability has emerged since the *ex ante* workshop and now exists among Group S2 (the value given by $P5_{S2}$ to this freedom strongly increased). • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists among Group S2 but the group's perception of its capacity to make a diagnosis decreased. • *Resources and conversion factors*: knowledge of the interest, values and personalities of other players, capacity to speak in public and leadership of several players, empathy; collective spirit.
Group S3	• *Winner of the game :* Player 4_{S5} Ø No information available on the capabilities of the players and of the group itself.	• *Joint winners of the game:* Players 2_{S3} and 5_{S3} • *Group dynamic and individual specificities:* rather good atmosphere despite tensions between players concerning the individualistic vs. the collective management of activities and the environment.

		• *Individual capability "being able to express oneself in front of a group"*: six players ($P1_{S3}$, $P2_{S3}$, $P3_{S3}$, $P4_{S3}$, $P8_{S3}$ and P9S3) possess the capability. It is unclear whether $P7_{S3}$ possess it. $P5_{S3}$ and $P6_{S3}$ do not possess it. • *Collective capability "being able to make and implement a management rule"*: one NMR designed and implemented by the whole group except $P2_{S3}$ (transparency). Yet they do not possess the collective capability to do so because of the lack of value given to it by several players ($P3_{S3}$, $P4_{S3}$, $P5_{S3}$ and $P9_{S3}$) • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists even though no diagnosis of the situation was made during the game. • *Resources and conversion factors*: knowledge of the interest, values and personalities of other players, capacity to speak in public and take part in group work; collective spirit.
Group S4	• *Winner of the game :* Player 6_{S4} • *Group dynamic and individual specificities:* group separated into two sub-groups of discussion and action (upstream/downstream). Upstream players ($P1_{S4}$, $P2_{S4}$, $P3_{S4}$ and $P4_{S4}$) led the game. • *Individual capability "being able to express oneself in front of a group"*: the four upstream players possess it. Two downstream players do not ($P5_{S4}$ and $P6_{S4}$). The capability of $P7_{S4}$ is unknown (missing data). • *Collective capability "being able to make and implement a management rule"*: no NMR was implemented on the scale of the whole group. It is unsure whether the collective capability does exist among the group (because of their medium collective capacity to do so). • *Collective capability "making a*	• *Winner of the game:* Player 3_{S4} • *Group dynamic and individual specificities:* one player was missing ($P5_{S4}$). Contentious atmosphere in the group, $P2_{S4}$ established himself as the group leader. $P3_{S4}$ played individually to win the game. • *Individual capability "being able to express oneself in front of a group"*: all players possess it except $P6_{S4}$ and $P3_{S4}$, whose data report medium value and even a medium capacity for $P3_{S4}$. $P6_{S4}$ shows an important improvement of his capability, $P3_{S4}$ shows an equally important decline in his capability. • *Collective capability "being able to make and implement a management rule"*: one NMR (transparency) was implemented by all players except $P3_{S4}$. The group does possess the collective capability which got

	diagnosis of a problematic situation": it is unsure whether the collective capability exists among Group 4 (the external behavior of the groups questions their actual capacity to make a collective diagnosis). • *Resources and conversion factors*: knowledge of the values, interest and personalities of the other players; empathy. Will to work together mostly shared by upstream players.	strengthened since the *ex ante* workshop. • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability exists but players value it slightly less than during the *ex ante* workshop. • *Resources and conversion factors*: widespread range of resources and conversion factors reported by players, among which their knowledge of other players' personality, values and interest and their skill to speak in public.
Group S5	• *Winner of the game*: Player 4_{S5} • *Group dynamic and individual specificities:* playful group, upstream players wanted to win the game on their own. $P7_{S5}$ did not seem very interested in the game during its first part. • *Individual capability "being able to express oneself in front of a group"*: none of the players in Group S5 seem to fully possess the capability. • *Collective capability "being able to make and implement a management rule"*: the group did not design or implement a NMR. They do not possess the collective capability to do so. • *Collective capability "making a diagnosis of a problematic situation"*: Group 5 does not possess it. • *Resources and conversion factors*: knowledge of other people's values and interests and empathy; individual winning spirit.	• *Winner of the game*: Player 6_{S5} • *Group dynamic and individual specificities:* playful group with united playing working together for a common goal: "*breaking the game*". • *Individual capability "being able to express oneself in front of a group"*: all players possess it, except one ($P1_{S5}$) whose value given to the corresponding freedom is not clearly positive. • *Collective capability "being able to make and implement a management rule"*: the group did not design or implement a NMR and they do not possess the collective capability to do so because of the lack of value of $P6_{S5}$ and $P7_{S5}$. • *Collective capability "making a diagnosis of a problematic situation"*: the collective capability has emerged among Group 5 since the *ex ante* workshop. • *Resources and conversion factors*: no specific resource or conversion factor stands out.

Table 14: Main observations and analyses derived from the two CappWag workshops held with the Water Master's students in Montpellier in October 2017 and January 2018.

4.1.2. ANALYSIS OF THE *EX ANTE* AND THE *EX POST* WORKSHOPS

We will first present the results of the *ex ante* workshop and discuss the state of capability of the players and the five groups in October 2017. We will then compare these results with those of the ex post workshop held in January 2018 and discuss constants and changes linked to their capabilities. Resources and conversion factors will be debated during the discussion.

Out of the five groups of students that took part in the *ex ante* CappWag workshop in October 2017, one provided data to the evaluator that could not be run or hence analyzed. During the first CappWag workshop, the members of Group S3 did not fill in the questionnaires that are used in the following pages to track the presence or absence of capabilities. Instead, they underwent a thorough collective debriefing at the end of the game. This debriefing (whose transcription ii available in Annex VII) was nevertheless insufficient to provide a reliable account of the state of capabilities among Group S3. Hence, the discussions concerning the *ex ante* CappWag workshop will concern only four groups (Groups S1, S2, S4 and S5). The *ex post* data for Group S3 will be analyzed, just like the other groups, in section 4.3, but a comparison with its *ex ante* state will not be possible.

4.2. THE *EX ANTE* CAPABILITIES

In the following pages, we will present the three capabilities one after the other. This structure will allow us to discuss the level of capabilities among each group, and then compare them with each other.

4.2.1. BEING ABLE TO EXPRESS ONESELF IN FRONT OF A GROUP

GROUP S1

In Group S1, the facilitator observed that two players, $P2_{S1}$ and $P7_{S1}$, were foreign students who had difficulties with the French language. $P2_{S1}$ especially (whose country of origin is China) was described as particularly quiet. He confirmed later in an individual interview that his difficulty in speaking and understanding the French language was the main reason for his silence during the *ex ante* CappWag game.

Consistently with these observations, data extracted from the questionnaire show that all players, except $P2_{S1}$ and $P7_{S1}$, reported a high or rather high frequency of discussion during the game. $P2_{S1}$ explained that he did not understand the rules of the game, which negatively impacted his participation in the discussions. $P7_{S1}$ explained that he is shy and that other players discussed his ideas so that he did not feel like intervening into the discussion. These answers relate both to an internal constraint and to a choice.

The rating players give to their capacity to express themselves in front of the group is contrasted, as shown by a high SD of 0,35. Five players ($P1_{S1}$, $P3_{S1}$, $P4_{S1}$, $P5_{S1}$ and $P6_{S1}$) reported high or very high capacities. One player ($P9_{S1}$) reported a medium capacity. $P7_{S1}$ consistently reported a low capacity and explained that it might be related to a problem of

"*integration*" in the group. This very likely refers to the fact that the *ex ante* workshop took place at the beginning of the academic year, a period during which many players did not yet know anyone in the year group, which was the case of $P7_{S1}$ in this game group. His shyness and lack of ideas concerning the game prevented him from countering his "newcomer status". Two players ($P2_{S1}$ and $P8_{S1}$) did not rate their capacity to express themselves in front of the group. All players valued the freedom to express themselves in public in the context of the collective management of a water resource such as a river.

We've argued that whether players possess the capability to express themselves depended both on their capacity and the value they give to the freedom to be able to use this capacity. We consequently cross the rating given by players concerning these two variables, as shown on Figure 30.

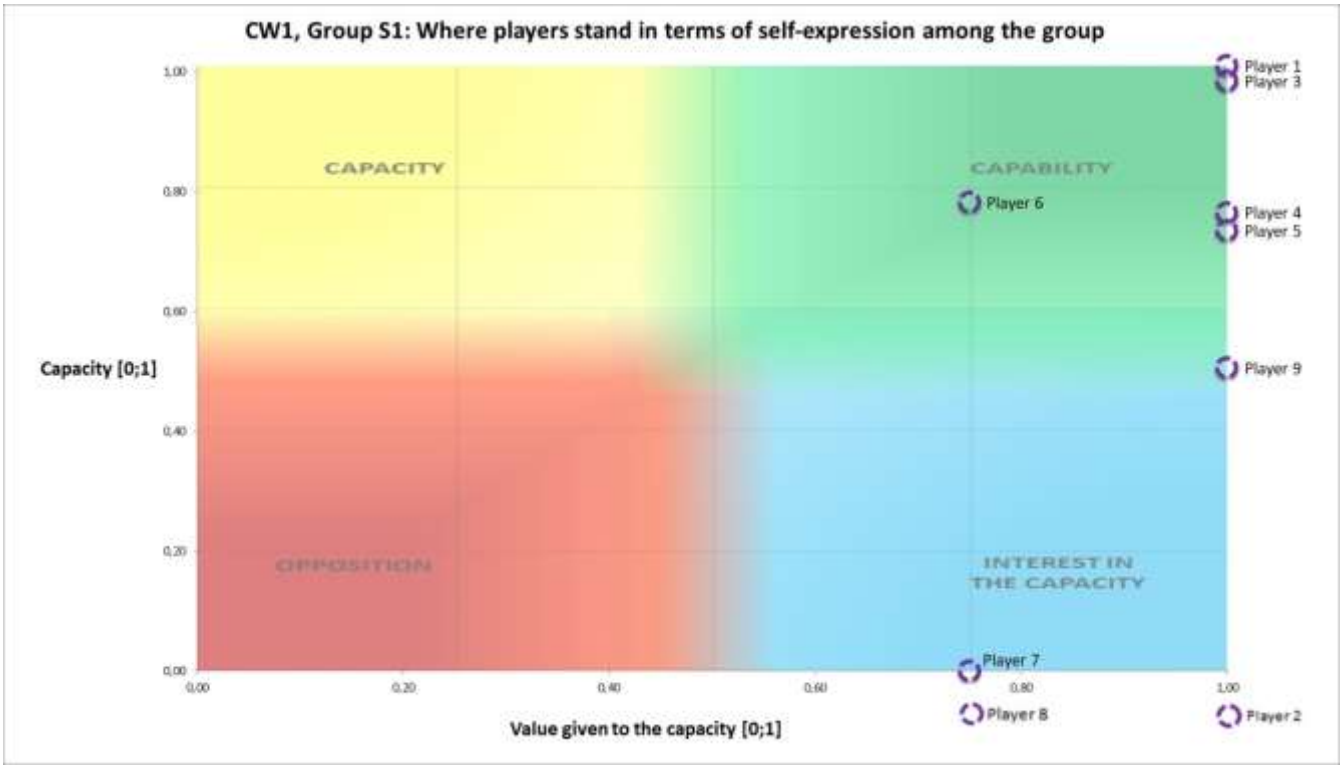

Figure 30: The individual capability "being able to express oneself in a group" of Group S1's players during the *ex ante* workshop.

According to these measures, we argue that five players ($P1_{S1}$, $P3_{S1}$, $P4_{S1}$, $P5_{S1}$ and $P6_{S1}$) do possessed the individual capability "being able to express oneself among a group". We similarly argue that the two foreign players $P2_{S1}$ and $P7_{S1}$, who both showed and reported difficulties in expressing themselves (even though $P2_{S1}$ has not answered the question concerning his capacity to do so), did not possess the capability, even though they demonstrated a clear interest in it. It is unclear whether $P9_{S1}$ possessed the capability or not, since he reported a medium capacity of self-expression. In the same way, $P8_{S1}$ did not rate his capacity to express himself in front of a group. His answers to other questions tackling self-expression were not sufficiently clear as to make it possible to state whether or not he

possessed the capability. It is consequently also unclear whether he possessed the capability or not.

GROUP S2

In Group S2, external observations reported that $P7_{S2}$ was a foreign student who had serious difficulties with the French language and barely spoke during the whole game.

Data extracted from the questionnaire show that players' frequency of participation in the discussions varies, which is illustrated by a high SD of 0,30. $P3_{S2}$ and $P7_{S2}$ particularly stand out from the group and reported a low frequency of discussion. $P3_{S2}$ justified this behavior by the fact that "other persons [had] the same ideas and discussed them with the group before [he] did", which we assimilate to a non-constrained choice. $P7_{S2}$ on the contrary exclusively gave explanations related to internal constraints (his shyness and his incapacity to formulate a proposition elaborated enough to be discussed with other people). The ratings concerning their individual capacity to express themselves are consensual and high among the group. One player only ($P7_{S2}$) gave himself a medium rating and explained it by the fact that "[he is] not very comfortable when speaking". All players except one ($P7_{S2}$ again) valued highly or rather highly the freedom possessed by a person to express himself in the context of the collective management of a water resource such as a river.

We understand from these answers that seven players out of eight ($P1_{S2}$, $P2_{S2}$, $P3_{S2}$, $P4_{S2}$, $P5_{S2}$, $P6_{S2}$ and $P8_{S2}$) possessed the capability "being able to express oneself in front of a group", as illustrated on Figure 31.

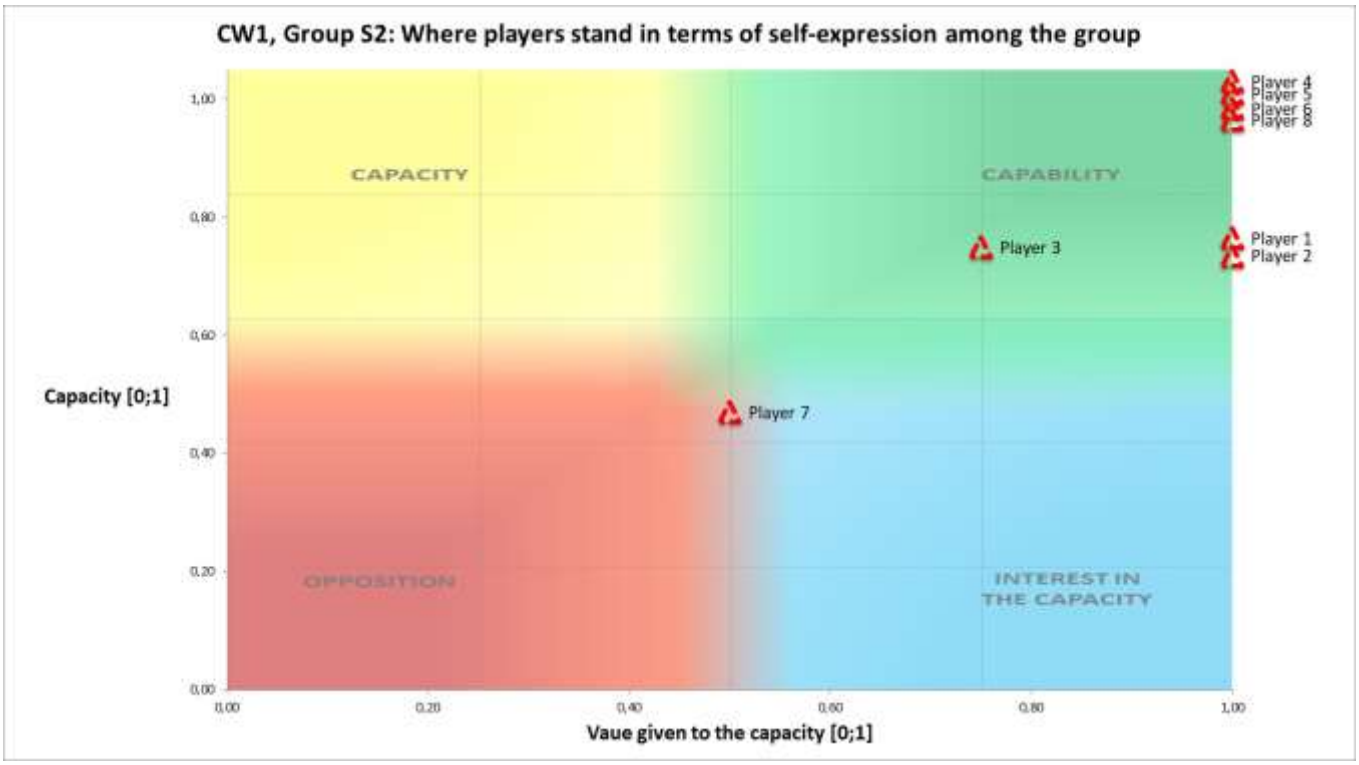

Figure 31: The individual capability "being able to express oneself in a group" of Group S2's players during the *ex ante* workshop.

It is unclear whether $P7_{S2}$ possessed this capability or not, since he neither especially valued nor rejected the freedom associated with it. Moreover, he perceived his capacity to express himself in public as medium, even though external observations showed that he spoke almost not at all during the game because of internal constraints. We consequently argued that it is likely that he did not possess it.

GROUP S4

External observations report that $P7_{S2}$ was not fully involved in the game (he often looked at his cell phone). Players located upstream of the river ($P1_{S4}$, $P2_{S4}$, $P3_{S4}$, $P4_{S4}$) were way more talkative than players located downstream ($P5_{S4}$, $P6_{S4}$, $P7_{S4}$), which led to the constitution of two sub-groups.

The data extracted from the questionnaire consistently show that players' participation in the discussions is varied, which is demonstrated by a rather high SD of 0,25. Only one player ($P5_{S4}$) reported a rather low frequency of discussion during the game (he stated he did "*not often*" participate in the discussions). He explained this by two arguments related to a non-constrained choice ("*discussions did not interest [him]"* and "*serious discussions only started at the end of the game*") but also by an external constraint ("*[he] did not have enough time to propose [his] idea(s) to the group*").

The individual capacity to express themselves reported by players in the questionnaire is contrasted. Six players out of seven gave themselves a high rating ($P1_{S4}$, $P2_{S4}$, $P3_{S4}$, $P4_{S4}$ and $P7_{S4}$) but two of them ($P5_{S4}$ and $P6_{S4}$) reported a low or very low rating. $P5_{S4}$ explained that even though he did speak, "*no tangible result came out of it*", which can be related to the fact that other players did not listen to his ideas or that after discussing them, his ideas did not seem feasible or desirable to the group. $P6_{S4}$ similarly explained that his propositions did not succeed. All players except two ($P6_{S4}$ and $P7_{S4}$) valued the freedom possessed by a person to express oneself in front of a group, in the context of the collective management of a water resource. $P7_{S4}$ did not answer the question at all and $P6_{S4}$ stated that he "*did not agree*".

We understand from these data that $P1_{S4}$, $P2_{S4}$, $P3_{S4}$ and $P4_{S4}$ possessed the capability "being able to express oneself in front of a group", as illustrated by Figure 32. $P5_{S4}$ shows the weakest capability of the group, since he reported incapacity to perform a freedom he does value. We argue that because $P6_{S4}$ did not even value this freedom, he had no capability either. It is not possible to evaluate $P7_{S4}$'s capability because he did not provide information on the value he gives it.

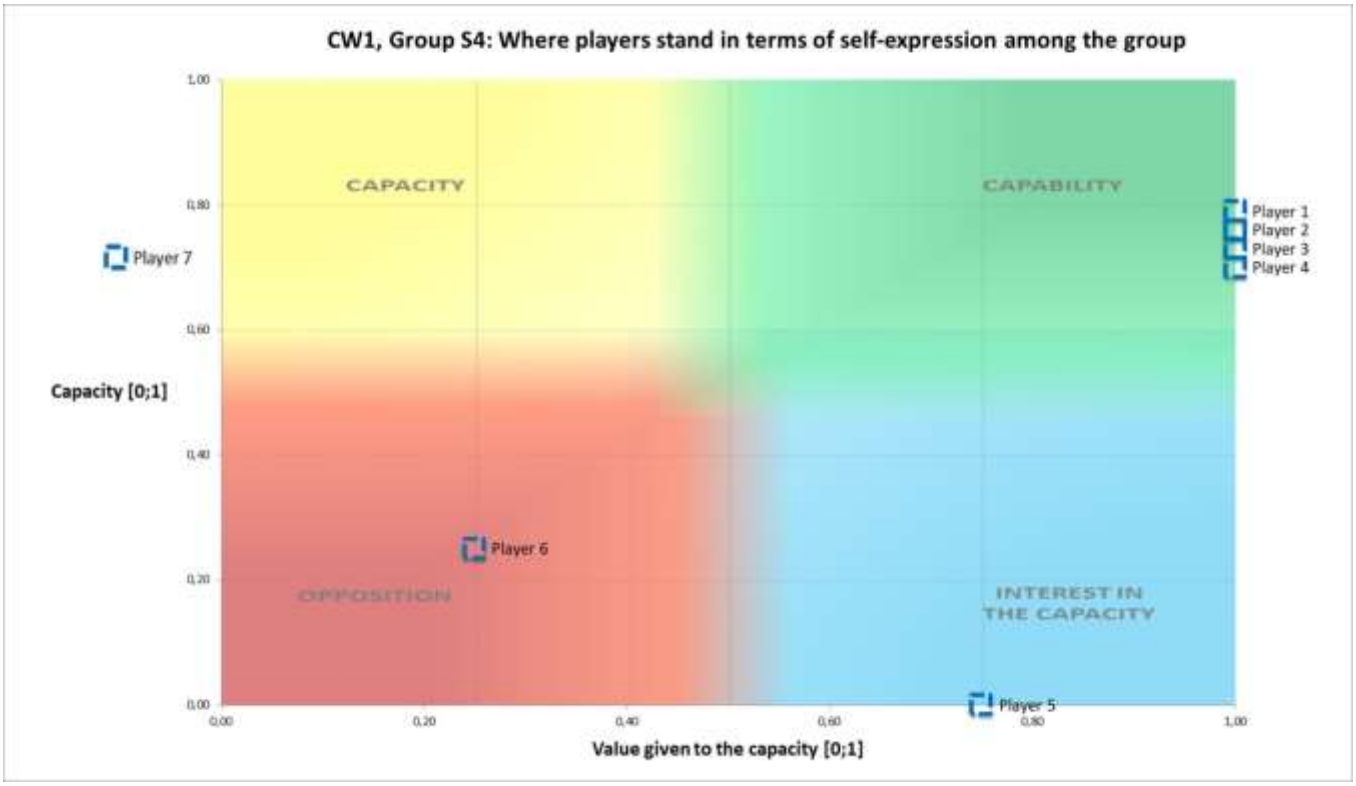

Figure 32: The individual capability "being able to express oneself in a group" of Group S4's players during the *ex ante* workshop.

These results confirm the external observations which reported a clear distinction between upstream players (who all possess the capability "being able to express oneself in front of a group" and used it) and downstream players (who do not possess or seem to possess the capability and consistently did not talk a lot during the game). Because the location of players along the river is decided according to a random pick of number from an opaque bag, we can

say that the fact that the three downstream players were also the ones who had the lowest individual capability for self-expression is an obstacle.

GROUP S5

External observations report that $P7_{S5}$ did not seem very interested in the game, especially during its first part. As a result, he often gave away resources such as wealth or social capital units "for free" to other players. He also often looked at his cell phone. Players located upstream of the river were reported to talk more than players located downstream.

The participation of players in the group discussions is consensual. They all stated that they "quite often" participated, except two of them ($P4_{S5}$ and $P5_{S5}$) who answered "not often". $P4_{S5}$ explained that this behavior was a strategic choice to win the game, while $P5_{S5}$ gave various types of explanations, related either to a non-constrained choice (discussions did not interest him) but also to constraints (he "*did not sufficiently understand what was happening in the game*" and he "d*id not feel able to correctly formulate [his] propositions to be heard*").

The level of capacity to express themselves players report is consensual but rather medium for five players out of eight, as illustrated by Figure 33. Two players stand out in the group: $P4_{S5}$ "*the strategist*" who gave himself the highest rating and $P3_{S5}$ who, in contrast, gave himself a low rating. P3S5 explained his rating by the fact that he did or could not "*speak with everyone to make common actions*"[18]. $P5_{S5}$ did not know how to answer the question. There is a strong contrast within Group S5 concerning the value given to the freedom of self-expression. Three players ($P4_{S5}$, $P5_{S5}$ and $P7_{S5}$) did not think this freedom is valuable, while four others ($P1_{S5}$, $P2_{S5}$, $P3_{S5}$ and $P6_{S5}$) thought that it is.

[18] The exact comment in French as formulated on the questionnaire: « *parler pas avec tout le monde pour faire des actions communes* ». This sentence is not grammatically correct and does not specify whether the commented situation is simply factual (the player did not speak with everyone) or an incapacity (he could not speak with everyone).

Figure 33: The individual capability "being able to express oneself in a group" of Group S5's players during the *ex ante* workshop.

None of the players in Group S5 seem to entirely possess the capability "being able to express oneself in front of a group", because of a low or medium capacity to do so (all players except $P4_{S5}$, $P5_{S5}$ and $P8_{S5}$) or because of a low value of this freedom ($P4_{S5}$, $P7_{S5}$, $P5_{S5}$). In the case of $P8_{S5}$, it is not possible to evaluate his capability because one unit of key-information concerning the value he gave to it is missing.

4.2.2. THE COLLECTIVE RULE-MAKING AND RULE-IMPLEMENTATION

GROUP S1

In Group S1, external observations reported the implementation of one NMR in the group: transparency, that is to say the uncovering of players' cards, by every player. This contradicts the data from the individual monitoring files, where none of the nine players report such a rule. Two players ($P8_{S1}$ and then $P4_{S1}$) mention it as a proposal discussed with the group, but they do not say that it was collectively accepted by the group. The group is described otherwise as fragmented, with many agreements taking place two by two and concerning the purchase of cards.

Data from the questionnaire are just as contradictory: few players said they did think of, and formulate NMRs during the game ($P3_{S1}$, $P4_{S1}$, $P6_{S1}$ and $P9_{S1}$, at least "once or twice" or "several times" – $P8_{S1}$, who is one of the two players who thought of the transparency rule according to his monitoring file, stated he "never" thought or formulated NMR, which shows

there might have been a problem of understanding the questions in the questionnaire), and only one of them ($P3_{S1}$) never presented his ideas to the group. Of the four players who "never" thought of and formulated NMR proposals, only two gave meaningful explanations, one stating that he had "*similar ideas at the same time with other persons*" ($P5_{S1}$), which relates to a choice made out of free will, the other one ($P7_{S1}$) stating that he "*did not have any ideas*", which rather relates to an internal constraint.

In contrast to the monitoring files but in accordance with the external observations, the members of the group consensually stated that they, as individuals and as a group, often accepted the rules that were formulated, which is shown by a rather high median of 0,75 for both questions. The eight players (out of nine) who explained how they participated all state that when NMRs were validated, they gave their consent. Seven players say they "*spontaneously [gave their] agreement to the group*" and three players state they "*[gave their] agreement after one or several persons in the group asked for it*". Two players ($P4_{S1}$ and $P9_{S1}$) stated that they were "*the one who asked the group to validate the rule*". This shows a "smooth" process of NMR validation, with no players acting out of constraint to follow the group's will.

The answers of the questionnaire concerning the implementation of at least one NMR are contradictory between them and with the other data. Seven players out of nine stated they applied NMR during the game, so we should say that no NMR on the scale of the whole group of players emerged during the game, even though this contradicts the external observations that report a transparency rule implemented by everyone. Similarly, two players ($P3_{S1}$ and $P7_{S1}$) state they did not apply NMRs but answered positively when asked if they had respected NMRs, two answers that once again contradict each other.

The median of the seven players who answered the questions concerning their respect of potential NMR is rather high (0,67), which could mean either that (i) players often respected NMR they were involved in, but not always; or that (ii) not all players always respected NMR because they were not involved in all of them. Of the four players who stated that they did not always respect NMR, three ($P4_{S1}$, $P6_{S1}$ and $P9_{S1}$) explained they wanted to win the game and two ($P5_{S1}$ and $P6_{S1}$) that they "*did not give any importance to the rules implemented in the game because it is only a game*". $P4_{S1}$ further explained his decision not to always respect the group's rules during his interview: "*Sometimes a majority of players decided to do something. I did not really participate, without feeling like I was going against a rule. But it was not really a rule anyway*".

Finally, the mean of the perceived collective capacity of the group to implement one or several management rules by individual players is rather high and consensual (0,78 for a SD of 0,13), as illustrated on Figure 34. Two players ($P1_{S1}$ and $P8_{S1}$) gave medium ratings to the group (3 on a [0;5] scale), but only $P2_{S1}$ gave it the highest rating (5/5), which shows a similar appreciation of the group capacity among the players.

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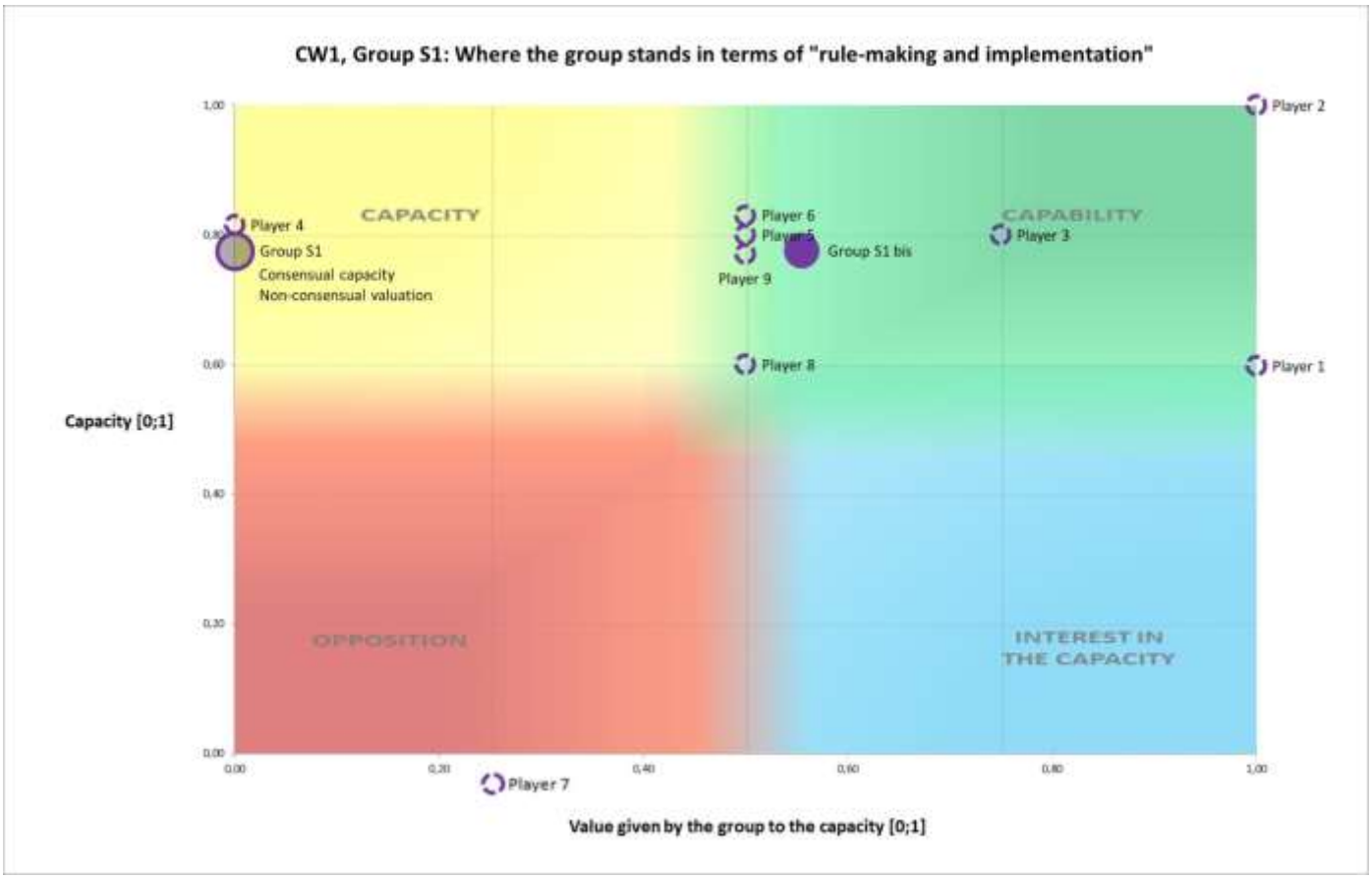

Figure 34: The collective capability "being able to collectively make and implement management rules" of Group S1 during the *ex ante* workshop.

The value given to the freedom to collectively make and implement one's own management rules is, on the contrary, not consensual. Two players ($P4_{S1}$ and $P7_{S1}$) stated in the questionnaire that they did not value this freedom. We note that $P2_{S1}$, the foreign student, is the only one of the group to give the highest rating to both the collective capacity of the group to make and implement its own NMR, but also to the importance of the freedom for a group to be able to do so.

The two negative values given by $P4_{S1}$ and $P7_{S1}$ prevent a collective capability from existing on the scale of the whole group, even though this does not mean that no collective capability is present whatsoever on the scale of sub-groups.

GROUP S2

In Group S2, no external observations were available concerning the existence of one or several NMRs made and implemented during the game. Nevertheless, data extracted from individual monitoring files show that two NMRs were adopted and implemented at the beginning of the game by the whole group:

(1) Transparency: the whole group must be transparent by showing everyone their Activity cards;
(2) The "polluter-pays-principle"[19]: players who pollute the most must pay a higher share of the collective environmental fine than players who pollute less by contributing to a "common funding pot".

Four players ($P1_{S2}$, $P2_{S2}$, $P5_{S2}$ and $P6_{S2}$) thought of the transparency rule, while $P8_{S2}$ introduced the "polluter pays principle". Players 1_{S2} and 6_{S2} suggested using the "common funding pot" to buy new activity cards for players who wanted to change theirs. This was eventually abandoned in the middle of the game because of "*inequalities between persons*" (as reported by $P6_{S2}$). $P1_{S2}$ and $P2_{S2}$ did implement an interesting arrangement after the second tour, specifying that $P1_{S2}$ had to pay money (1 wag) during every tour to $P2_{S2}$ in compensation for the de-polluting card that the latter bought. $P1_{S2}$ stands out as a particularly cooperative player.

Data extracted from the questionnaire show that the group was not homogenous in the design of NMRs. For instance, while five players ($P1_{S2}$, $P3_{S2}$, $P5_{S2}$, $P6_{S2}$ and $P8_{S2}$) stated they thought of and formulated NMRs "many times" or "several times", two players ($P4_{S2}$ and $P7_{S2}$) stated they "never" did so because they "*did not have any ideas*". $P2_{S2}$ is the only player to say that he never presented his ideas to the rest of the group (but he did discuss money arrangements with at least $P1_{S2}$, as shown by their monitoring files). He presented this behavior as a choice: after seeing that the first "*polluter tax*" was abandoned, he thought that his idea of implementing a "*water consumer tax*" would not work either and consequently decided not to discuss it with the group. Players consensually validated NMRs that were discussed during the game, which is shown by a very high median of 1 and a very low SD of 0,12. $P3_{S2}$ is the only player to mention a vote as a way to validate the rules discussed by the group. All the other players answered that they "*spontaneously [gave their] agreement to the group*" or that they "[*gave their] agreement after one or several persons in the group asked for it*". Because the majority of the players did not mention voting, we interpret the answer of $P3_{S2}$ as non-valid. All players state that they did apply NMRs during the game, which aligns with the data from the individual monitoring forms. They consensually say they "always" respected the NMRs because they "*agreed with all the management rules validated by the group*". Only one player ($P2_{S2}$) stated he "often" respected them but did not justify his behavior.

The perceived collective capacity of the group to implement NMRs is not consensual, which is illustrated by a SD of 0,21, even though the median of the answers is high (0,90). $P4_{S2}$ in particular gave a low rating to the group (2 on a [0;5] scale), explaining that even though there was a common funding pot created at the beginning of the game, "*it aborted quickly*".

[19] Adopted by the OECD in 1972, the polluter-pays-principle is an economic principle according to which the polluter should bear the "*costs of pollution prevention and control measures*". Source: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD(92)81&docLanguage=En; retrieved in 2018/12/15).

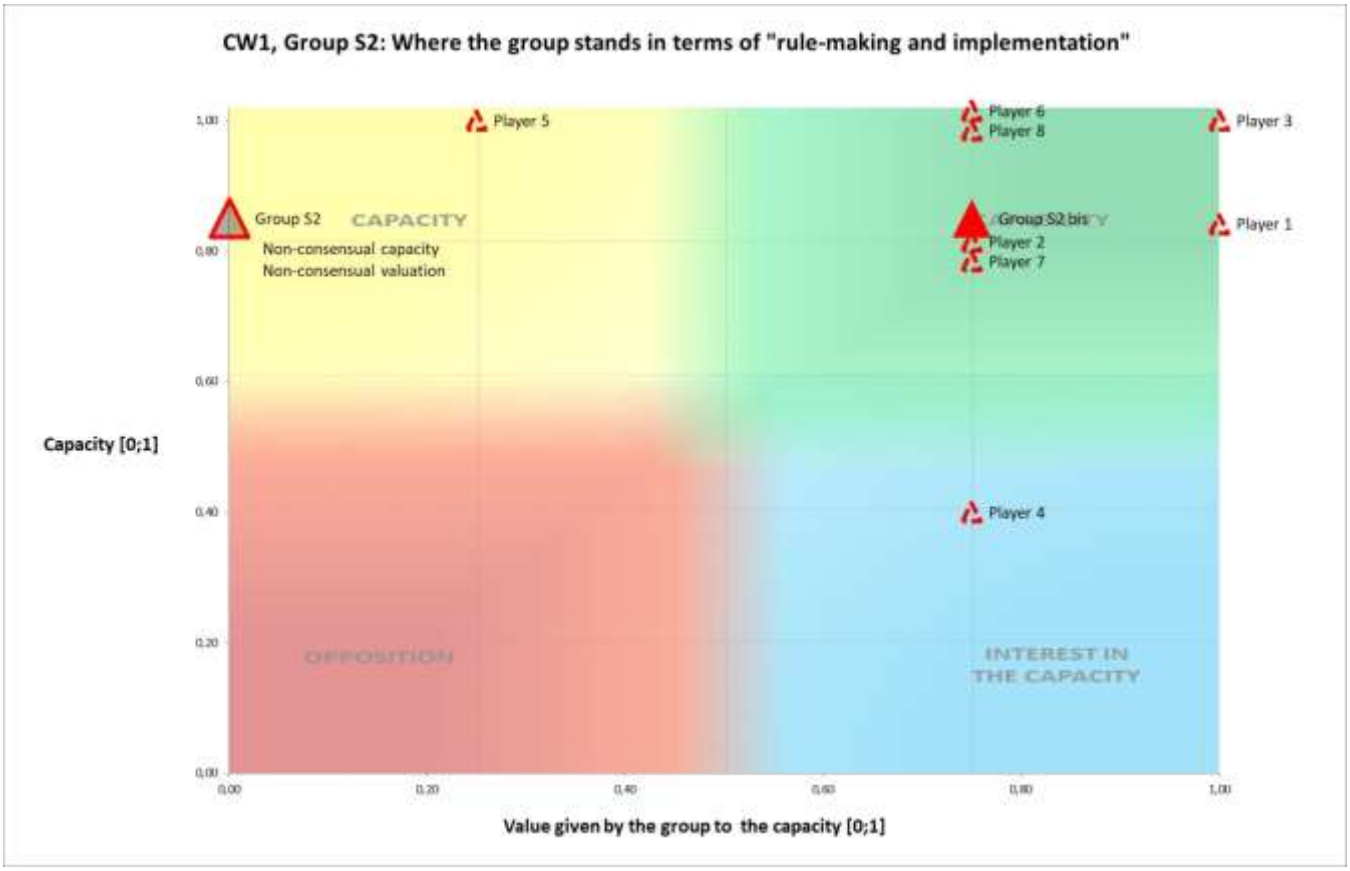

Figure 35: The collective capability "being able to collectively make and implement management rules" of Group S2 during the ex ante workshop.

In a similar way, the value given to the freedom to perform this capacity in a real context is not consensual among the group (as illustrated on Figure 35). One player ($P5_{S2}$) did not value this freedom. Just as in Group S1, this leads to the impossibility for the collective capability "being able to make and implement management rules" to exist on the scale of the whole group, even though all the other players answered that they agreed or completely agreed with the proposed statement.

Nevertheless, the rest of the players did value this freedom. Moreover, the lack of value given by $P5_{S2}$ did not prevent them from implementing two NMRs during the game.

GROUP S4

In Group S4, external observations report that no NMRs were implemented by the group or by sub-groups of players.

This is contradicted by the data from the individual monitoring form, which report that after the first tour of the game, one NMR was chosen and implemented by the upstream players ($P1_{S4}$, $P2_{S4}$, $P3_{S4}$ and $P4_{S4}$). They decided they would ensure that there was enough water for the players located downstream and for the environment by creating "*water quotas*". It is not

specified how long this rule was implemented or how exactly the quotas were constructed. Transparency was mentioned by one player ($P3_{S4}$) after the first tour but he reported he had no time to discuss it with the group. Upstream players also decided to share their units of social capital, even though it is unclear who took this collective decision and what its specific terms were. This leads us to consider it not as a rule, but rather as a short-term agreement between a handful of players.

Data extracted from the questionnaire show that the group was not homogenous in terms of thinking and formulation of NMRs. One player ($P7_{S4}$) stated that he "*never*" thought of or formulated NMRs, while the rest of the group oscillated between "*several times*" and "*once or twice*". $P7_{S4}$ explained that he preferred to "*let the other players intervene*", which we consider as a choice made out of free will and not as a constraint. Four of six other players stated they presented their ideas "*only once*" to the rest of the group, while two players ($P1_{S4}$ and $P3_{S4}$) stated they did so "*[several or many] times*". The answers to the validation questions are very contrasted within the group, which is illustrated by a SD of 0,32. This confirms the division between upstream and downstream players, the latter not having participated in the design of any NMR. While one player stated he "always" validated the rules ($P3_{S4}$), another one ($P7_{S4}$) answered "never" and $P5_{S4}$ "seldom" - all the others answering "often" (the answer of $P6_{S4}$ being contradictory to his other assertions). This shows once again the emergence of two small groups with Group S4, with an Players mainly favored two types of rule-validation: "*giving [their] agreement after one or several persons in the group asked for it*" ($P4_{S4}$, $P5_{S4}$ and $P6_{S4}$) and "voting" ($P1_{S4}$, $P2_{S4}$, $P4_{S4}$, $P7_{S4}$). $P3_{S4}$ and $P4_{S4}$ added that they were "*the ones who asked the group to validate the rule*", which emphasizes the role of $P3_{S4}$ and $P4_{S4}$ as leaders. $P7_{S4}$ added that he "*did not wish for rules to be implemented in the game*" and that "*the rules did not all seem interesting*" to him, without further specifying the reasons behind this lack of interest. The upstream players and $P5_{S4}$ stated that they did apply NMRs (except $P1_{S4}$ whose answer is missing) and the two downstream players $P6_{S4}$ and $P7_{S4}$ stated they did not, which is consistent with the monitoring files. The answer of $P5_{S4}$ is difficult to interpret since he stated himself in his monitoring file that he did not take part in the only rule implemented during the game. The five upstream players also stated they always respected the rule and "*agreed with all the management rules validated by the group*". $P6_{S4}$ gives a contradictory answer by saying he did "not often" respect the rule because he "*wanted to win the game and (he] chose to play in [his] own way*." This answer explains why $P6_{S4}$ did not participate in the collective agreement of upstream players or barely participated in the group conversations. But it is likely that there were confusions here between NRMs and short-terms agreements (e.g. wealth or social unit lending, cards acquisition with other players, etc.).

The perception of group capacity to implement NMR is contrasted, which is revealed by the high SD of 0,30 and illustrated on Figure 36. The four upstream players ($P1_{S4}$, $P2_{S4}$, $P3_{S4}$ and $P4_{S4}$) gave medium to high ratings to the group (3 or 4 on a [0;5] scale), but $P7_{S4}$ gave it a 0. The two other downstream players ($P5_{S4}$ and $P6_{S4}$) did not know how to rate the collective capacity of the group.

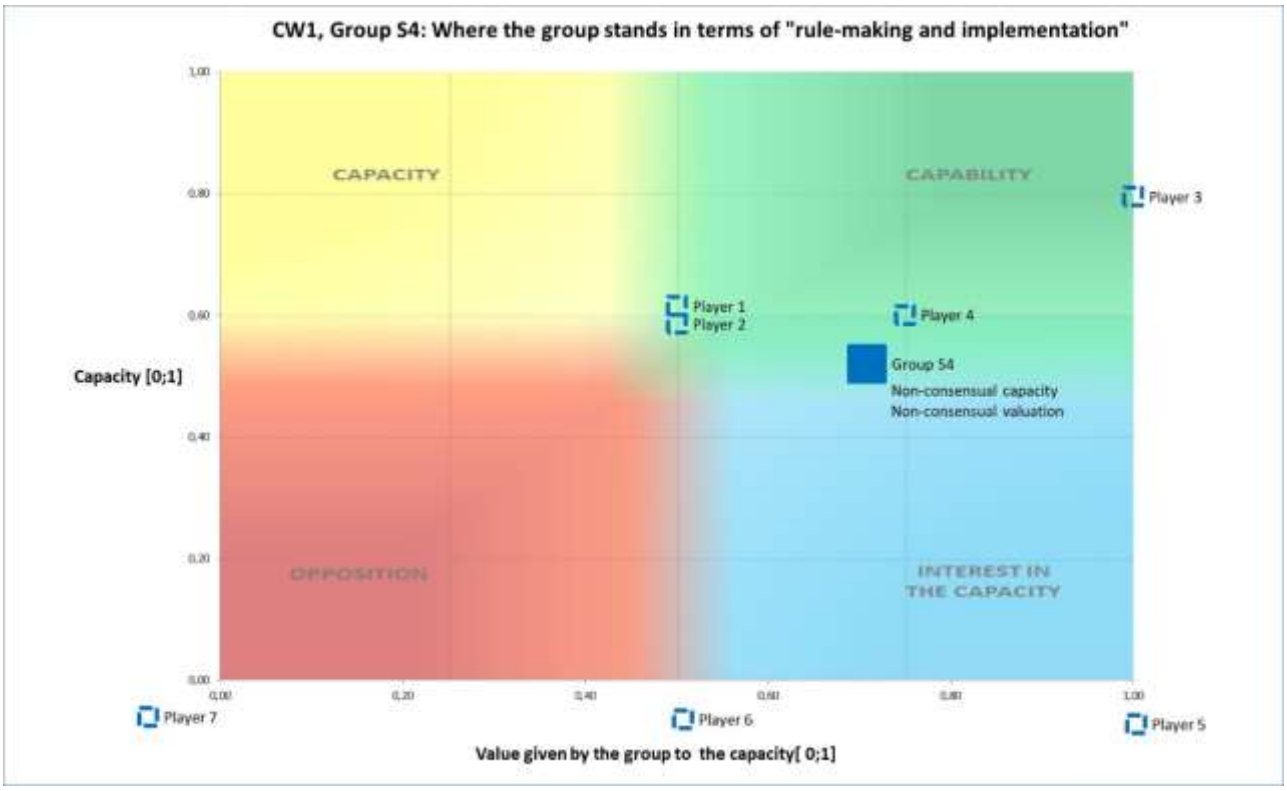

Figure 36: The collective capability "being able to collectively make and implement management rules" of Group S4 during the *ex ante* workshop.

Similarly, the mean of the value given by players to the freedom to perform the capacity in a real context of water management by the group's members is quite low (0,52) and not consensual (SD of 0,25). Even though three players ($P3_{S4}$, $P4_{S4}$ and $P5_{S4}$) clearly value the capacity, three others ($P1_{S4}$, $P2_{S4}$ and $P6_{S4}$) gave neutral answers. One player ($P7_{S4}$) did not answer at all.

The medium collective capacity described by players coupled with the rather high value of the related freedom does not give a clear indication of the existence of a collective capability "being able to make and implement NMRs" among Group S4. This analysis is backed by the external observations of the group, which was visibly divided into two smaller groups who did not discuss or work together much during the game.

GROUP S5

In Group S5, external observations do not report the design or implementation of NMRs, even by sub-groups of players.

The individual monitoring files also show that no proposals of NMRs were made by any of the players. They also show that no NMRs were collectively chosen and implemented by the players, which is consistent with the external observations.

The data extracted from the questionnaire confirm this. For instance, players all answered in the same way when asked if they thought about and formulated NMRs during the game. None of them reported doing so, which is illustrated by a median of 0 and a SD of 0. Three players ($P2_{S5}$, $P4_{S5}$ and $P8_{S5}$) explained that as there was only one winner in the game, they did not need NMRs to win and favored earning money instead. One player ($P3_{S5}$) explained that he was "not interested" in creating NMRs, and one other ($P6_{S5}$) that he "*did not feel like it*". Two players ($P5_{S5}$ and $P7_{S5}$) said they "*preferred to let other player intervene*". All of these answers amount to unconstrained choices from the players. Only $P5_{S5}$ added to his reasons for not making NMRs the fact that he "*did not have any ideas*", which we relate to an internal constraint.

$P7_{S5}$ is the only player to answer positively to the questions concerning the acceptance of NMRs, which is contradictory to his previous answers, as well as to the answers from the rest of the group. Indeed, all the other players either stated they "never" accepted any NMR, or did not answer at all. These contradictions could be explained by the fact that $P7_{S5}$ was singled out by the external observations as not being very interested in the game. He could have answered the questions based on a partial vision and follow-up of the group behavior. He nevertheless specified that he "*wanted to win the game*" and "*chose to play in [his] own way*", which could also explain why he did not want to participate in NMRs discussions.

Players consensually stated that no NMR was implemented during the game. Once again, contradictory answers were given by players when asked if they respected possible NMRs that would have been implemented during the game ($P5_{S5}$, $P6_{S5}$ and $P7_{S5}$ respectively answered "yes, always, "no, never" and "yes, often"). These contradictions are likely to stem from confusions between the initial rules of the game and short-term agreements between several players and NMRs that would have been designed by the group itself. $P5_{S5}$ also gave a contradictory answer related to the respect of NMRs, saying that he "*did not agree with every rule, but I followed them because they were collectively chosen*", even though once again, no rule was actually chosen.

The collective capacity of the group to design and implement NMRs is perceived in a contrasted way by players, as illustrated on Figure 37. This is demonstrated by a high SD of 0,30. The mean of players' answers is very low (0,28): three players ($P1_{S5}$, $P4_{S5}$ and $P6_{S5}$) did not know how to rate the collective capacity of the group and three others ($P2_{S5}$, $P3_{S5}$ and $P8_{S5}$) gave the group a very low rating (0 or 1 on a [0;5] scale). $P5_{S5}$ and $P7_{S5}$ gave the group medium ratings (3 on a [0;5] scale). Despite the contrast, one similarity in the answers appears: all of players have either a medium or rather negative vision of the capacity of the group, or no vision at all

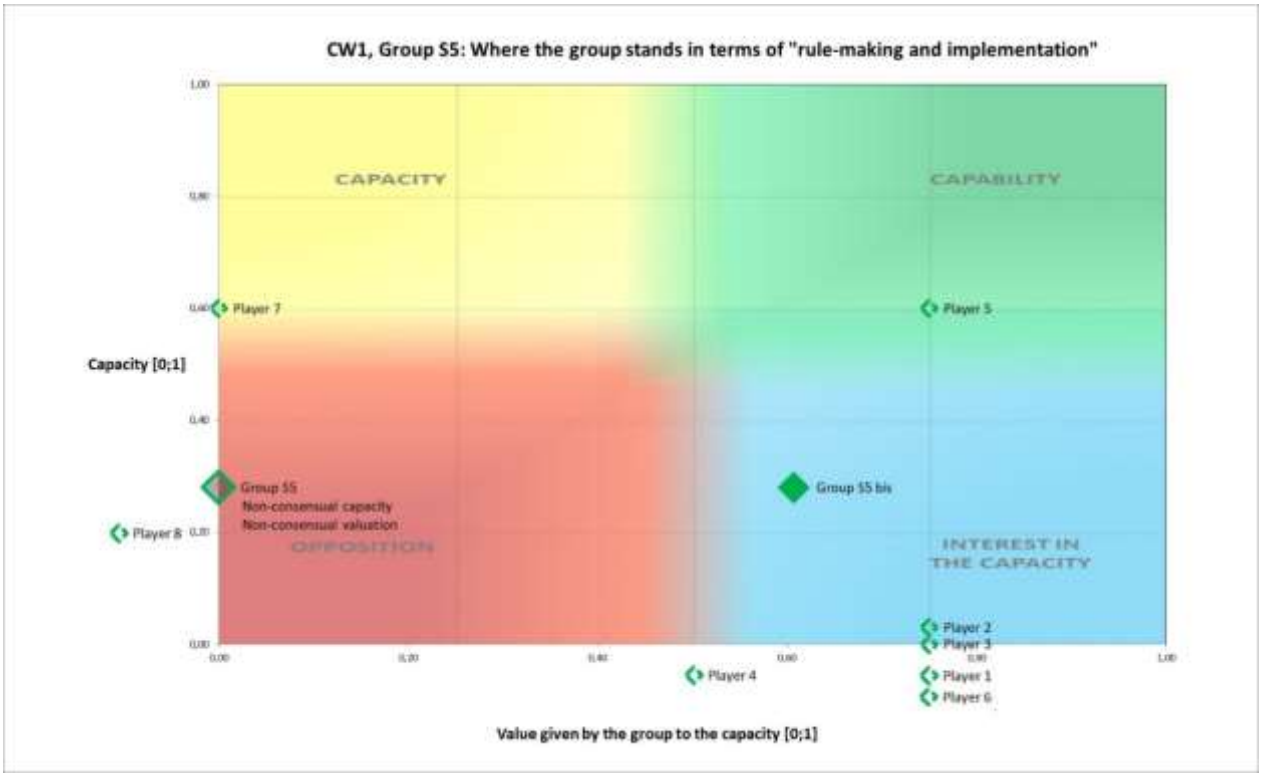

Figure 37: The collective capability "being able to collectively make and implement management rules" of Group S5 during the *ex ante* workshop.

The value given by players to the freedom of a group to make and implement its own management rules is similarly contrasted. One player ($P7_{S5}$) did not agree at all with the proposed statement, which we translate into a lack of value for the freedom. This lack of value can be explained by the fact that $P7_{S5}$ had no interest in playing collectively because he wanted to win on his own. He may have answered a question that tackled the importance of this freedom in a "real" context, based on his belief in the "game" context.

Just as in Group S1 and S2, the fact that one player does not at all value the freedom to make and implement its own MR for a group should prevent the very existence of the related collective capability. This absence of collective capability is confirmed by the absence of a functioning, since no NMRs whatsoever was designed by the whole group of players or even by smaller sub-groups. The low collective capacity to perform this action, as rated by the players themselves, is additional consistent information that strengthens the analysis.

4.2.3. THE COLLECTIVE DIAGNOSIS OF A PROBLEMATIC SITUATION

GROUP S1

In Group S1, external observations have not provided direct information on a collective diagnosis performed by the players. Instead, the facilitator reports that collective discussions

actually took place between groups of two players and principally concerned the understanding of the game rules and the acquisition of new Activity cards.

The data extracted from the questionnaire is consistent with the external observations and show that no collective "diagnosis" was made. Players think they all understood in the same way how the river and its uses work, which is shown by a low SD of 0,15 and a rather high median of 0,67. The frequency of the discussions between players is nevertheless contrasted. Two players in particular ($P2_{S1}$ and $P4_{S1}$) stated they seldom discussed the reasons behind the river management issues, while five players gave opposite answers (they "very often" discussed it). The answer of $P2_{S1}$ is consistent with his relative silence during the game.

Players were nevertheless consensual when asked about the helpfulness of these discussions, whether they participated in them or not. This is demonstrated by a median of 1 and a SD of 0,18. The examples that players gave to illustrate their answer concerned the game rules themselves (how to play the game, an example given by $P2_{S1}$), but also the link between the water quantity, the pollution, players' activities and the climate. Such subjects are directly related to a diagnosis of the problematic situation simulated in the game.

Several players (the two foreign students $P2_{S1}$ and $P7_{S1}$, as well as $P9_{S1}$) did not identify any action to modify the game situation and only one ($P6_{S1}$) identified "a lot of actions". It demonstrates that the group is heterogeneous, because its members report different levels of implication in the game (which is illustrated by a median of 0,50 and a high SD of 0,35). This also questions the real level of understanding of the game by the three players who did not identify a single action as having an impact on the game situation.

The group is also heterogeneous when it comes to the perceived helpfulness of the interactions with other players to identify game actions. The median of players' answer for this specific question is very high (1), even though answers are still not consensual, which is demonstrated by a high SD of 0,31. Six players indeed stated that the interactions with other players were helpful (one did not answer), when two ($P4_{S1}$ and $P5_{S1}$) stated the very contrary (not very helpful).

We observe that players are consensual on the similarity of their understanding of the socio-ecosystem with the rest of the group. Moreover, they did consider group discussions helpful in understanding various subject related to the way the socio-ecosystem simulated in the game works. They are not consensual on how much they individually identified actions to modify the game situations or on the usefulness of the group discussions to do so, but the median of players' answers for the latter question is very high.

We argue that a collective diagnosis among the group could have been realized, but that the external observations show that these discussions did not take place on the scale of the whole group, but on that of smaller sub-groups of players.

The collective capacity of the group to identify management issues together, as rated by all players, is rather high as demonstrated by a mean of 0,77 (see Figure 38). More importantly, this score is very consensual, as illustrated by a SD of 0,08. We understand from these data that the group has the capacity to make a diagnosis of the socio-ecosystem together. It

should nevertheless be noted that three players ($P5_{S1}$, $P7_{S1}$ and $P9_{S1}$) did not know how to answer this question.

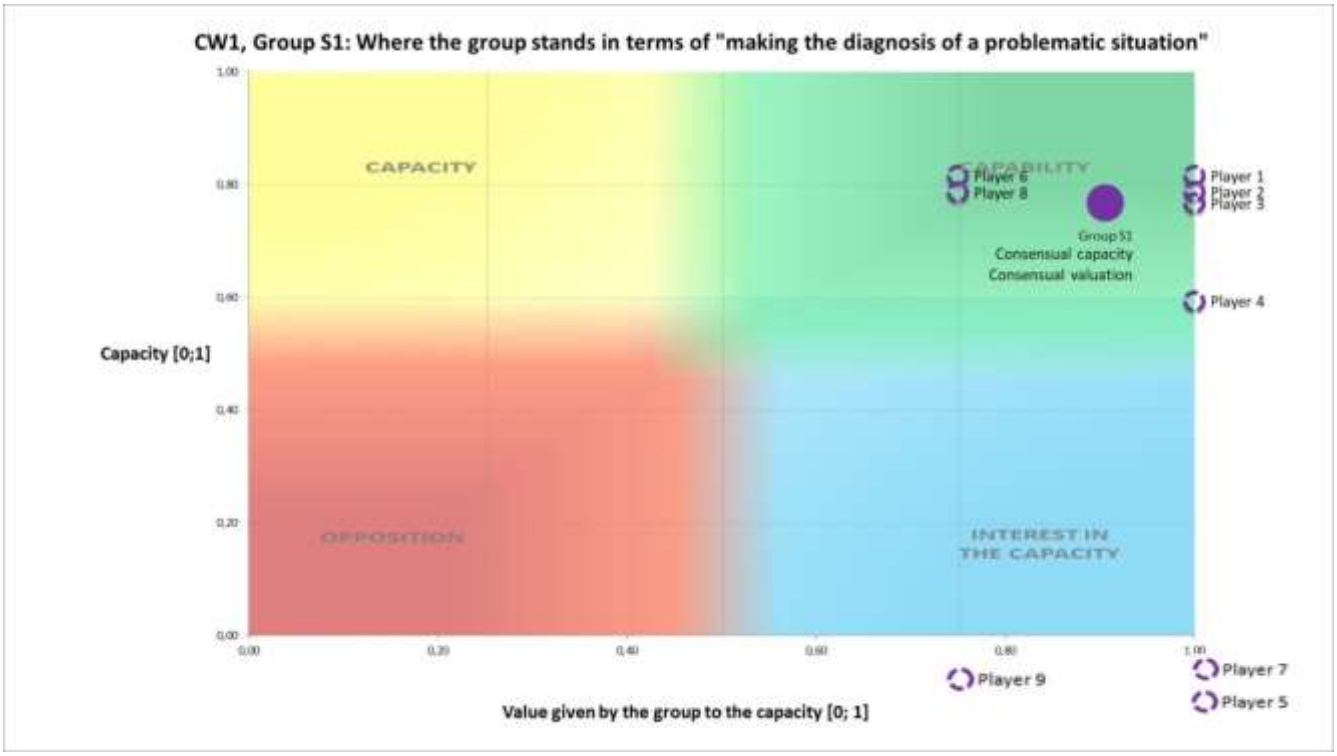

Figure 38: The collective capability "being able to make a diagnosis" of Group S1 during the *ex ante* workshop.

Similarly, all players valued the freedom for a group to make a collective diagnosis in order to effectively manage a water resource. This is illustrated by a mean of 0,91 and a SD of 0,13 (one player only, $P6_{S1}$, did not answer the question). There is consequently a high collective value given to the capacity "making a collective diagnosis".

We argue that even if no collective diagnosis was performed on the scale of the whole group of players, we understand from players' answers to the questionnaire and from the external observations that the group did possess the capability to do so.

GROUP S2

In Group S2, the external observations do not give information on a collective diagnosis performed by the players.

The data extracted from the questionnaire show that players have a contrasted opinion concerning the shared understanding of the way the river works. This is shown by a SD of 0,25. One player in particular ($P7_{S2}$) thought that the group did not understand the river and its uses similarly, when all the other players thought the group did or did to some extent.

Players discussed in a contrasted way the reasons behind the river's issues. This is demonstrated by a high SD of 0,42, even if once again the median of every players' answer is

very high (1). Two players ($P7_{S2}$ and $P8_{S2}$) stated that, contrary to the rest of the group, they never or very seldom discussed with the rest of the group these subjects. In the case of $P7_{S2}$, this also relates to a low capability of self-expression (see section 4.2.1). $P1_{S2}$ nevertheless is the only player of the group to state that the discussions were rather unhelpful for him in understanding how the river worked. The rest of the group was very consensual and the median for the eight players is 1.

Two players ($P1_{S2}$ and $P7_{S2}$) stated they (almost) did not individually identify actions to modify the game situation. Even though the median of all the answers is high (1), the heterogeneity of the group is shown by a high SD of 0,41. Nevertheless, $P7_{S2}$ is the only player who did not rely much on interactions with other players to identify these types of actions, while once again, the rest of the group is consensual, which is shown by a high median (1).

Players are not consensual on the similarity of their understanding of the game's socio-ecosystem. Because they are not consensual on how much they individually identified actions to modify the game situations or on the usefulness of the group discussions to do so, we state that no collective diagnosis on the scale of the whole group was performed during the game. In Group S2, the external observations do not give information on a collective diagnosis performed by the players.

The data extracted from the questionnaire show that players have a contrasted opinion concerning the shared understanding of the way the river works. This is shown by a SD of 0,25. One player in particular ($P7_{S2}$) thought that the group did not understand the river and its uses similarly, when all the other players thought the group did or did to some extent.

Players discussed in a contrasted way the reasons behind the river's issues. This is demonstrated by a high SD of 0,42, even if once again the median of every players' answer is very high (1). Two players ($P7_{S2}$ and $P8_{S2}$) stated that, contrary to the rest of the group, they never or very seldom discussed with the rest of the group these subjects. In the case of $P7_{S2}$, this also relates to a low capability of self-expression (see section 4.2.1). $P1_{S2}$ nevertheless is the only player of the group to state that the discussions were rather unhelpful for him in understanding how the river worked. The rest of the group was very consensual and the median for the eight players is 1.

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Players are not consensual on the similarity of their understanding of the game's socio-ecosystem. Because they are not consensual on how much they individually identified actions to modify the game situations or on the usefulness of the group discussions to do so, we state that no collective diagnosis on the scale of the whole group was performed during the game.

It is still possible that the collective capability existed among Group S2, which is why we now look at the collective capacity and the way players valued the freedom to perform this capacity. The collective capacity of the group to identify management issues together is very

high and consensual, as reported on Figure 39. It is illustrated by a mean of 0,91 and a SD of 0,11. Players stated, for example, that "*everybody had good ideas that I would not have thought of*" ($P4_{S2}$) or that "*discussing together helped us solve problems*" ($P1_{S2}$). Only one player answered that he did not know how to rate this capacity ($P6_{S2}$).

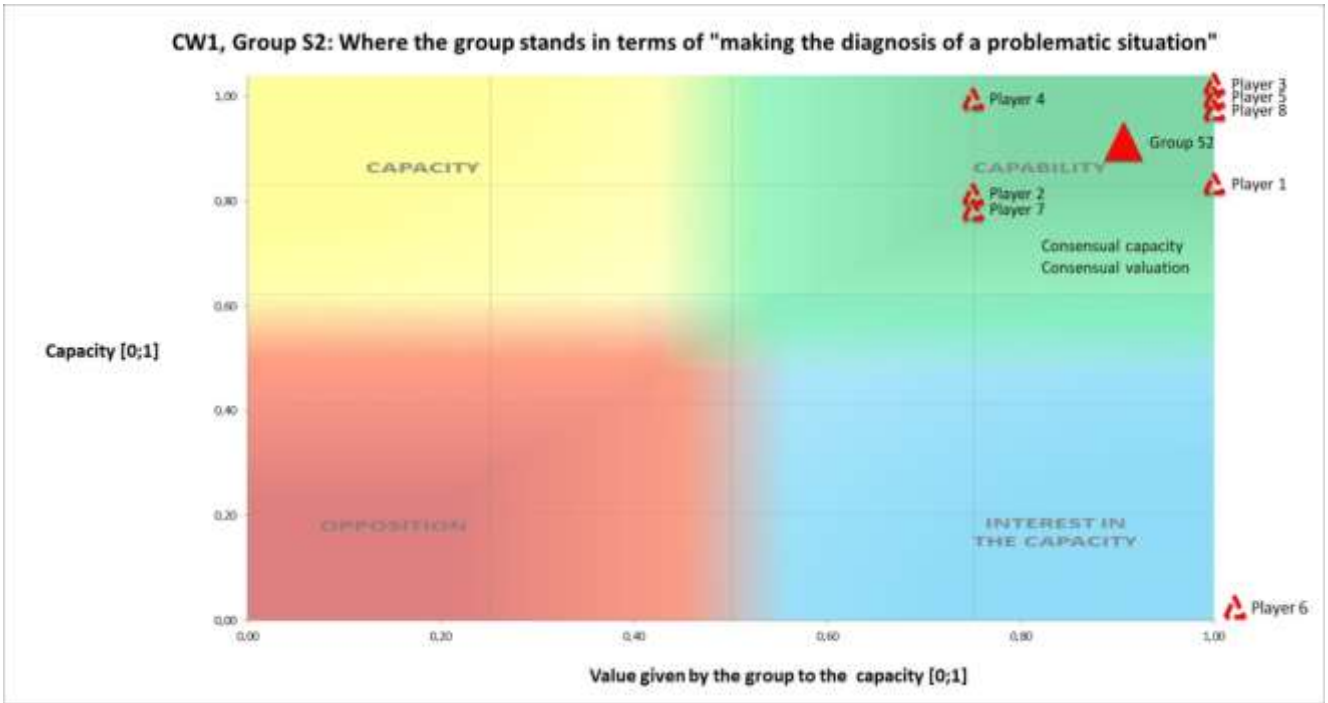

Figure 39: The collective capability "being able to make a diagnosis" of Group S2 during the *ex ante* workshop.

Similarly, all players consensually valued the freedom of a group to make a collective diagnosis in order to effectively manage a river. This is demonstrated by a median of 1 and a low SD of 0,13. This suggests to us that there is a high value of the freedom to make a diagnosis by the entire group.

The combination of the two variables leads us to say that the collective capability "being able to make a diagnosis" existed among Group S2, even though it did not transform into a functioning on the scale of the whole group during the *ex ante* CappWag game.

GROUP S4

In Group S4, the external observations did not give direct information on a collective diagnosis performed by the players.

The data extracted from the questionnaire show that players consensually considered that they shared to some extent a common understanding about the way the river and its uses worked. This is illustrated by a median of 0,67. It should be noted that two players ($P1_{S4}$ and $P6_{S4}$) answered this question negatively.

Players discussed in quite a contrasted way the reasons behind the problems they experienced during the game, which is illustrated by a high SD of 0,45. Two downstream players in particular ($P6_{S4}$ and $P7_{S4}$) stood out and stated that they never discussed river issues with the rest of the group. Nevertheless, they stated that the group discussions on this subject were helpful. This particular assertion is consensual among the group (this is shown by a median of 1 and a low SD of 0,18). We remark here the clear distinction between upstream and downstream players. The four upstream players all stated they were clearly helped by the collective discussions but the three downstream players gave a more nuanced answer.

Moreover, there was an important heterogeneity in the group concerning the individual identification of actions to modify the game situation. $P1_{S4}$ is the only player who stated that he identified "a lot of actions", while all the others, no matter what their location along the river, answered "few actions" or no actions at all ($P2_{S4}$ and $P4_{S4}$ answered the latter). There is also no consensus on the helpfulness of the interactions between players to identify these actions. Indeed, the upstream players all state that the discussions were somewhat helpful, but once again, the downstream players answered in a more nuanced way. $P5_{S4}$ and $P6_{S4}$ stated for example that discussions were not very helpful.

Players were consensual on the similarity of their understanding of the socio-ecosystem to that of the rest of the group; but they were not consensual on how much they individually identified actions to modify the game situations or on the usefulness of the group discussions to do so. More importantly, the separation between the two groups of players (upstream and downstream) is clearly visible. We consequently understand from these answers that no collective diagnosis on the scale of the whole group of players was performed during the game.

One player only ($P5_{S4}$) considered the capacity of the group to identify management issues as low (he gave it a rating of 2 on a [0;5] scale). Other players ranged between medium ($P1_{S4}$ and $P6_{S4}$) and high ratings ($P3_{S4}$ and $P7_{S4}$). The mean collective capacity of the group is 0,74, which is rather high, but not consensual. It is not so high that no doubts exist about the effective capacity of the group. Indeed, the external observations stated that the group was clearly divided into two sub-groups (upstream/downstream) who barely talked together. Would they have been able to discuss together the way the game socio-ecosystem works? When reading the external observations made during the game, this may be doubted and it questions the veracity of the statements given by players.

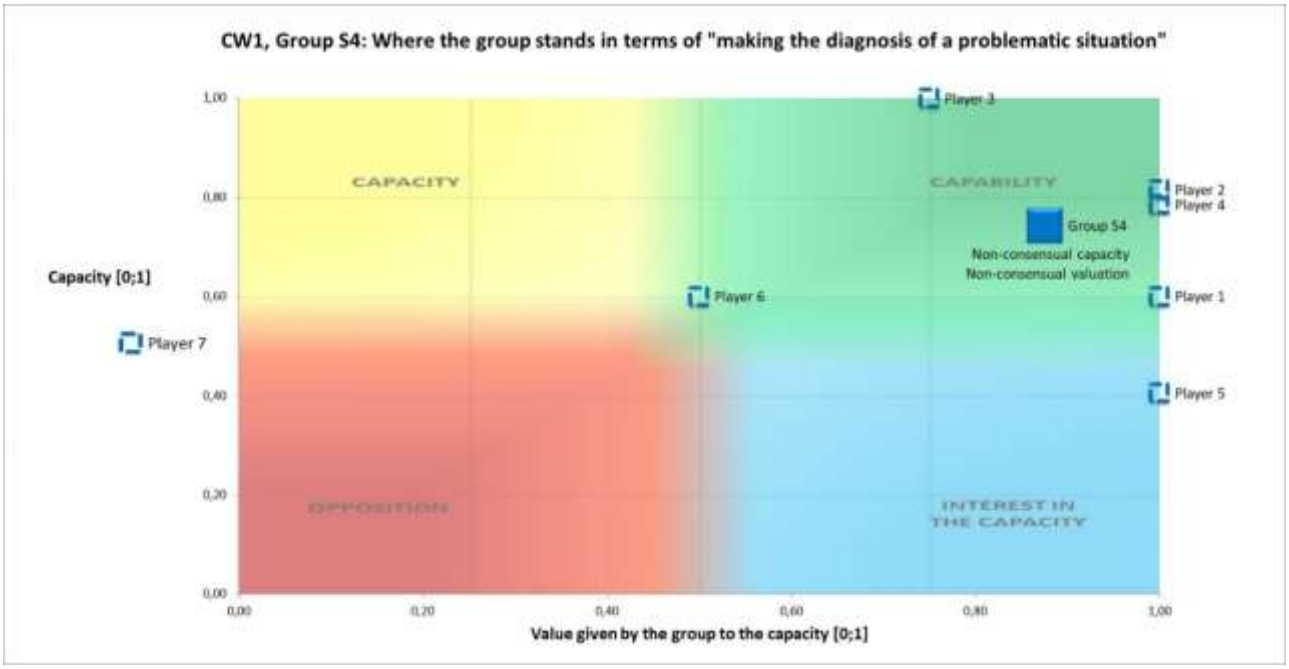

Figure 40: The collective capability "being able to make a diagnosis" of Group S4 during the *ex ante* workshop.

The value given by players to the freedom to make a collective diagnosis in order to effectively manage a river is not consensual. Even though the mean of players' answers is high (0,88), the SD of 0,22 shows that they do not all value this freedom in the same way. One downstream player especially, ($P6_{S4}$) did not agree nor disagree with the proposed statement and another one ($P7_{S4}$) did not answer the question.

We derive from these answers that the collective capability "being able to make a diagnosis" might have existed in Group S4, even though it is not possible to be certain of this. The contrast between players' behaviors during the CappWag game and players' perceptions reported in their questionnaire is rather striking. Moreover, the ratings of players concerning their capacity and the value given to the related freedom are not consensual. The pattern upstream/downstream can be found in players' answers, as shown on Figure 40, with upstream players giving more positive answers than downstream players (one of the latter also being the only one not to answer a question).

GROUP S5

In Group S5, the external observations have not given direct information on a collective diagnosis performed by the players.

In their questionnaire, players stated consensually that they shared a common understanding of the river and its various uses with the rest of the group. Nevertheless, they did not all discuss this subject with the rest of the group, which is illustrated by a SD of 0,33. Three players ($P2_{S5}$, $P4_{S5}$ and $P7_{S5}$) stated they never discussed the reasons behind the problems they met with during the game while four others ($P1_{S5}$, $P3_{S5}$, $P6_{S5}$ and $P8_{S5}$) stated that they

did sometimes do so. The helpfulness of these discussions is similarly perceived in a very contrasted way by players, which is shown by a SD of 0,40. Two players ($P1_{S5}$ and $P6_{S5}$) answered that group discussions "never" helped them to understand the functioning of the river while two other ($P3_{S5}$ and $P5_{S5}$) stated the very opposite.

In the same way, two players ($P2_{S5}$ and $P7_{S5}$) stated they did not by themselves identify any actions to modify the game while two other ($P1_{S5}$ and $P4_{S5}$) stated they did on the contrary identify a lot of actions. Nevertheless, all players except $P6_{S5}$ stated that interactions with the rest of the group were helpful or fairly helpful in identifying actions to modify the game situation. This is illustrated by a rather high median of 0,67.

Group S5 mostly presented contrasted answers to the questions related to the functioning "making a collective diagnosis". Every player thought there was a common understanding of the river and its uses. But there were always one or two players, for every question about group discussions and their helpfulness or ideas to improve the game and the group influence on these ideas, who did not share the view of the others. These players who stood out from the common opinion were never the same ones, which tends to show a slight but general difference of vision concerning the way the group worked together. We derive from these answers that no collective diagnosis was made on the scale of the whole group.

The collective capacity of the group to identify potential management problems is very contrasted, as one can see on Figure 41. Three players ($P1_{S5}$, $P4_{S5}$ and $P8_{S5}$) did not know how to answer the question and one player ($P2_{S5}$) gave the lowest grade to the group (0 on a [0;5] scale). The rest of the group gave high or medium ratings. The average of the collective capacity as perceived by each player is consequently medium (0,54), which is not high enough for us to say that a collective capability did exist among the whole group.

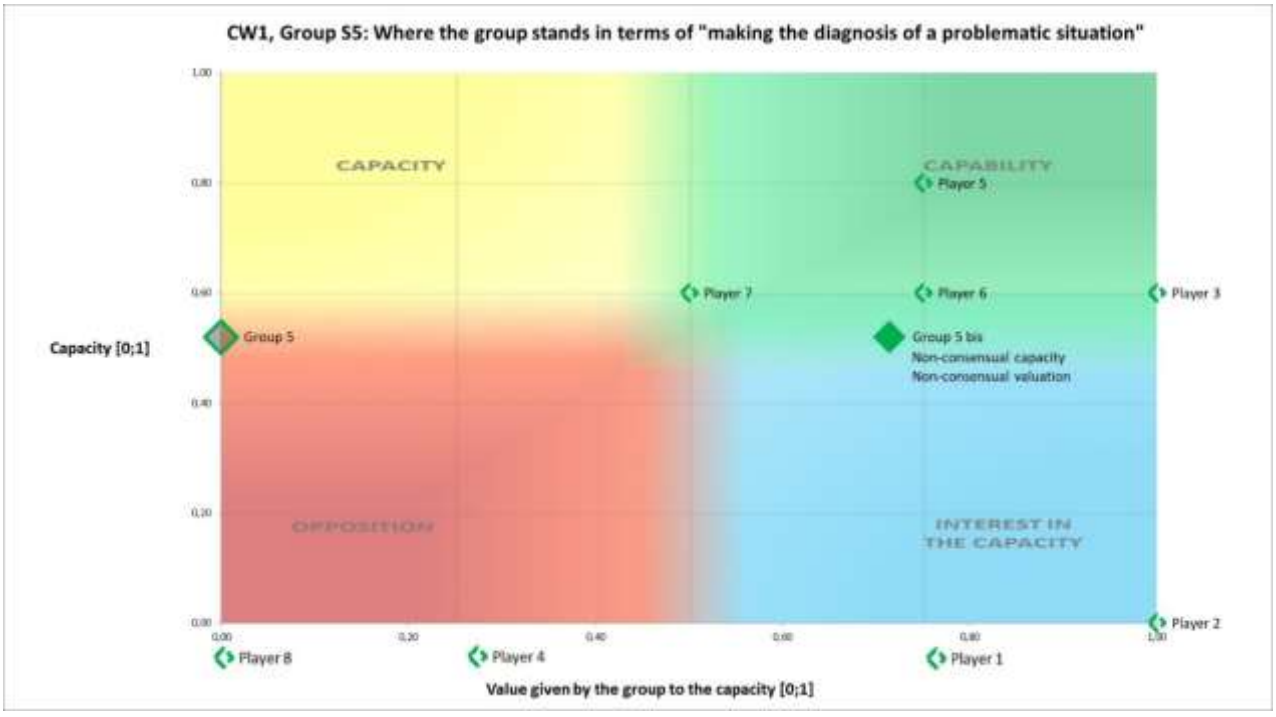

Figure 41: The collective capability "being able to make a diagnosis" of Group S5 during the *ex ante* workshop.

The value given by each player to the freedom to perform this capacity is similarly contrasted. One player in particular ($P4_{S5}$) stated that he did not think it important for a group to have this capacity in order to manage a water resource effectively. Because of this one negative value from $P4_{S5}$, we cannot say that the whole group values this freedom, which prevents a collective capability from existing at the scale of the whole group of players.

4.2.4. RESOURCES AND CONVERSION FACTORS

GROUP S1

Players consensually rated the atmosphere in the group as very good, which is demonstrated by a median of 0,80. Only two players made negative comments on the atmosphere. $P5_{S1}$ described the atmosphere as "*very good at the beginning and slightly tense at the end*" and $P6_{S1}$ choses the words "*organized", open, help, [with] a little bit of individual strategy*" to describe the group atmosphere. Other players praised with one voice the cooperative spirit of the group. This rather collective atmosphere that slightly deteriorated towards the end of the game is an important contextual conversion factor that enabled the group to act together during the game.

One player only ($P6_{S1}$) clearly stated that he wanted to win the game, which is consistent with his previous answers in the questionnaire (see section 4.2.2 on collective rule-making and implementation in Group S1).

Overall, $P1_{S1}$, $P2_{S1}$ and $P6_{S1}$ are the three players who stated they did want to win the game, even if each of them also had more collective interests (environmental protection or social equity). On the contrary, $P5_{S1}$ is the only player in the group who clearly stated that he did not want to win the game and was more concerned by the collective interest of the group. These opposite visions of the objectives of the game explains why there were tensions at the end of the game between individualist players and collective players.

During the *ex ante* CappWag game, more than half of the players reported that they were mainly influenced by two resources, as illustrated on Figure 42: their capacity to "*anticipate the strategy of other players*", which is a social skill that relates to the effective reading and understanding of each other's knowledge, situation and interests in the game; and their capacity to "*speak in public*", which is both a social skill and a resource stemming from their personal or academic experience. This latter resource is related to the individual capability that was previously observed among the players: "being able to express oneself in front of a group". We notice, that the two foreign players ($P2_{S1}$ and $P7_{S1}$) whose capability was either observed to be non-existent ($P7_{S1}$) or suspected of being non-existent ($P2_{S1}$) stated here that they were "constantly" or "often" influenced by this personal resource. At first sight, these answers are contradictory. Because the question tackles the influence rather than the effective use of a resource or a conversion factor, we understand that the two players might

have felt constrained by this, and their actual or suspected lack of capacity influenced the way they played during the game. It should be noted that $P2_{S1}$ gave positive answers to almost all of the questions concerning his resources and conversion factor, which cast doubt on their reliability.

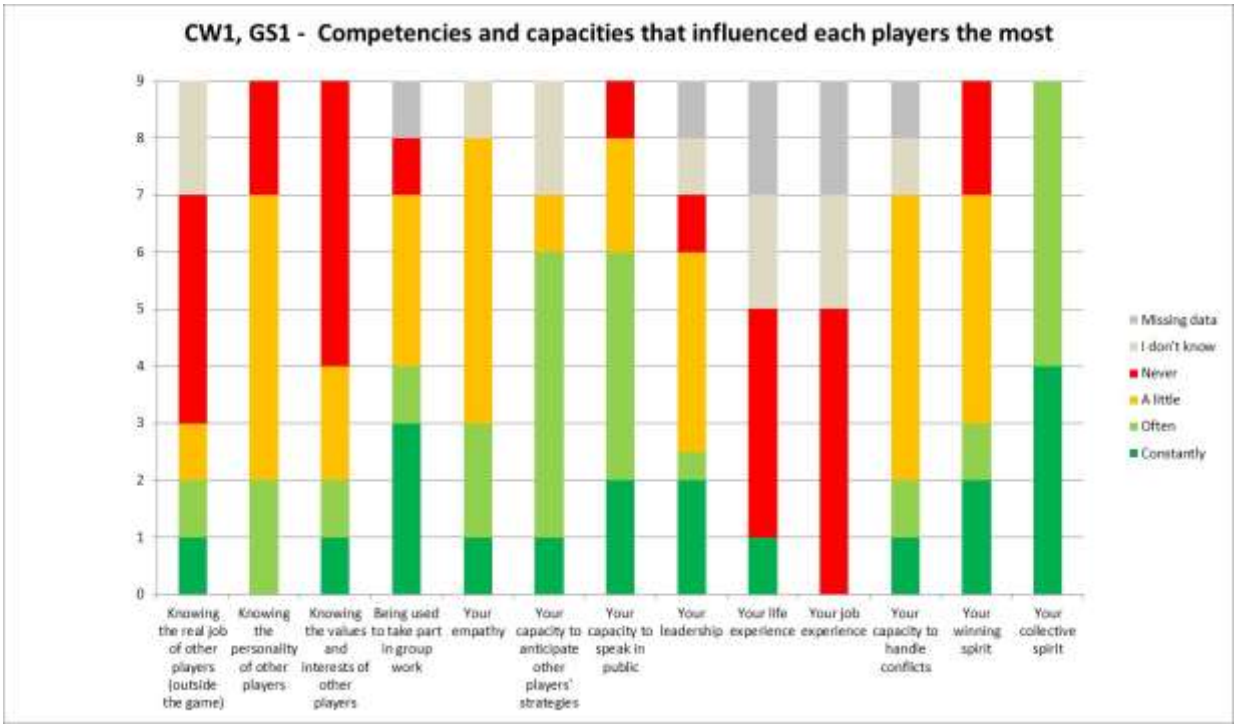

Figure 42: The main resources and conversion factors that influenced the behavior of the players in Group S1 when they played the *ex ante* CappWag game.

The "*collective spirit*" of the players is the one and only conversion factor that won their unanimous vote. They also mentioned it during the collective debriefing at the end of the game. This is consistent with the external observations reporting a rather collective group, despite the presence of several players (especially P6) also demonstrating individualistic behavior aimed at winning the game on their own. The resources with the least influence according to players were their professional and life experience, as well as the knowledge of the values, interests and personality of other players. This is consistent since players did not all know each other at the beginning of the Master's year and were still young adults at college.

The comparison between the way players perceived their behaviors and the way they perceived the behavior of the whole group shows some similarity. Only one main difference reveals how perceptions differ among the group. The "collective spirit" that influenced each individual player is considered by only six players to have influenced the group ($P6_{S1}$ did not answer the question; the other two players are $P1_{S1}$ and $P7_{S1}$, who considered that, on their own, they "constantly" used it). This shows that (1) players strongly sensed the individual behaviors of other some members of Group S1, and that (2) players who played more individually than others did not necessarily consider this incompatible with a "collective" state

of mind. We notice that several players did not answer (missing data) or did not know how to answer many of the questions related to the groups' capacities and conversion factors.

GROUP S2

Players consensually considered that the atmosphere among the group was very good. This is illustrated by a median of 1 and a SD of 0,17. All the players used positive words to describe this atmosphere, such as "*mutual assistance, friendship, equality*" ($P4_{S2}$), "*team spirit, sympathetic, dynamic*" ($P6_{S2}$) or "*funny, communicative, organized*" ($P7_{S2}$).

The intentions of players concerning the goal of the game are, however, rather contrasted. Respect for the environment and avoidance of environmental fines, whether they are accompanied by a clear will to win the game or not, were central for all of the players and correspond to social conversion factors that drove their behavior during the game. Three players stated that they wanted to win the game ($P3_{S2}$, $P4_{S2}$ and $P8_{S2}$) and only two players ($P2_{S2}$ and $P6_{S2}$) stated that they did not try to win the game because they were too absorbed in the game discussions.

Moreover, as illustrated on Figure 43, players reported that two resources particularly influenced them during the game: their empathy and their capacity to speak in public. Additionally, their collective spirit was a major social conversion factor that explains their collective behavior during the game. On the contrary, the two resources that influenced them the least are their knowledge of other people's profession and personality, and their professional experience. Players were students who did not yet know each other well at the beginning of the academic year and most of them had not yet had a long-term job.

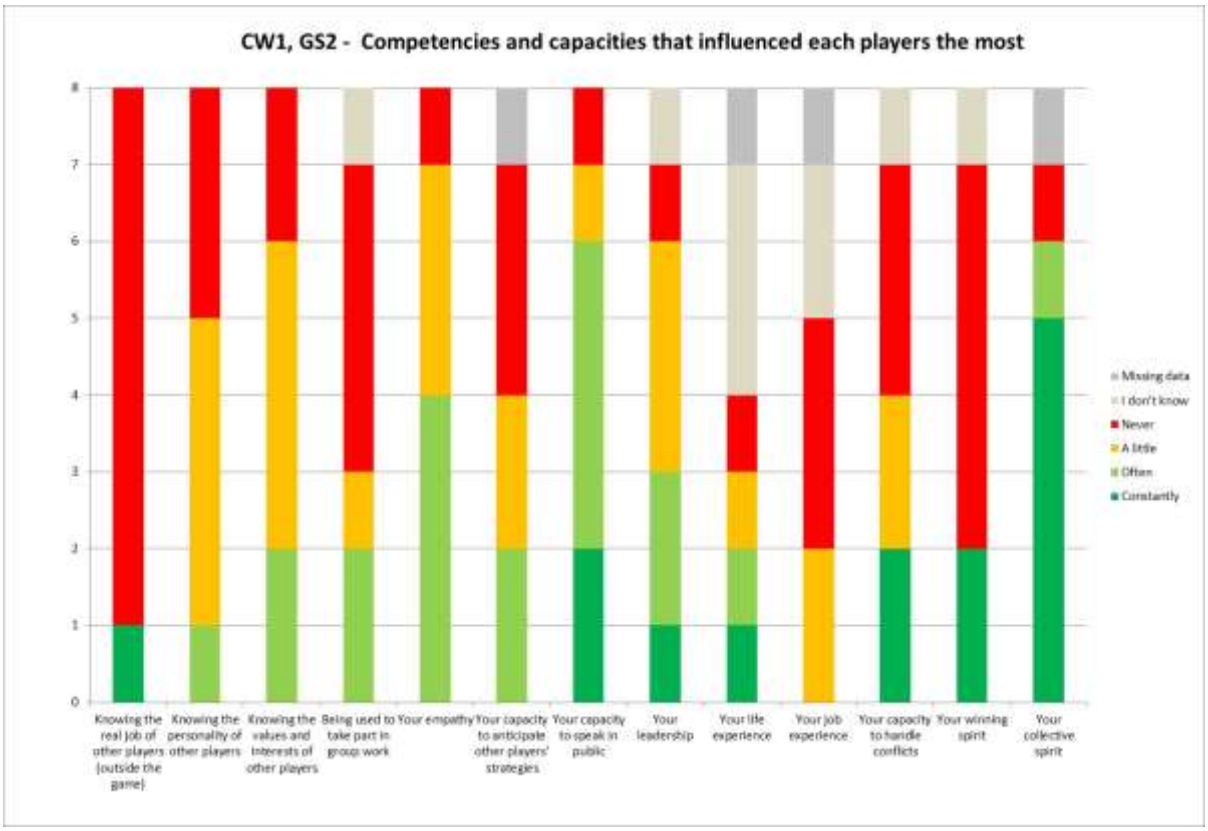

Figure 43: The main resources and conversion factors that influenced the behavior of the players in Group S2 when they played the *ex ante* CappWag game.

Players acknowledged the presence of leaders in the group, as well as the generally high capacity of the group to launch discussions and act collectively. All players agreed in saying that knowledge about the personality and profession of people outside the game was not a distinctive resource that influenced their actions and decisions. Only one player ($P4_{S2}$) felt that there was a will to win and a weak collective spirit in the group, but he himself fed this atmosphere by buying cards on his own to earn wealth units.

GROUP S4

During the *ex ante* game, players consensually considered that the atmosphere among the group was good. This is illustrated by a median of 0,80 and a SD of 0,05. Nevertheless, the division of Group S4 into two small groups is visible through the qualifying term that players gave to describe the atmosphere. While upstream players mostly gave positive comments, such as "*VERY GOOD [atmosphere]: participative alliance, cooperation, discussion*" ($P2_{S4}$) or "*team, balance, prevention*" ($P4_{S4}$), downstream players gave mainly negative comments. $P5_{S4}$ chose "*egocentricity, partial agreement, unequal*" to qualify the group atmosphere, and $P7_{S4}$ describes it "*not supportive, upstream vs. downstream*". We consequently qualified the group atmosphere during the *ex ante* game as "twofold", very good for upstream players but only average for downstream players (their rating being counterbalanced by their written description). This social organization that appeared during the game is crucial because it influenced all of the actions (and lack of actions) of the group as a seven-player unit.

When they were asked in the questionnaire to define their mindset during the *ex ante* game, players gave mixed answers. A majority of players favored winning the game as a main objective. The three downstream players are the ones who answered that they "wanted to win the game" and only $P5_{S4}$ tempered his statement by adding that he too was interested in respecting the environmental objective and making sure no player would be in a difficult position during the game. In contrast, upstream players rather favored collective playing instead of winning the game individually.

The main resources that players evoked were their knowledge of the values, interest and personalities of the other players. The upstream players also reported a will to play together (see Figure 44 for the illustration).

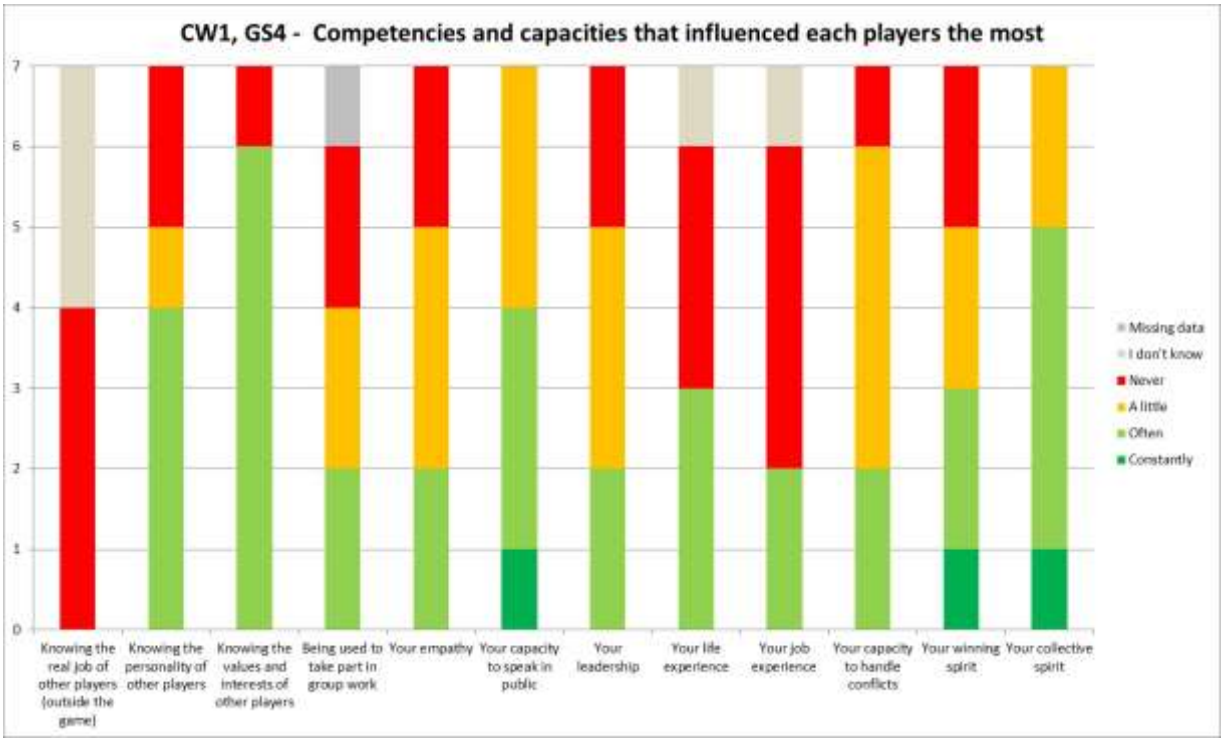

Figure 44: The main resources and conversion factors that influenced the behavior of the players in Group S4 when they played the *ex ante* CappWag game.

The distribution of resources and conversion factors used on the individual scale also follow an upstream-downstream gradient. Indeed, upstream players relied more than downstream players on their sense of collective work, their leadership, their capacity to speak in public and even their life experience (especially $P3_{S4}$ who has volunteered in several associations in the past). In contrast, downstream players relied more on their knowledge of other players' values, interests and personalities. This suggests that they probably already knew each other before the game.

When they were asked to state which resources and conversion factors were used by the whole group in general, they answered in a rather similar way. Interestingly, players (especially downstream players) thought that empathy played an important role in the group dynamic. This corresponds to the dynamic of the very end of the game, when conversations

finally took place on the scale of the whole group of players. At that moment, upstream and downstream players started to discuss how to improve the situation of downstream players who were getting into difficulties because of the lack of water.

GROUP S5

During the *ex ante* game, players consensually considered that the atmosphere among the group was very good. This is illustrated by a median of 0,90 and a SD of 0,08. Most the players used positive words to describe this atmosphere, such as "*jovial, amused, participatory*" ($P2_{S5}$) or "*amusing, strategy, realistic*" ($P8_{S5}$). $P5_{S5}$ also mentions the strategic aspect in the group dynamic. $P6_{S5}$ qualifies the atmosphere of "*eclectic, chaotic and disorganized*". Despite their lack of collective organization, players were caught up by the game and adopted a playful mood.

The intentions of players concerning the goal of the game confirm this analysis. They are rather consensual, in the sense that most of them wanted to win the game. Only two players ($P4_{S5}$ and $P5_{S5}$) stated that they did not want to win the game. Only $P5_{S5}$ specified that he also wanted all players to earn wealth and social capital units.

These answers are also consistent with the external observations, which describe the players as rather individualistic; and they even confirmed this themselves in their questionnaire as well as during the collective debriefing. During this time of collective discussion on the game, upstream players recognized that they were mainly motivated by their individual gain, while the downstream players were instead focusing on the environmental issues (especially limiting the amount of pollution).

Players report that two factors particularly influenced the way they played: their individual winning spirit and their knowledge of other people's values and interests, as illustrated on Figure 45. Only one player ($P7_{S5}$) considered that his leadership was useful and influenced the way he played. This is paradoxical, since $P7_{S5}$ was reported by external observations to have seemed uninterested in the game. But if we take a close look at $P7_{S5}$'s answers to the rest of the questions, we notice that he gave the same importance to all the resources and conversion factors discussed. His actual leadership during the game and its importance concerning the way he played is consequently strongly questioned.

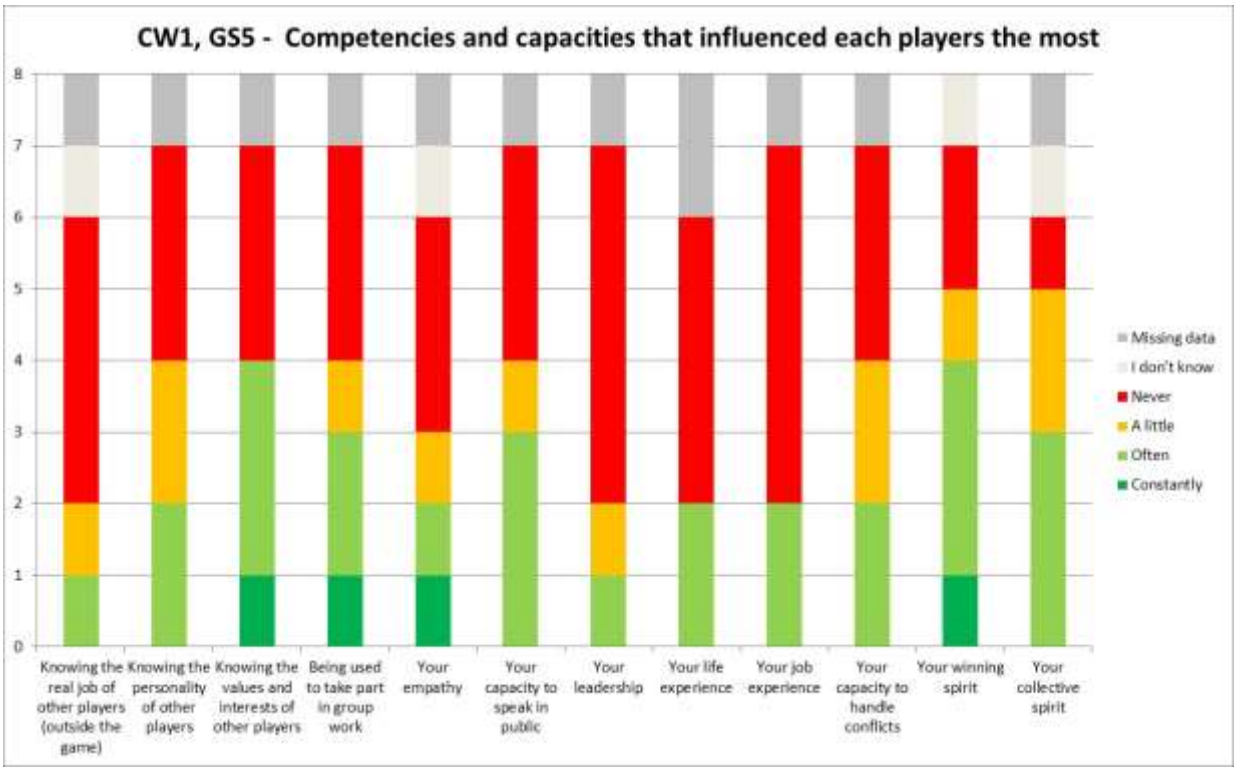

Figure 45: The main resources and conversion factors that influenced the behavior of the players in Group S5 when they played the ex ante CappWag game.

When they were asked to state which resources and conversion factors were used by the whole group in general, once again the winning spirit of other players was brought up by the majority of players, as well as, less consensually but more surprisingly, the empathy of other players. This shows that even though the group was not united and collective, there were no tensions and the game was played in a good atmosphere, without any internal constraint from any player (e.g. who would monopolize the discussions, prevent players from debating, crash the game system by doing anything to win, etc.).

4.2.5. A COMPARISON OF THE *EX ANTE* COLLECTIVE CAPABILITIES BETWEEN GROUPS S1, S2, S4 AND S5

The five groups of students participated in identical and controlled CappWag *ex ante* workshops. It is consequently possible to compare their results in terms of capabilities. The four groups who answered the questionnaire (Groups S1, S2, S4 and S5) will be compared below.

The information given by these comparing the state of the capabilities among and for the groups of students was not used during the three-month training to reinforce them or develop them. The implementation of the *ex ante* and *ex post* CappWag workshops with the students were instead aimed solely at measuring the evolution of these capabilities in relation to the original IWRM course.

4.2.5.1. COLLECTIVE RULE-MAKING AND RULE-IMPLEMENTATION

Comparing the results of the groups (Figure 46) illustrates difficulties for a collective capability such as "being able to make and implement a rule" to emerge in a group.

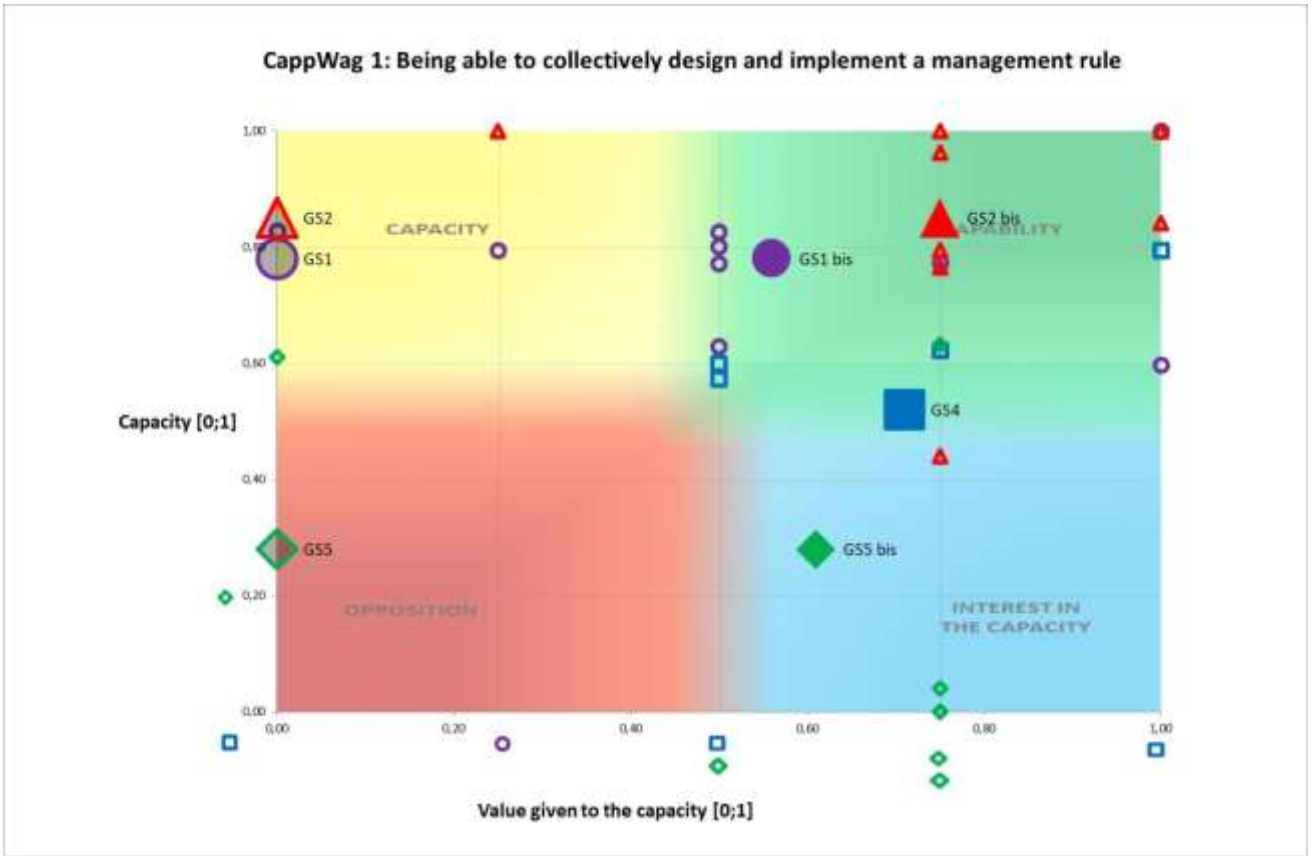

Figure 46: The collective capability "being able to make and implement its own management rules" of Groups S1, S2, S4 and S5.

Three groups out of four did not reach this collective state of freedom because at least one player among them did not consider it as a necessary condition for an effective collective management of river water. Even the members of Group S4 were very cautious with their statements when asked to comment on this, which is reflected by three players giving a medium value to the freedom.

If we look at the sole means of the collective capacity and the value given to it we observe that Group S5 and Group S4 are the ones with the lowest ratings. This is consistent with the absence of NMRs that was observed and reported in their group, contrary to the other two groups (Group S1 and Group S2). Group S1 and Group S2 show perceptibly higher means for both variables, which is consistent with the fact that both of them made and implemented at least one NMR during the *ex ante* game.

Moreover, we observe on Figure 46 an important dispersion of players' individual ratings of the collective capacity and the value given to the freedom to perform it. In none of the groups

do we observe a cluster of players who all share similar ideas and values concerning the group capacity and the importance of this capacity. This can be explained by the fact that the *ex ante* CappWag workshops took place before any of the planned courses on participatory management for water and participatory methods. Hence, it is very likely that awareness concerning this subject had yet to be raised among many players.

4.2.5.2. MAKING A COLLECTIVE DIAGNOSIS

Comparing the results of the group (Figure 47) allows us say that every group presents a different level of the collective capability "being able to make a diagnosis".

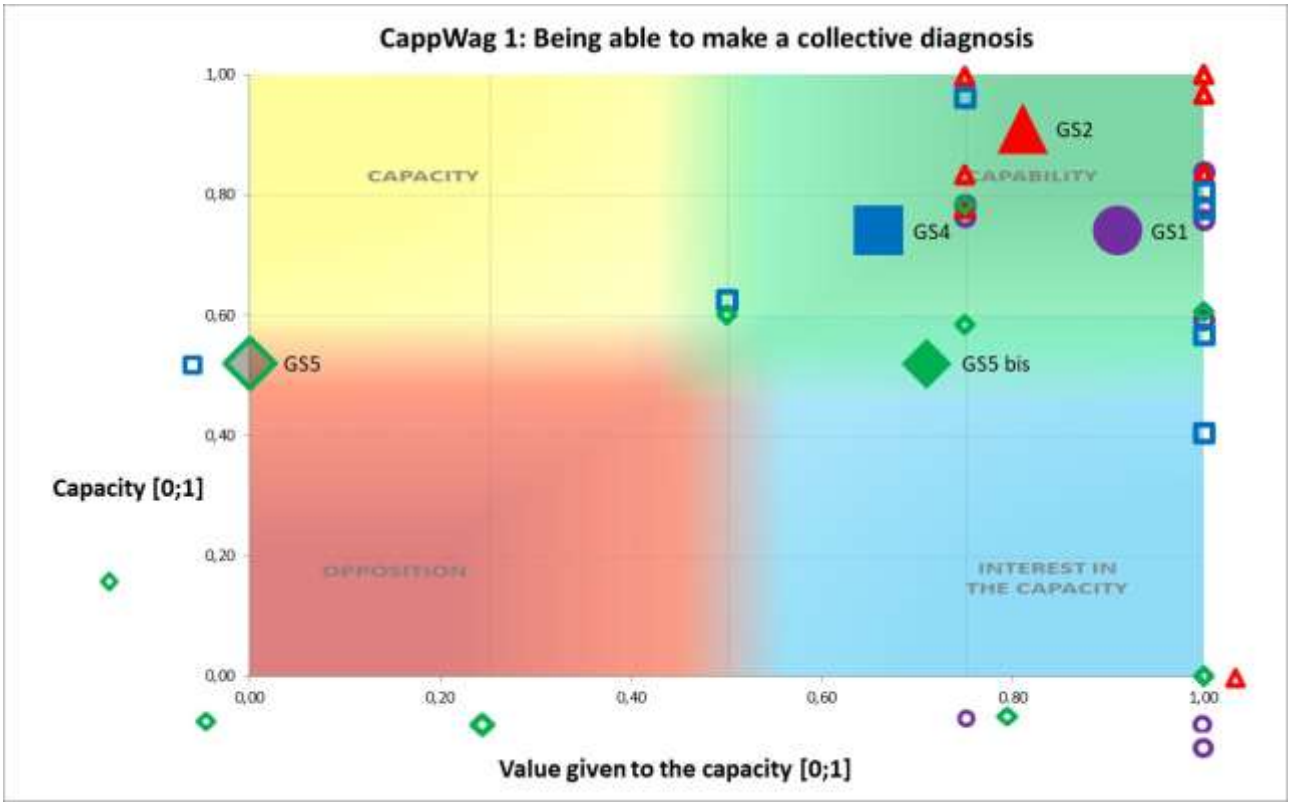

Figure 47: The collective capability "making a diagnosis" of Groups S1, S2, S4 and S5.

Groups S1, S2 and S4 all seem to possess the collective capability. This would mean that they had deliberately chosen not to transform it into a functioning and actually realized together a diagnosis of the game situation. This is a plausible evaluation, since the short time left for discussions during the game might have been a strong incentive for players to focus instead on the organization of agreements or management rules. Nevertheless, the contradictions in Group S4 between the external observations (a visibly divided group) and the perceptions stated by the players in the questionnaire (which theoretically show the existence of a collective capability "being able to make a diagnosis") question the accuracy of the measure. This will be discussed further in Chapter 5, section 3.5.2.

Only one group (Group S5) does not possess this collective capability. Even without taking into account this one player, this brings the collective value of the freedom to make a diagnosis to 0; Group S5 is still one of the two groups (with Group S4) where players gave it the lowest rating, as well as giving the lowest rating to their collective capacity to perform this collective action.

4.3. THE *EX POST* CAPABILITIES

During the *ex post* session, the configuration of the workshop was exactly the same for all of the five groups (see Table 13). Hence the capabilities of Group S3's players could be analyzed following the previously described methodology. The analysis will not integrate a comparison to their previous state of capabilities due to the lack of data explained in section 4.1.

4.3.1. BEING ABLE TO EXPRESS ONESELF IN FRONT OF A GROUP

GROUP S1

According to external observations, the three foreigners ($P2_{S1}$, $P7_{S1}$ and $P8_{S1}$) sat together and barely talked with the other players. Just as the first time, many discussions and agreements took place in twos or threes. The discussions on one side of the table, where $P9_{S1}$, $P1_{S1}$, $P4_{S1}$ and $P6_{S1}$ sat, were described as particularly animated.

Contrary to the *ex ante* workshop, the members of Group S1 answered all the questions related to self-expression. Data extracted from the questionnaire show that, unlike the first time, the reported frequency of participation in group discussion is rather contrasted. Seven players ($P1_{S1}$, $P3_{S1}$, $P4_{S1}$, $P5_{S1}$, $P6_{S1}$, $P8_{S1}$ and $P9_{S1}$) stated that they participated "quite often" or "a lot" in group discussion, while two players ($P2_{S1}$ and $P7_{S1}$) reported that they did not often participate. The statement of these two players is consistent with the observations of the facilitator, who remarked that they and $P8_{S1}$ were *"excluded from the dialogue"* during the whole game. Nevertheless, $P2_{S1}$ and $P7_{S1}$ justified their actions by explaining that "*'other persons had the same ideas and discussed them with the group before [they] did*". This would consequently not prevent them from owning the capacity to express themselves in front of a group.

Just as in CW1 and as shown on Figure 48, the rating that players gave to their capacity to express themselves in front of the group is contrasted, which is illustrated by a SD of 0,24. Six players ($P1_{S1}$, $P3_{S1}$, $P4_{S1}$, $P5_{S1}$, $P6_{S1}$ and $P9_{S1}$) reported a high or very high capacity to express themselves in front of the group, while two players ($P2_{S1}$ and $P7_{S1}$) reported a medium capacity. It should be noted that despite this medium rating given to his capacity, $P2_{S1}$ explained during an individual interview that: "*[I did not speak much] the first time because during the first half of the game, I did not understand what I was supposed to do. The second time is was because during the 7-minute discussion phases, there were already colleagues who*

talked about what I wanted and who made proposals. So I agreed with them and we implemented solutions together". This explanation shows he considered his capacity to speak was good and free from constraints during the second game. $P8_{S1}$ was the only player to report a low capacity, which corresponds to his behavior during the game according to the external observations. The value given to the freedom to realize this capacity in a "real context" is on the contrary very consensual.

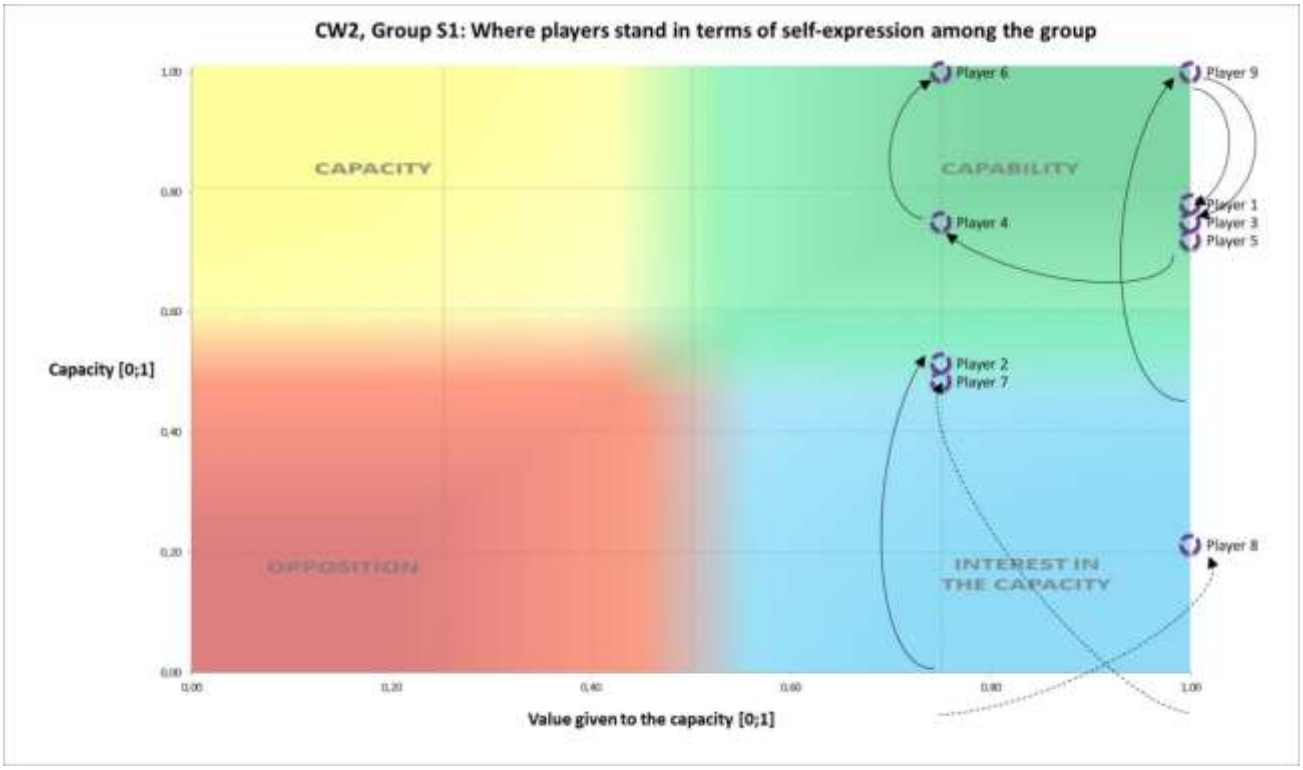

Figure 48: The individual capability "being able to express oneself in a group" of Group S1 players during the *ex post* workshop.

When we compare the capabilities of the players between the first CappWag workshop in October 2017 and the second CappWag workshop in January 2018, we observe very contrasted trajectories, as illustrated on Figure 48.

On the one hand, three players ($P6_{S1}$, $P7_{S1}$ and $P9_{S1}$) report higher individual capabilities, with $P7_{S1}$ and $P9_{S1}$ showing the most spectacular increase. In all three cases, they valued the freedom to realize the capacity similarly to the first time, but they reported an increase in their capacity to express themselves in front of the group. On the other hand, results show a lower capability during the second workshop for three players ($P1_{S1}$, $P3_{S1}$ and $P4_{S1}$). Just like the three players whose capability increased over time because of a higher capacity, $P1_{S1}$ and $P3_{S1}$ reported a lower capacity but a similar value given to the freedom to realize it (a value which is the highest proposed by the questionnaire). $P4_{S1}$ on the contrary reported a similar capacity to express himself in front the group during the second workshop, but valued the associated freedom slightly less.

This may be related to the fact that the *ex post* game was more contentious than the *ex ante* game, and hence more frustrating, as reported by $P4_{S1}$ in his monitoring file (he explains for example that despite a rather collective game, "*some [persons] do not play along*"). This might have lessened his interest in the capacity given to anyone to discuss during group work, even though it impacted his opinion concerning the two collective capabilities differently, as we will see later in this Chapter.

The evolution over time of the capability of two players ($P2_{S1}$ and $P8_{S1}$, who were two of the three foreign students and who were excluded from the dialog during the second workshop) cannot be compared because they did not answer the questionnaire during the first workshop properly. It can nevertheless be noted that if the value given to the capacity "expressing oneself in front of a group" increased through time for $P8_{S1}$, it equally decreased for $P2_{S1}$ (we note that he did not furnish an explanation for this decrease).

It should be noted that the three foreign players who were observed not to participate in group discussions during the *ex post* workshop reported medium to low capabilities, which is consistent with the facilitator's remarks.

GROUP S2

External observations from the facilitator and the observers report that all players participated in the discussions during the game but note that $P7_{S2}$ was first silent at the beginning of the game, and later in the game rather reticent. This nevertheless represents a certain improvement compared to his behavior during the *ex ante* game, during which he was reported not to speak at all.

Data extracted from the questionnaire show that no major changes occurred among Group S2 between the *ex ante* and the *ex post* workshops, except for 3 players. $P7_{S2}$, the foreign student who barely talked during the *ex ante* workshop and evaluated his capacity to do so and the related value as medium, showed a contrasted evolution during the *ex post* game. If he considered that it was more valuable than it had been the first time to be able to express oneself in front of a group (see Figure 49), he also evaluated his capacity to do so lower than the first time, even though external observations report he spoke slightly more (questionnaire's data do not show any change in the frequency of participation in the group discussions for $P7_{S2}$).

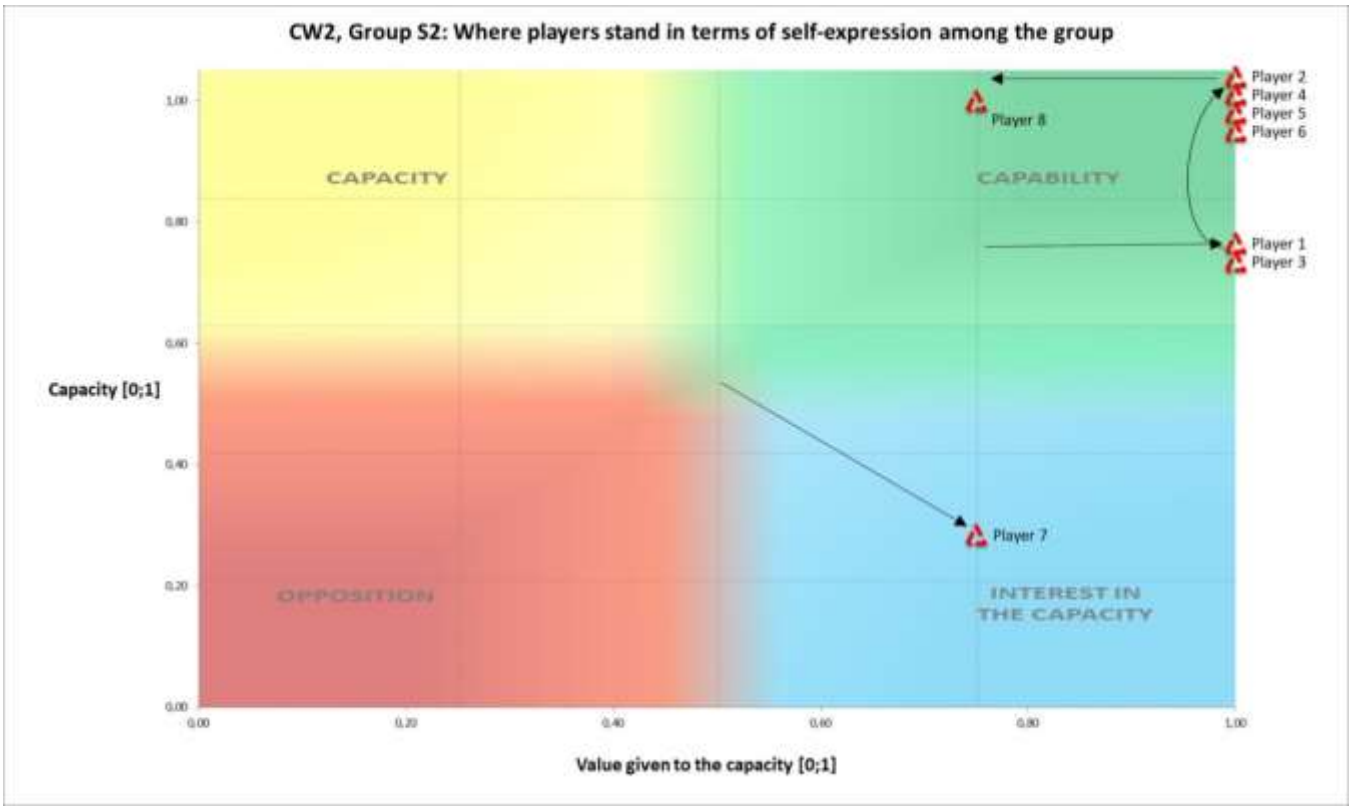

Figure 49: The individual capability "being able to express oneself in a group" of Group S2 players during the *ex post* workshop.

The rest of the players reported during the *ex post* workshop a capacity to express themselves and a remarkably constant related value. Only $P3_{S2}$ showed an increase in the value given to the freedom to express himself, which was associated with a higher participation in group discussion, compared to the *ex ante* workshop. $P8_{S2}$ showed the very opposite change in terms of capacity and value rating (however, he did not explain this change further in his questionnaire nor during the focus group and we could not interview him to ask him for an explanation). $P1_{S2}$ was the only player to report a higher capacity to express himself during the *ex post* workshop.

GROUP S3

External observations from the facilitator and the observers reported that all players participated in the discussions during the game. $P7_{S3}$ was reported as the most talkative player of the group. The discussions were intense and several players (whose identity was not specified) hence did not respect the silence phases of the game.

Data extracted from the questionnaire show that all players reported having spoken often or a lot, except two ($P5_{S3}$ and $P6_{S3}$), which contradicts the external observations. $P5_{S3}$ explained this behavior by the fact that he was not interested in the conversations, which related to a choice made out of free will, but he also explained that he is shy and hence did not dare to speak up, which is a constraint. $P6_{S3}$ also mentions constraints to explain his weak

participation in the discussions. He refers to both an internal constraint (his lack of elaborated propositions to discuss with other players) and an external constraint (the group would not have listened nor taken his remarks into account).

These two players considered their capacity to express themselves in front of the group as medium. If $P5_{S3}$ explained that he possessed the capacity despite the lack of interest of the group in his propositions ("*I imposed myself but nobody cared*"), $P6_{S3}$ explains that the lack of receptiveness of the group hindered his capacity to speak up ("*I did not feel that other players were receptive, which made my capacity to express myself more complicated*"). One player only (P4S3) in Group S3 rated his capacity to express himself in the group as low (Figure 50). He explained that "even though [he] tried to help, [he] did not have an impact on the game".

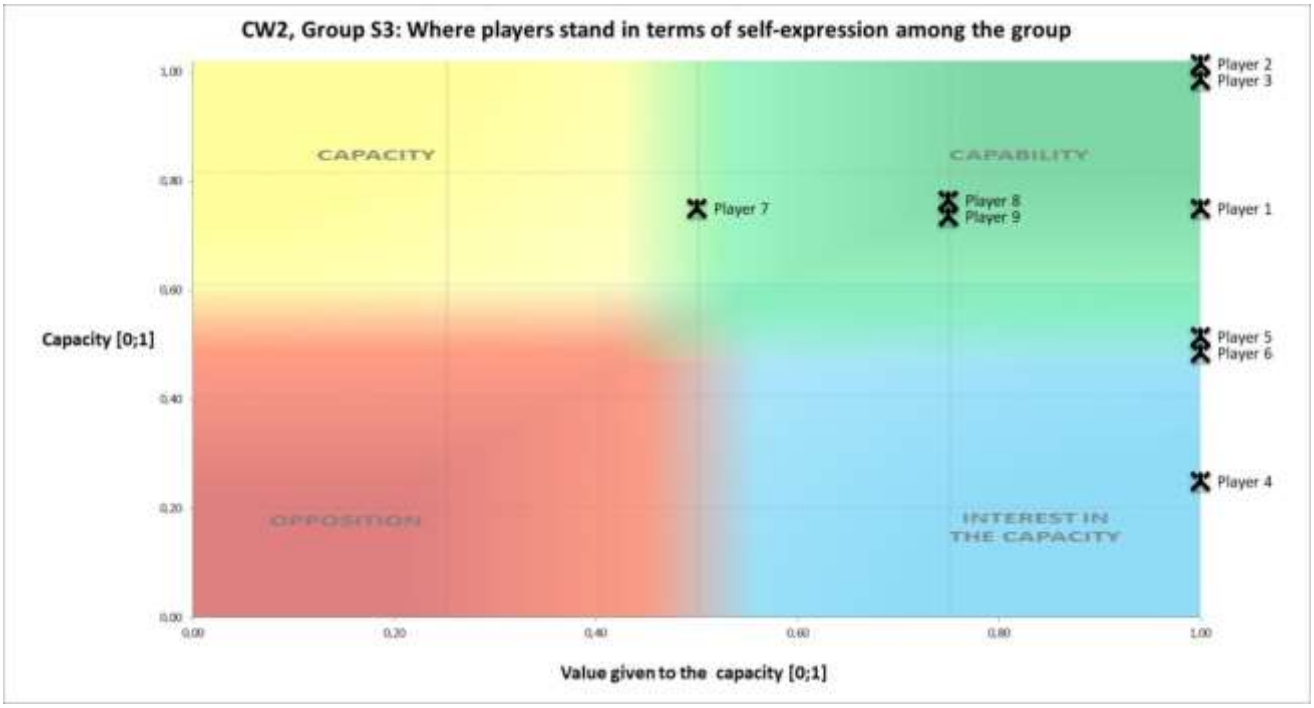

Figure 50: The individual capability "being able to express oneself in a group" of Group S3 players during the ex post workshop.

All players except one ($P7_{S3}$) valued the freedom possessed by a person to express oneself in front of a group, in the context of the collective management of a water resource. $P7_{S3}$ stated that he did not agree nor disagree with this value statement, which suggests to us that it is not clear whether he possesses the capability. We also state that even though $P5_{S3}$ and $P6_{S3}$ reported a high value for the freedom to express oneself in a group and a medium capacity, they were constrained by other players or even by themselves during the game and hence did not possess the capability either.

We argue that the rest of the group ($P1_{S3}$, $P2_{S3}$, $P3_{S3}$, $P4_{S3}$, $P8_{S3}$ and $P9_{S3}$) possessed this individual capability. The accuracy of the measure was illustrated by $P2_{S3}$, who was interviewed after the *ex post* workshop. He explained why he considered that his capability is

very high: "*I do not have difficulties to work in a group. The IWRM course did not teach me much because I have always worked in group".* The last part of his statement let us to believe that were data available for the *ex ante* workshop, his capability would have also existed. It is also likely that it would not have increased much during the two workshops.

GROUP S4

During the *ex post* workshop, one player ($P5_{S4}$) was missing. He dropped the IWRM course after the first class in October 2017, which also corresponded to the *ex ante* workshop in which he took part. External observations report a collective and then tense atmosphere among the group. Every player spoke, even though $P6_{S4}$ is said to have had "*difficulties to make his voice heard*". One player ($P2_{S4}$) acted as the leader of the group, but observations show that his leadership was rather aggressive (he was "*agitated*", "*hyperactive*" and he "*tried to impose his ideas*"). Two players ($P3_{S4}$ and $P4_{S4}$) seemed "*bored*", according to external observations.

In the questionnaires, all players stated they participated "quite often" or "a lot" tin the group discussion, except $P3_{S4}$ who stated he did "not often" do so. This is consistent with the observations made of him playing individually and not participating in collective decisions on purpose.

Important changes in the individual capability of two players can be observed thanks to players' self-evaluation. As Figure 51 illustrates it, $P6_{S4}$ reported a marked increase in his capacity to speak in front of a group of people, as well as a slight increase in the value he gives to the related freedom. During the *ex ante* workshop, he had been reticent and was among the downstream players who did not lead the discussions nor have any impact on them. This time, the observers report that he did participate more and also played more collectively than during the *ex ante* workshop.

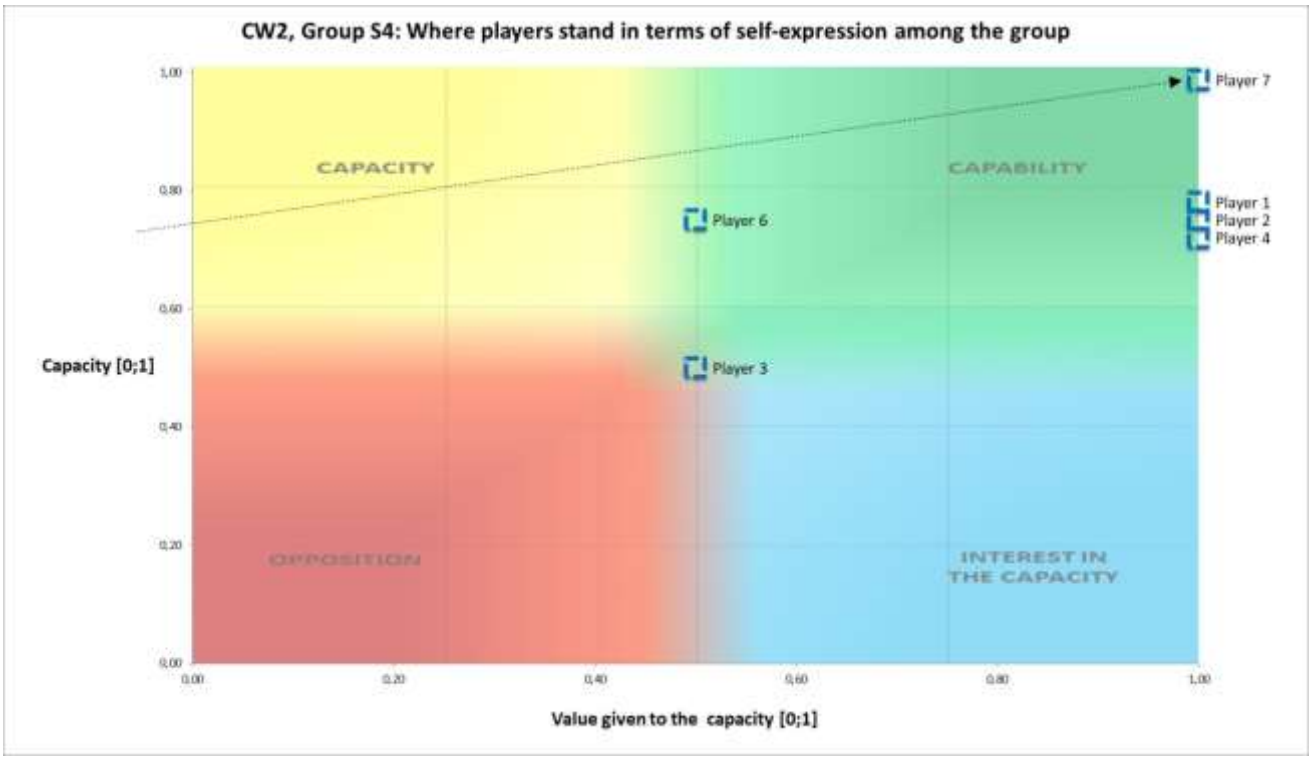

Figure 51: The individual capability "being able to express oneself in a group" of Group S4 players during the *ex post* workshop.

$P3_{S4}$ on the contrary shows an opposite pattern: he valued the freedom to be able to speak in front of a group way less than during the *ex ante* workshop and he also gave a lower rating to his capacity to do it. This can be related to the fact that, while he played collectively among the group of four upstream players during the *ex ante* workshop, he decided this time to play openly individually in order to win the game. This would raise the question of whether $P3_{S4}$ might have mistaken the questions concerning his functioning (how much did he speak during the game) and his capacity and the importance of being able to do so. Indeed, this decrease of his capability, strongly correlated with a voluntary decrease of his functioning between the two games, definitely leads in this direction. It is also possible that $P3_{S4}$ was not interested in the game and answered the questions, "lightly" or that he answered them out of frustration with what he considered as a waste of time.

It is interesting to notice that two players ($P3_{S4}$ and $P7_{S4}$) adopted an individualist strategy to win the game but that most of the conflicts reported between the players concerned $P2_{S4}$ and $P7_{S4}$ and not $P2_{S4}$ and $P3_{S4}$. This might be explained by a friendly relationship between the two latter outside the game, which probably did not exist between $P3_{S4}$ and $P7_{S4}$. Similarly, and still according to the observers, $P7_{S4}$ teamed up with $P6_{S4}$ during the game, which was already the case during the *ex ante* workshop. These patterns lead us to believe that in Group S4, the location of the players along and around the table was not the main factor influencing players' behaviors towards each other, as we might have thought the case after witnessing a clear upstream-downstream division during the *ex ante* game. Friendship relationships were most likely the main variable to influence behaviors, which would indeed explain the coalitions and the oppositions in the game.

Answers from the questionnaire are not clear enough to understand if $P6_{S4}$ did possess the individual capability "being able to express oneself in front of the group". But even though there was a clear improvement according to his report, external observations show, this time without any doubt, that he was not able to speak to the group and did not manage to discuss his ideas, partly because the group leader ($P2_{S4}$) would not let him. We consequently consider that he does not possess the capability.

GROUP S5

Just as in Group S4, there was one player missing during the *ex post* workshop. $P5_{S5}$ from the *ex ante* workshop also dropped out of the IWRM course after the first class in October 2017. External observations show that there was no noticeable behavior that in any way stood out concerning self-expression among the group.

Data extracted from the questionnaire show that all players frequently participated in the collective discussions during the *ex post* workshop. When asked to rate their own capacity to express themselves in front of a group, all players without exception showed a significant improvement on their answers during the *ex ante* workshop (see Figure 52). $P1_{S5}$ and $P3_{S5}$ are the players who reported the greatest improvement of their capacity to speak in public

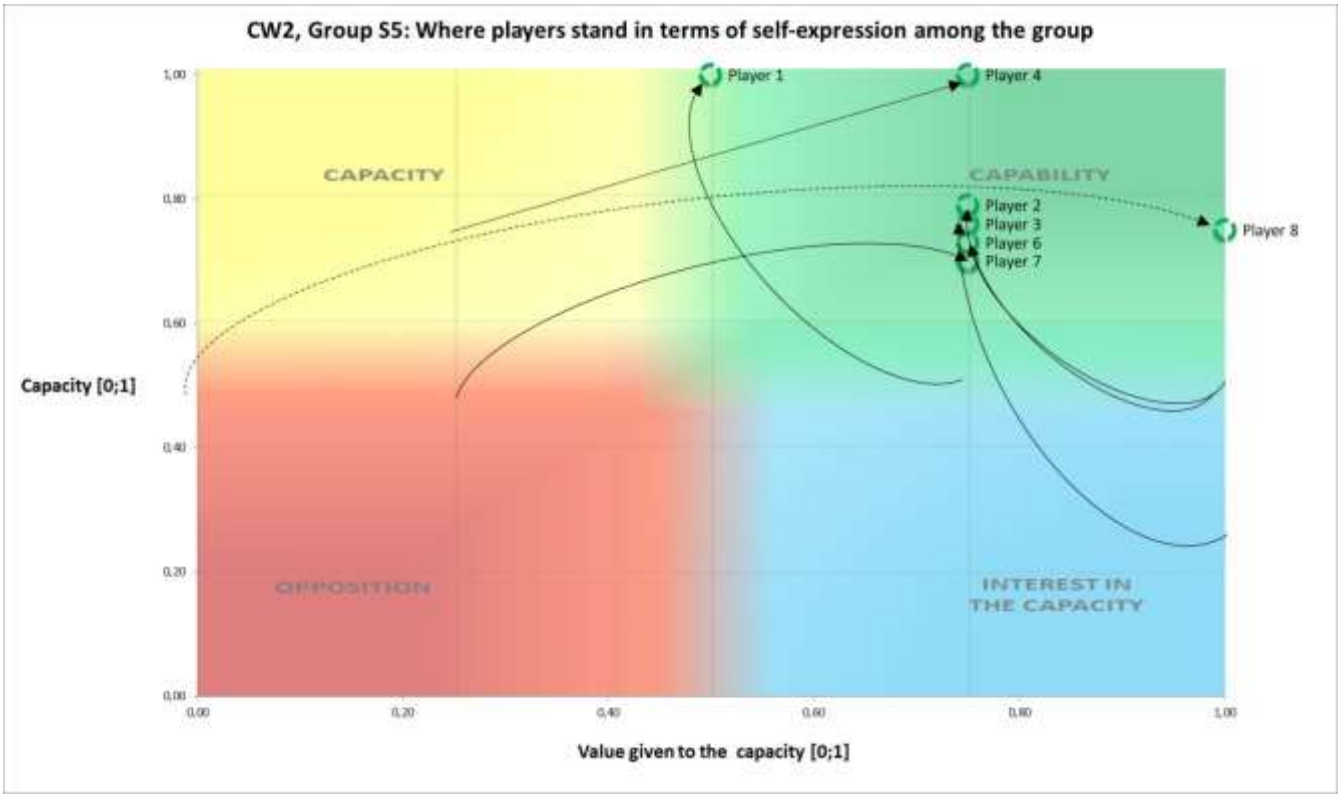

Figure 52: The individual capability "being able to express oneself in a group" of Group S5 players during the *ex post* workshop.

The evolution of the value given to the freedom to realize such a capacity was on the contrary and in general among Group S5 less valued during the *ex post* workshop than during the *ex ante* workshop. Only two players ($P4_{S5}$ and $P7_{S5}$) out of seven reported a strong increase in this value.

All of the players of Group S4 except $P1_{S5}$ can be considered as possessing the individual capability "being able to express oneself in front of a group". The limited value given by $P1_{S5}$ to the freedom of "self-expression" in a participatory context raises a doubt concerning the existence of the related capability, even though he certainly owned the capacity.

4.3.2. COLLECTIVE RULE-MAKING AND RULE-IMPLEMENTATION

GROUP S1

External observations have reported no implementation of a NMR during the *ex post* workshop by Group S1. Agreements have been reported to take place between duos or trios of players, but not on the scale of the whole group of players.

This is confirmed by data from the individual monitoring files. Most of the collective actions made by players concerned the acquisition of Activity cards. Only one player ($P1_{S1}$) thought of a collective rule to implement at the end of the game ("*to find a penalty for the biggest [water] consumers*", because of the "*injustice*" of the environmental fine system), and even though he indicated that his proposition was discussed with other players, no collective decision emerged from it. Moreover, the monitoring files show that at least three players ($P1_{S1}$, $P3_{S1}$ and later $P6_{S1}$) decided to play individually on purpose, in order to win the game ($P1_{S1}$ and $P3_{S1}$) or because of the frustration induced by the fine system, as explained by $P6_{S1}$ (everyone must pay because a handful of players pollute a lot or consume a lot of water). We note that $P6_{S1}$ found justifications for his behavior but he had already played to win on his own during the *ex ante* game. $P4_{S1}$ singles out only one player who would have played individualistically during the game (without naming him): "*there was a particular player who […] stopped playing collectively and consequently everyone stopped. But apart from that, we played mostly together because we knew less about what would happen during the following rounds*".

Data from the questionnaires confirm the external observations and the data from the monitoring files. Just as during the *ex ante* workshop, few players said that they thought of and formulated NRMs during the game ($P3_{S1}$ and $P4_{S1}$ answered that they did not do so at all, $P1_{S1}$, $P5_{S1}$, $P7_{S1}$, $P8_{S1}$ and $P9_{S1}$ only "once or twice"). The monitoring file shows that only $P1_{S1}$ wrote down a proposition that could have been a NRM. All of the seven players who stated that they did think of and formulate NRMs said they presented them to the rest of the group. $P3_{S1}$ explained that he did not think of or formulate NRMs because *"[he liked] the current management [and] did not think of it*", which relates to a choice made out of free will. $P4_{S1}$ on the contrary explained that he "*did not have any ideas*", which rather relates to an internal constraint.

The members of the group consensually stated that they often accepted the rules that were formulated (this is shown by a rather high median of 0,75, which is equal to the one for the same question during the *ex ante* workshop).

Players gave contrasting answers concerning the way they participated. Five players ($P1_{S1}$, $P3_{S1}$, $P5_{S1}$, $P7_{S1}$ and $P9_{S1}$) stated that they "*spontaneously [gave their] agreement to the group*" and four players stated they *"[gave their] agreement after one or several persons in the group asked for it*". This time no player stated he was "*the one who asked the group to validate the rule*". Only one player ($P6_{S1}$) mentioned a voting process, as well as the fact that "*the rules did not all seem interesting to [him]*" and that he "*did not agree with the content of the management rules*". This can be related to the fact that he wanted to win the game and played individually on purpose to reach his objective. Finally, one player ($P8_{S1}$) stated that he "*did not want to confront the collective will of the group*", which implies that there was a certain pressure among Group S1 to play collectively. This would also explain why $P6_{S1}$ played individually but did not openly let the other players see this.

Four players out of nine stated that they did apply NMRs during the game ($P1_{S1}$, $P2_{S1}$, $P6_{S1}$ and $P9_{S1}$), which is consistent with their previous answers to the questionnaire but not with their monitoring files. In any case, we can say with certainty that no NMR at the scale of the whole group of players emerged during the game. The existence of at least one NMR at the scale of a sub-group is disproved by external observations and answers from the monitoring files. Out of these four players, one only ($P6_{S1}$) stated that he did not "always" respect the NMR implemented by the group. He justified his answer by explaining that he "*wanted to win the game and [he] chose to play in [his] own way*", which is similar to his answer during the *ex ante* workshop. He added that he did not openly say this to the rest of the group. He was the only one to give this reason as a justification though, unlike the *ex ante* workshop where $P4_{S1}$ and $P9_{S1}$ had shared the same thought. Other players who stated they "always" respected NMR explained they did so because they "*agreed with all the management rules validated by the group*". It should be noted that even though only four players answered positively when asked about the implementation of NMRs, all of them answered the question concerning the respect of these rules… This contradiction raises the question of the reliability of the questionnaire, which will be discussed further in Chapter 5, section 5.2.

The mean of the perceived collective capacity of the group to implement one or several management rules by individual players is rather high and consensual (0,63 for a SD of 0,13, see Figure 53), even it is lower than for the *ex ante* workshop (mean of 0,78). One player in particular ($P4_{S1}$) gave a low rating of 2 on a [0;5] scale, explaining that the rules were "*rather ineffective*". Other players confirmed this impression, even though they gave higher ratings to the group capacity. $P3_{S1}$ stated that "*it was difficult to convince everybody*" and $P9_{S1}$ that they "*did not always agree on the way to manage gains and losses*". Only $P1_{S1}$ gave a positive review of the group capacity, explaining that they "*managed to find agreements rather easily*". His use of the word "agreement" instead of "rule" shows that there might have been confusion between the two, which would also explain why players' answers to the questionnaire suggest that rules were implemented when external observations and the monitoring files show that this was in fact not the case.

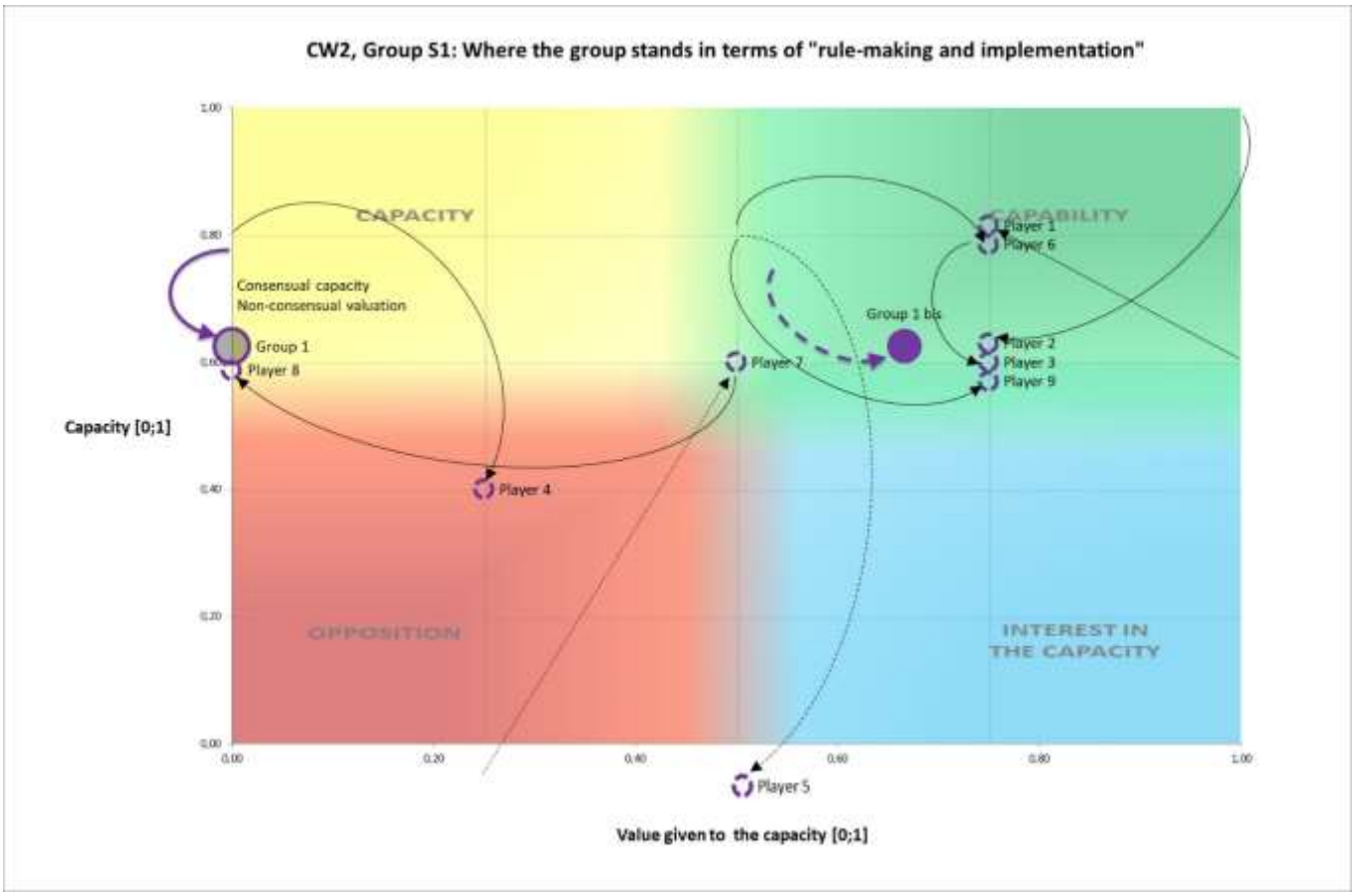

Figure 53: The collective capability "being able to collectively make and implement management rules" of Group S1 during the *ex post* workshop.

The value given to the freedom to make and implement NMRs is less consensual, which is illustrated by a SD of 0,22. Only one player ($P8_{S1}$) valued this freedom a lot and gave it the highest rating (5 on a [0;5] scale), and one player ($P4_{S1}$) gave it a low rating. Interpreted strictly, the low value given by $P4_{S1}$ would prevent a collective capability "being able to make and implement rules" to exist, since all members of the group should value, or at least be neutral about it. Yet it is interesting to focus on the overall average of the value given by players. It shows that even though the mean of the collective capacity notably decreased between the *ex ante* and the *ex post* workshop (dropping from 0,78 to 0,63), the mean of the collective value given by players on the contrary increased (rising from 0,56 to 0,67) (see Figure 53).

At the individual level, when we compare the collective capability as evaluated by individual players between the *ex ante* and the *ex post* workshops, we observe contrasted trajectories. Only $P6_{S1}$ and $P7_{S1}$ showed an improvement on either the value or the capacity scale, which is not accompanied by a reverse movement of the other one. If $P8_{S1}$ showed a decrease in the value given to the capacity, $P3_{S1}$ and $P4_{S1}$ showed a decrease in their evaluation of the group capacity. $P2_{S1}$ showed an impressive decrease of both variables. The decrease in the group capacity perceived by several players is very likely related to the fact that, contrary to the ex ante workshop, no NMR was implemented this time. The decrease in the value given to the

freedom to realize this capacity is more difficult to explain. We relate it to the deterioration of the group atmosphere in Group S1 and to the improvement of player's knowledge and interest in this constitutive stage of a participatory process. Contrary to the collective capability "diagnosis-making", no common trend was found between the three foreign players $P2_{S1}$, $P7_{S1}$ and $P8_{S1}$, who are each located on a different gradient of the capacity/value scope and evolved differently between the *ex ante* and the *ex post* workshop.

The evolution through time of the capability of two players ($P7_{S1}$ and $P5_{S1}$) cannot be compared because $P7_{S1}$ did not answer the questionnaire properly during the *ex ante* workshop, nor the second one during the *ex post* workshop. It can nevertheless be noted that if the value given to the freedom to realize the collective capacity "rule-making and implementation" increased through time for $P7_{S1}$, it stayed similar for $P5_{S1}$.

GROUP S2

External observations reported the implementation of one NMR by all the players, the transparency rule. Players certainly showed each other their cards. Before the fifth tour, players decided who would be playing first during the following tour. This collective agreement is remarkable because it was made on the scale of the whole group of players, but it cannot be considered as a management rule, since it was only valid once and was not reproduced during the sixth tour. Many other punctual agreements were reported to have taken place between players in twos or threes.

Data from the individual monitoring files are difficult to decipher. The only NMR implemented by the group, according to the observers, is not reported in any of the monitoring files. It raises the question of the reliability of self-report (see Chapter 5, section 5.2 for a detailed discussion of this issue). It also raises the question of the clarity of the vocabulary used by the evaluator and the comprehension by the players of the questions asked (see Chapter 5, section 3.5.1 for a thorough discussion of this issue). As often happened, most of the collective actions made by players concerned the acquisition of Activity cards. The one collective agreement concerning the re-organization of the order of playing for tour 5 is mentioned by only two players ($P2_{S2}$ and $P3_{S2}$), even though it concerned the whole group.

Data from the questionnaires are equally unsettling. Players reported a decrease in the frequency of thinking of and formulating NRM during the game, which is illustrated by a median of 0,33 during the *ex post* workshop, while it was equal to 0,67 during the *ex ante* workshop. During the *ex post* workshop, no player reported to have thought and formulated NMR "many times", when there were three ($P5_{S2}$, $P6_{S2}$ and $P8_{S2}$) to so report the first time. On the contrary, three players ($P2_{S2}$, $P7_{S2}$ and $P8_{S2}$) reported having never thought and formulated NMR during the *ex post* game, while there were two ($P4_{S2}$ and $P7_{S2}$) during the *ex ante* game. $P2_{S2}$, $P7_{S2}$ and $P8_{S2}$ justified their behavior differently: $P7_{S2}$ and $P8_{S2}$ stated, "*they did not have any ideas*", which relates to an internal constraint, but $P2_{S2}$ explains that "*[they] we were not aware that [they] could invent rules*". This raises the question of the clarity of the games' rules, but also of the care with which players actually read the questions and answered them. Indeed, the game rules and options were similar between CW1 and CW2,

just as in this part of the questionnaire. If a player might have understood the game options during the game and learned them later when reading the questions in the questionnaire, this should logically have happened during the *ex ante* workshop and not during the *ex post* workshop.

Players consensually stated that they almost always accepted the rules that were formulated (this is shown by a median of 1, just as during the *ex ante* workshop, and a low SD of 0,12). They gave rather similar answers concerning the way they participated. They either "*spontaneously [gave their] agreement to the group*" ($P1_{S2}$, $P4_{S2}$, $P5_{S2}$, $P6_{S2}$ and $P8_{S2}$) or "*[gave their] agreement after one or several persons in the group asked for it*" ($P7_{S2}$). One player ($P4_{S2}$) reported that he as the "*one who asked the group to validate the rule*", stood out as a leader of the group. Because $P3_{S2}$ was the only player to report that he "*voted*", we question the veracity of this statement. Only five players ($P1_{S2}$, $P3_{S2}$, $P4_{S2}$, $P5_{S2}$ and $P8_{S2}$) stated that they applied NMRs during the game. This is not consistent with the external observations, which show that all of the players decided to be transparent with each other by disclosing their Activity cards. All of the five players who answered positively said they "always" respected the management rules, because they "*agreed with [them]*". $P4_{S2}$ specified that "*these rules (showing the cards for example) were made in order to facilitate the management of the game*".

As can be observed on Figure 54, the mean of the perceived collective capacity of the group to implement one or several management rules by individual players is rather high (0,80) and consensual, which is illustrated by a SD of 0,10. Similarly, the mean of the value given by every player to the freedom for a group to make and implement its own MR is also high (0,84) and consensual (SD of 0,19).

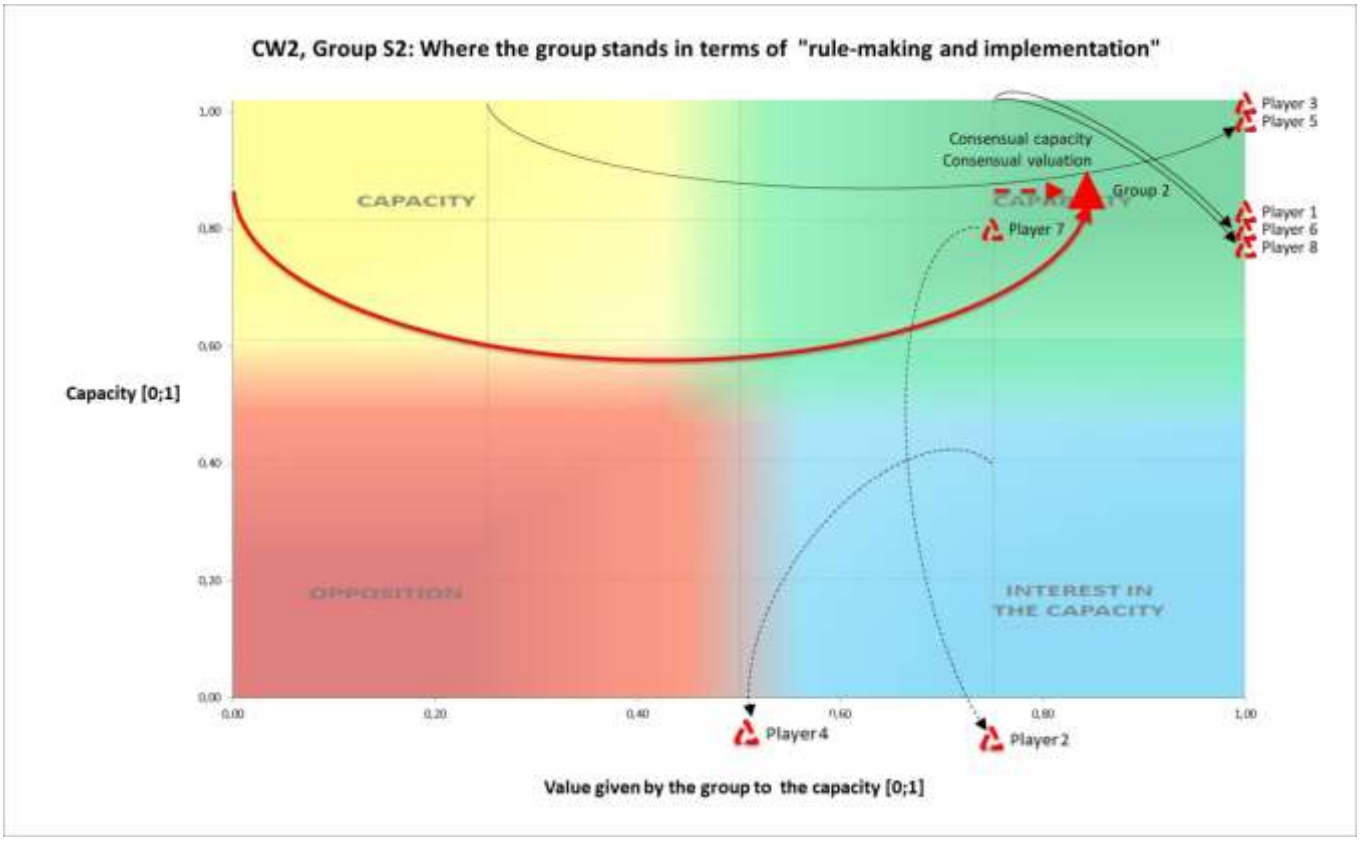

Figure 54: The collective capability "being able to collectively make and implement management rules" of Group S2 during the *ex post* workshop.

One player ($P4_{S2}$) differentiated himself from the rest of the group by rating the value given to rule-making and implementation lower than during the *ex ante* workshop. This is an interesting change since, as we understood from the various data collected during the workshop, $P4_{S2}$ acted as a leader during the *ex post* game. Other players showed similar ratings or a slight increase in their evaluation of the group capacity ($P1_{S2}$) or the value given to the related freedom ($P5_{S2}$, $P8_{S2}$). Other players showed opposite dynamics (a decrease in value for $P4_{S2}$, a decrease in the collective capacity for $P6_{S2}$). Two players ($P2_{S2}$ and $P4_{S2}$) did not answer the question concerning the group capacity.

In general, and just as at the moment of the *ex ante* workshop, we can say that the group did possess the capability "being able to make and implement management rules". Indeed, all its members valued it, and evaluated the group capacity to carry out these actions as high. This was demonstrated at least once during the *ex post* workshop, as shown by the external observations and confirmed to a certain extent by the monitoring files and the questionnaires.

GROUP S3

External observations reported the implementation of the transparency rule by eight players ($P2_{S3}$ did not participate). But despite this collective action, players were reported to play "*defensively*" rather than collectively and the individualistic behavior of several players discouraged others from maintaining a collective dynamic.

Data from the individual monitoring files are consistent with the external observation and several players reported the implementation of a transparency rule. They also reported the non-implementation of the rule by $P2_{S3}$. This was thought of and later brought into the discussion by $P1_{S3}$, $P3_{S3}$ and $P9_{S3}$. For these three players, its goal was to know which Activity cards should be uninstalled so that they would not have to pay environmental fines anymore. The monitoring files also show that four players ($P2_{S3}$, $P7_{S3}$, $P8_{S3}$ and $P9_{S3}$) were particularly focused on earning units of wealth and winning the game.

Data from the questionnaires confirm the external observations and the data from the monitoring files. Four players ($P1_{S3}$, $P2_{S3}$, $P6_{S3}$ and $P7_{S3}$) stated they never thought of NMRs and brought them into the collective discussion. It is consistent with $P1_{S3}$'s report in his monitoring file (he had no time to discuss his proposal of transparency with the group). The median of the frequency of rules' thinking and formulating among the group was rather low (0,33). This confirms the external observations which stated that the collective discussions during the game seldom tackled the design of NMRs. $P2_{S3}$ confirmed this by explaining during an interview: "*during the second game, everyone participated. There would be either collective decisions on the entire watershed or between two players. There were ideas coming up after every round*". All players who thought of and formulated NMRs stated that they did present them "once" to the group.

Three players ($P1_{S3}$, $P2_{S3}$ and $P6_{S3}$) out of the four who had no NMR's ideas during the game explained this by the fact that they "*did not have any idea*", and two ($P6_{S3}$ and $P7_{S3}$) refer to the tense atmosphere among the group as an external constraint that prevented them from speaking. $P6_{S3}$ and $P8_{S3}$ also referred to their lack of ideas' proposal as the result of a choice made out of free will, since they "*preferred to let the other players intervene*".

The validation of NMRs among the group is not consensual, as demonstrated by a median of 0,50 and a high SD of 0,30. One player ($P8_{S3}$) stated that he never accepted ideas of rules discussed by the group and one player ($P4_{S3}$) only "seldom". In contrast, three players said that they "always" (P6S3) or "often" (P7S3 and P9S3) validated the rules that the group proposed. In contradiction with the external observations and his statement in his monitoring file, $P2_{S3}$ also stated that he "often" validated the group's NMRs. This answer questions $P2_{S3}$'s understanding of what a "NMR" is in the game (see Chapter 5, section 3.5.1 for a detailed discussion).

Players either "*spontaneously [gave their] agreement to the group*" ($P1_{S3}$, $P5_{S3}$, $P6_{S3}$ and $P9_{S3}$) or "*[gave their] agreement after one or several persons in the group asked for it*" ($P1_{S3}$, $P2_{S3}$, $P4_{S3}$, $P6_{S3}$, $P7_{S3}$ and $P8_{S3}$). Only two players ($P3_{S3}$ and $P6_{S3}$) mentioned that they voted to validate the rules, which casts doubt on whether this voting process did happen and, if so, how many players were actually concerned. Finally, $P4_{S3}$ also specified that even though he gave his agreement to some rules, he "*did not participate*" and $P8_{S3}$, that he "*did not wish for rules to be implemented in the game*".

The perception of the implementation of NMRs by players during the game is contrasted: half of the group stated they did implement a NMR ($P3_{S3}$, $P5_{S3}$, $P8_{S3}$ and $P9_{S3}$), while the rest of the group state that they did not. This is not consistent with the external observations and the monitoring files of players, which report the implementation of one management rule (transparency) by eight players during the game. Only one player ($P5_{S3}$) out of the four who stated they implemented NMRs explained that he "always" respected them; but he did not further justify this choice. $P8_{S3}$, who stated he did "not often" respect management rules implemented by the group during the game, explained consistently with his other answers and his behavior in the game that he "*wanted to win the game and […] chose to play in [his] own way*".

The mean of the perceived collective capacity of the group to implement one or several management rules by individual players is medium (0,55), as illustrated on Figure 55. It is however highly consensual, as demonstrated by a SD of 0,09. Players explained that the main reason for their rating is the lack of homogeneity in the group and the presence of several individualistic individuals that prevented the whole group from acting collectively ($P3_{S3}$: "*not all of us shared the same spirit*"; $P7_{S3}$: "*a few players were against the collective way of thinking*").

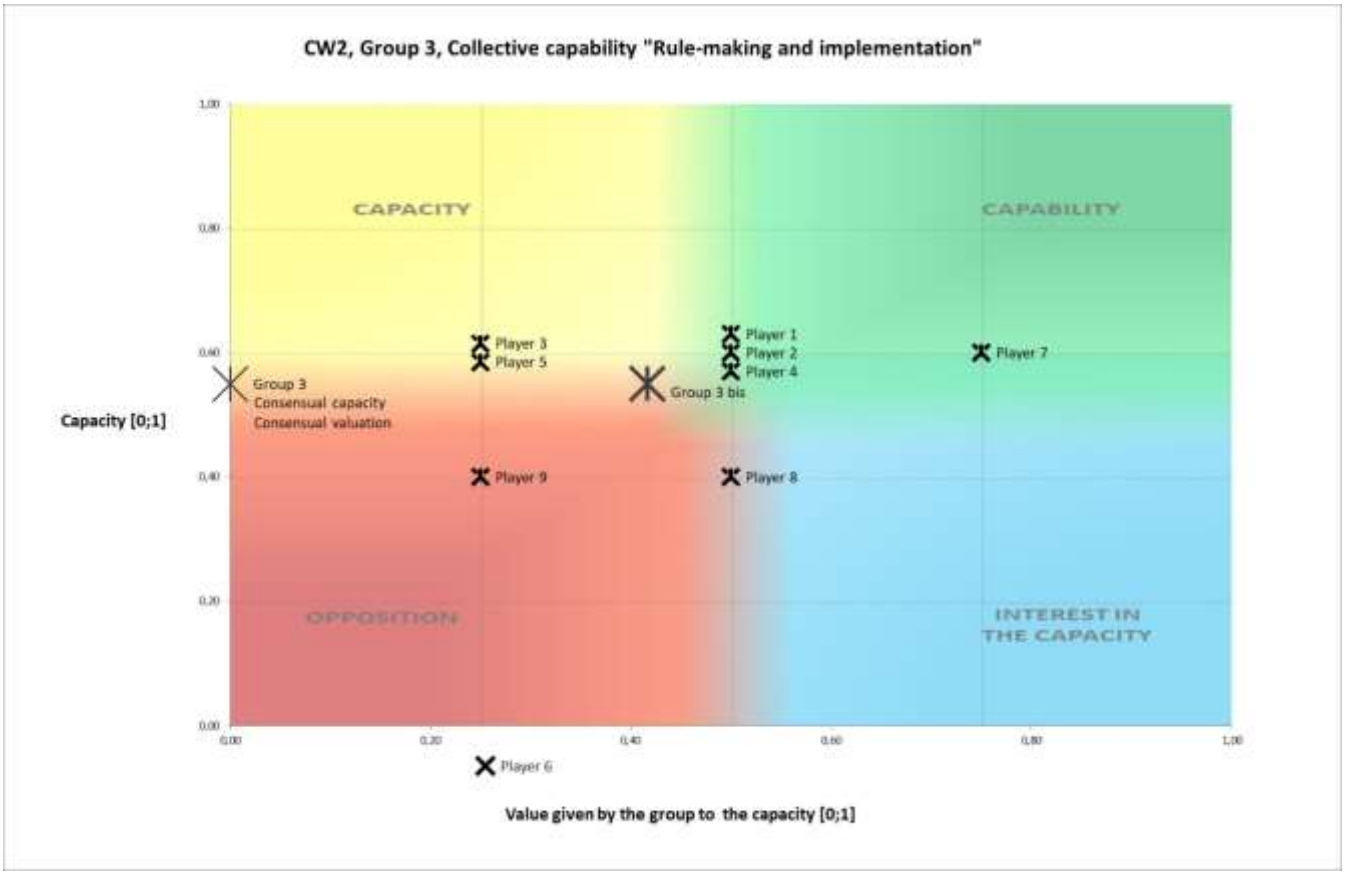

Figure 55: The collective capability "being able to collectively make and implement management rules" of Group S3 during the *ex post* workshop.

The mean of the value given by every player to the freedom for a group to make and implement its own MR is particularly low (0,42) but consensual (SD of 0,18). Four players ($P3_{S3}$, $P5_{S3}$, $P7_{S3}$ and $P9_{S3}$) did not believe that this freedom is an important condition to effectively and collectively manage a water resource. Hence we argue that there is no collective capability "being able to make and implement management rules" among Group S3.

GROUP S4

External observations have reported that one rule was implemented during the game: the transparency of the activities of the players. It was nevertheless not implemented by the whole group, since $P3_{S4}$ refused to comply and kept his cards secret during the whole game.

These observations are corroborated by the monitoring files players filled in during the *ex post* game. $P7_{S4}$ was the only player to write down a proposal he would like to discuss with the group; it corresponds to the transparency rule. This is a positive change from the *ex ante* game, during which he did not made any NMR proposal to discuss with the other players. The monitoring files show that towards the end of the game, several players ($P3_{S4}$, $P4_{S4}$ and $P7_{S4}$) considered that the state of the system was satisfactory enough that they would not need rules or agreements anymore. $P2_{S4}$, the group leader, mentioned several times that even though he proposed several collective actions to the group (e.g. collectively investing in Activity cards), people played "*again individually*".

Data from the individual monitoring files show that there was an improvement in the collective functioning of the group, in terms of rule-making and implementation. $P7_{S4}$ especially, who had "never" thought of or formulated NMR during the *ex ante* workshop, answered during the *ex post* workshop that he did so "once or twice". He and $P3_{S4}$, the two players who played rather individually during the *ex post* game, are also the ones who stated they had very few ideas of collective NMRs. This contrasts with the three players who formed a coalition ($P1_{S4}$, $P2_{S4}$ and $P4_{S4}$). External observers reported that they "many times" thought of and formulated NMRs. $P6_{S4}$ and $P7_{S4}$, the other two players who were reported to have teamed up, said that they had some ideas but only discussed them with the group "once". This is few, compared to the "many times" reported by the three players $P1_{S4}$, $P2_{S4}$ and $P4_{S4}$. The upstream/downstream group dynamic observed during the *ex ante* workshop seems to resurface here, even though the geographical location of the players around the water resource is completely different.

Consistently with the external observations and the monitoring files, all players except $P3_{S4}$ (and $P2_{S4}$ whose answer is missing) state they did validate NMRs when they were formulated (here there was only one, the transparency rule). These same players also stated they implemented it. According to their questionnaire, they did so by "*spontaneously giving [their] agreement to the group*" (all players except $P1_{S4}$, who is the only one to state he "*voted*"). $P4_{S4}$, $P6_{S4}$ and $P7_{S4}$ stated they "[*gave their] agreement after one or several persons in the group asked for it*", but $P4_{S4}$ and $P6_{S4}$ also said that they *"[were] the one who asked the group to validate the rule*". These two answers seem contradictory. $P3_{S4}$ the "solo player" adds that

"*the rules did not seem at all interesting to [him]*", consistently with his individualistic behavior aiming at winning the game. Finally, three out of six players ($P2_{S4}$, $P6_{S4}$ and $P7_{S4}$) stated that they only "often" (instead of "always" like $P1_{S4}$ and $P4_{S4}$) respected the NMR implemented by the group during the game. Precision as to why they did not always do so and if they showed this to other players or kept it for themselves (which would anyway be impossible given the one real NMR that was implemented) is missing from the questionnaire.

The mean of the perceived collective capacity of the group to implement one or several management rules is rather high and consensual, which is demonstrated by a mean of 0,70 and a SD of 0,11 (see Figure 56). It has sensibly increased when compared with the same value for the *ex ante* workshop. Only one player ($P1_{S4}$) spoke of his rating in a positive tone and talked about "*ideas rather unifying*" for the group. But $P2_{S4}$, $P3_{S4}$ and $P4_{S4}$, on the contrary, reported that "*actors [were] not always ok*" ($P2_{S4}$) and the fact that "*some [players] do not want to participate, even though their participation is paramount"* ($P3_{S4}$). $P3_{S4}$ was also the only player to lower his rating of the collective capacity between the *ex ante* and the *ex post* workshops. $P4_{S4}$ noted that the collective capacity to make and implement NMRs was "*sometimes not shared by the whole group, [with] little respect [for the collective] when the machine was running*". $P7_{S4}$ on the contrary showed a spectacular increase in his rating of the group capacity, which he evaluated as non-existent during the *ex ante* workshop.

These comments made by players temper the rather high rating they gave to their collective capacity. We explain them by the fact that several players in this group were particularly motivated to player collectively and were disappointed to see that not every member of the group shared their point of view.

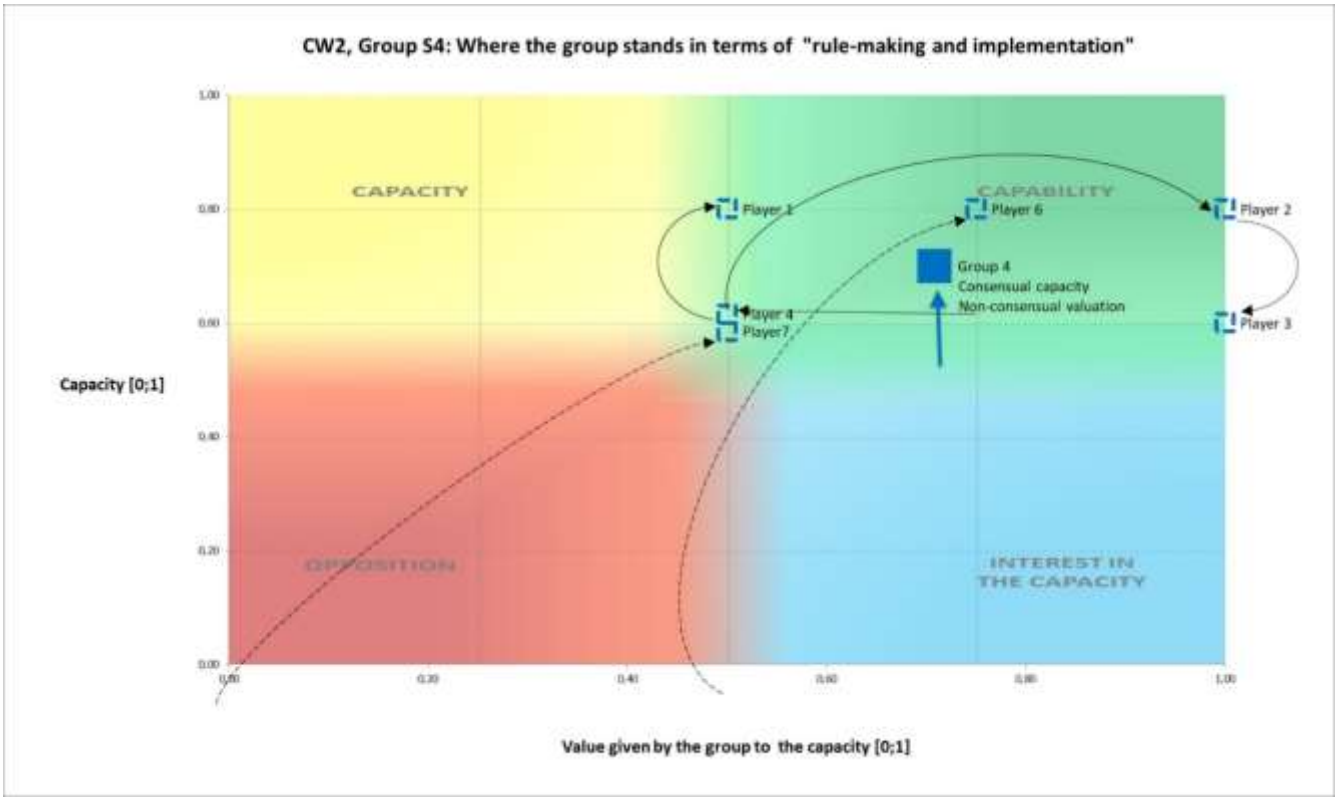

Figure 56: The collective capability "being able to collectively make and implement management rules" of Group S4 during the *ex post* workshop.

The mean of the value given by players to the freedom to make and implement their own NMR in a real context is constant. One player ($P4_{S4}$) showed a decrease in his rating and two ($P2_{S4}$ and $P6_{S4}$) an increase, which is very significant in the case of $P6_{S4}$. $P6_{S4}$ was a downstream player during the *ex ante* workshop and was at that time excluded from the discussions taking place among the upstream players. This may have explained his *ex ante* medium rating. During the *ex post* workshop, he was included in the discussions more, which may have positively impacted his interest in rule-making and design.

We can consequently say that Group S4 still possessed the collective capability "being able to make and implement NMRs". This capability slightly improved between the two workshops, as shown on Figure 56 and by the group dynamics with was less fragmented and more collective during the *ex post* game than during the *ex ante* game.

GROUP S5

External observations have not reported that any NMRs were made or implemented in Group S5.

These observations are not corroborated by the monitoring files, which show that one management rule was implemented: transparency. Two players reported the collective decision of unveiling their cards. It is not clear how many players agreed with and implemented this rule: P8S5 said that all players participated except $P7_{S5}$, while $P6_{S5}$ said "all players". $P8_{S5}$'s account seems more reliable, because he took the time to list all players instead of answering "all" and also because other players reported that $P7_{S5}$ did not participate in collective agreements concerning the collective acquisition of cards, when all the rest of the group was participating. One player ($P4_{S5}$) brought into the discussion a rule proposal: pooling all the monetary and social resources at the group level in order to form an "*association*". He said that his proposal was discussed but not validated by the group.

Data from the individual questionnaire show that the frequency of thinking of and formulating NRM during the game sky-rocketed from a consensual median of 0 during the *ex ante* workshop to a median of 0,67 during the *ex post* workshop, even though players answered in very different ways. $P7_{S5}$ reported that he "never" did so (explaining that he "*preferred to let other players intervene* ") while $P4_{S5}$ reported he did so "many times". All six players who answered positively then stated that they presented these rules to the group "at least once" for $P3_{S5}$, several times for the other players. Not all players validated the discussed rules: $P7_{S5}$ stated he did so only "sometimes" while $P2_{S5}$ and $P3_{S5}$ stated they always did so. The rest of the group went for "often", but they did not, in the questionnaire, give explanations as to why they did not always accept the ideas that were proposed.

According to their questionnaire, the validation process took place by "*spontaneously giving [their] agreement to the group*" ($P2_{S5}$, $P6_{S5}$, $P7_{S5}$) or "*giving [their] agreement after one or several persons in the group asked for it*" ($P1_{S5}$, $P3_{S5}$, $P4_{S5}$, $P6_{S5}$). Two players took responsibility for initiating the processes of validation: $P4_{S5}$, a "collective player" who had

already proposed to create an association with all the players, and $P8_{S5}$. $P8_{S5}$ openly stated in the monitoring files that he wanted to win (he stated he wanted to "*overtake all the other [players]"* and to "*win the game*". Even if he shifted at the end of the game towards more collective comments, one may wonder how he would be the group leader if making and implementing collective agreements and rules together with the rest of the group. We suspect this was probably a strategy to ensure he would not be targeted as an "individualist player". It is also possible that $P8_{S5}$ was genuinely converted to collective work and cooperation during the game.

Consistently with the monitoring files, all players except $P7_{S5}$ stated that they did apply a NMR during the game and always respected it because they "*agreed with all the management rules validated by the group*" ($P6_{S5}$ and $P8_{S5}$ did not answer this question). $P1_{S5}$ even made his answer more specific by saying that his choice (to play collectively) was the "*only logical and long-term choice*". $P7_{S5}$ explained his choice by the fact that "*[he wished the] rule would have been different*", even though how different remains unknown. $P6_{S5}$, who said he always respected the NMR, later stated that he "*wanted to win the game and […] chose to play in [his] own way*", a strategy that is not reflected by his answers in his monitoring files or external observations.

When we compare the collective capacity "being able to make and implement a NMR" as evaluated by individual players between the *ex ante* and the *ex post* workshops, we observe significant and consensual trajectories. Every single player reported a higher level of capacity during the *ex post* workshop, as illustrated on Figure 57. As a result, the mean of the collective capacity jumped from 0,28 during the *ex ante* workshop to 0,93 during the *ex post* workshop.

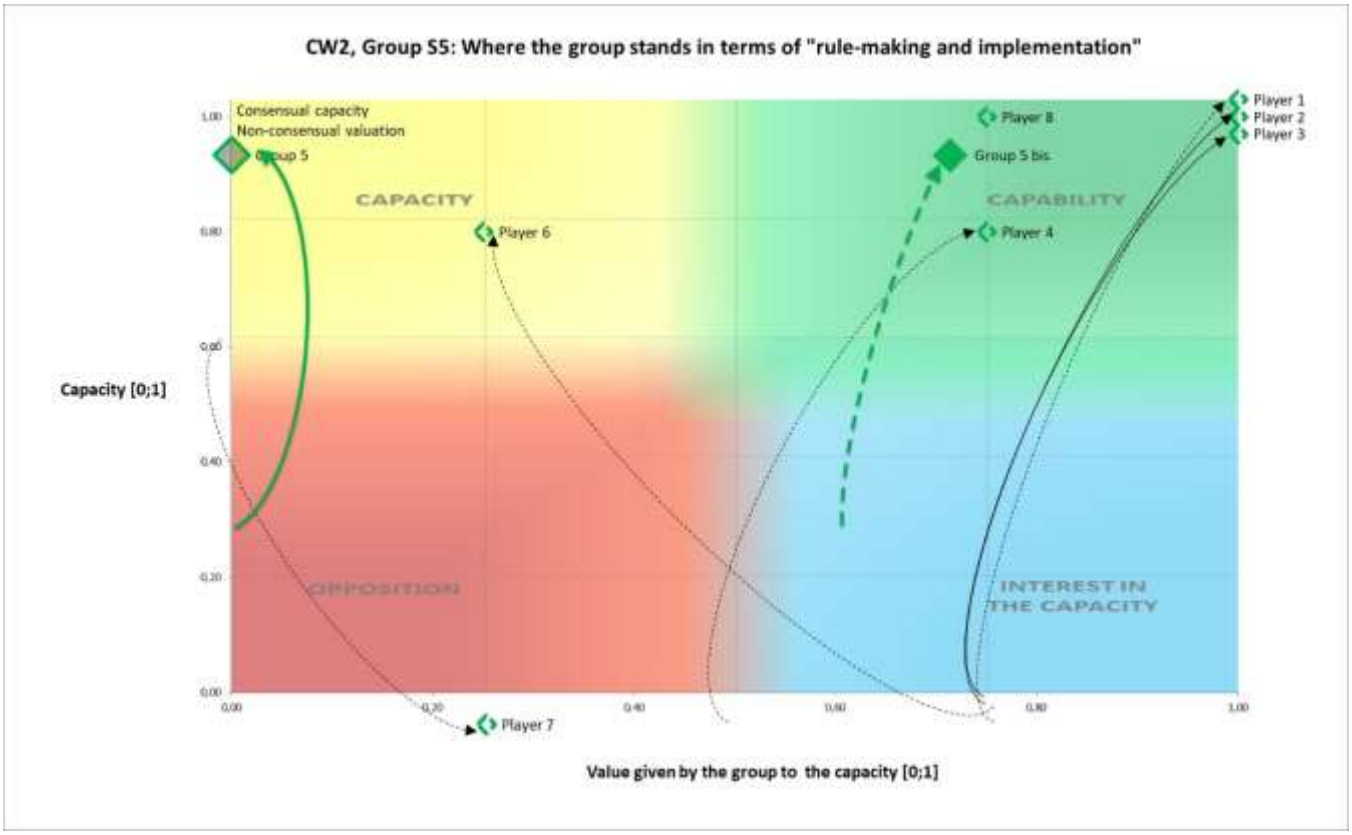

Figure 57: The collective capability "being able to collectively make and implement management rules" of Group S5 during the *ex post* workshop.

In a less impressive but just as noticeable way, the mean of the individual value given to the freedom to realize the collective capability "rule-making and implementation" also increased. Nevertheless, one player ($P6_{S5}$) spectacularly changed his mind and lowered his score, in contrast to the rest of the group. One player ($P7_{S5}$) did not answer the question. Because $P6_{S5}$ did not believe that it is important for a group to possess this collective capability, its existence among Group S5 is non-existent.

4.3.3. THE COLLECTIVE DIAGNOSIS OF A PROBLEMATIC SITUATION

GROUP S1

External observations do not give direct information on a collective diagnosis performed by the players during the game. On the contrary, the facilitator reports that the group was not cooperating very much and that most of the exchanges and discussions between players happened made in twos or threes.

The data extracted from the questionnaire show that, similarly to the *ex ante* workshop, no functioning "collective diagnosis" was made during the *ex post* workshop. Players thought they all understood in the same way how the river and its uses work, which is shown by a low

SD of 0,18 and a high median of 1. This median has notably improved since the *ex ante* workshop (0,67 at the time). The discussion frequency of players with the rest of the group was no longer contrasted, as it was during the *ex ante* workshop. All players stated they discussed at least "sometimes" the reasons behind the river management issues. One player in particular ($P4_{S1}$) manifested an important change, stating that he "very often" discussed the river management issues during the *ex post* workshop, while he had answered "very seldom" to the same question during the *ex ante* workshop. Similarly, players were consensual when asked about the helpfulness of these discussions, whether they participated in them or not. This is shown by a median of 1 and a SD of 0,18, exactly as during the *ex ante* workshop.

During the *ex post* workshop and in contrast to the *ex ante* workshop, all players identified "a lot" ($P2_{S1}$, $P3_{S1}$, $P6_{S1}$ and $P9_{S1}$) or at least "few actions" (the rest of the group) to modify the game situation. This shows that players had a better understanding of the game and had more ideas for acting and changing the management situation than during the *ex ante* workshop. This is consistent with the answers concerning the shared understanding of the game by the group. Just as in October 2017, the group was heterogeneous when it comes to the individual perception of the helpfulness of interacting with other players to identify those actions. Nevertheless, the median for this question decreased from 1 to 0,67 and, contrary to the first workshop it is a consensual decrease, which is illustrated by a SD of 0,17. This shows that players did not rely or need each other to understand the game.

Answers to the questionnaire show that there could have been a collective diagnosis of the river system' functioning or management made on the scale of the whole group. Indeed, (i) players were consensual concerning the similarity of their understanding of the socio-ecosystem with the rest of the group, (ii) they spoke a lot about problems experienced during the game and (iii) they stated that collective discussions were helpful for that. They were also consensual on how useful the group discussions were in this respect, which is considered as rather high, even if they do not seem to have relied on each other to identify ideas and change the game settings.

Yet, this is contradicted by the observations made by the facilitator. Because his testimony is considered as more reliable than self-reports (which also do not allow the evaluator to distinguish the group from sub-groups), we understand that no collective diagnosis at the scale of the whole group was carried out during the game. It is very likely, though, that among small groups of players (especially between neighbor-players around the lake), diagnoses were made.

When we compare the capabilities of the players between the first and second CappWag workshops, we observe contrasted trajectories, just as for the previous collective capability "rule-making and implementation". This is illustrated below on Figure 58.

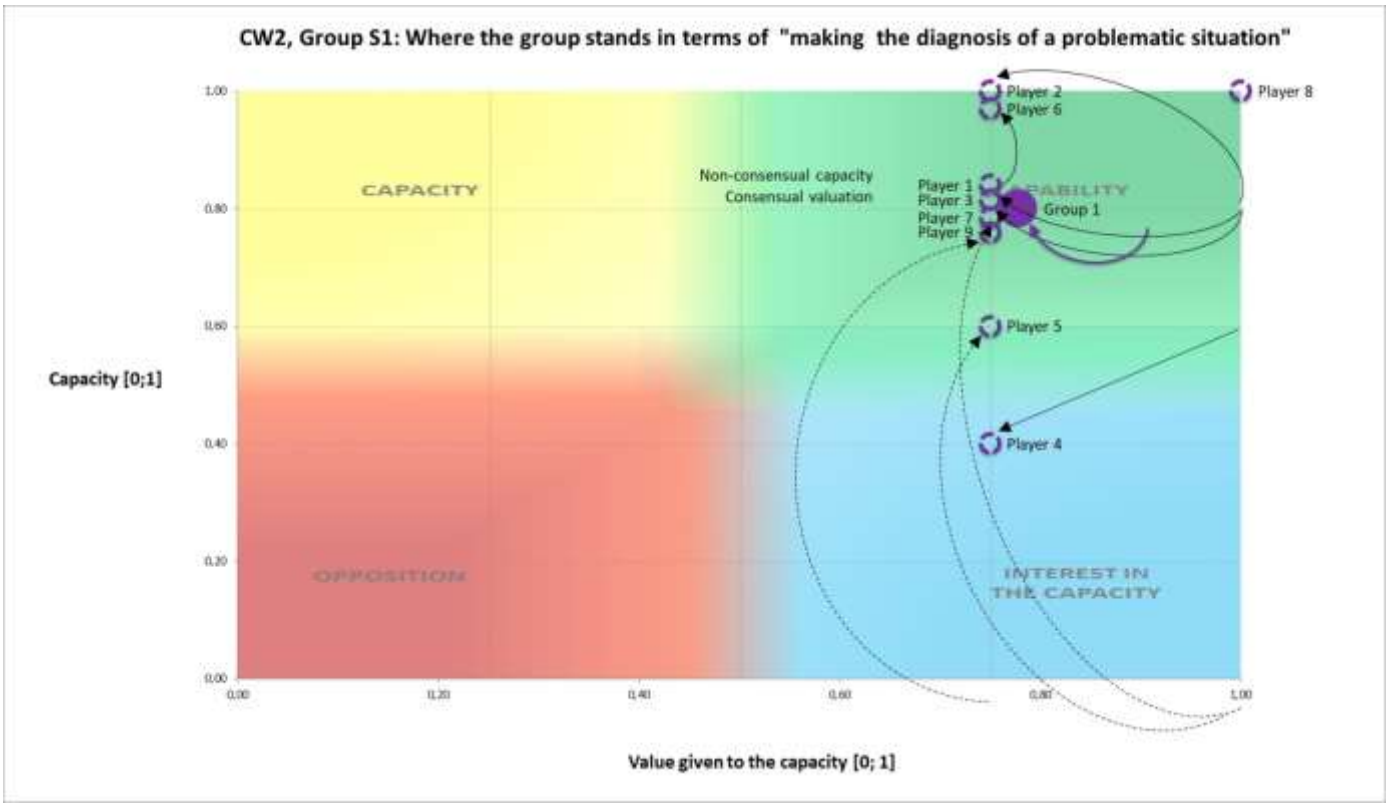

Figure 58: The collective capability "being able to make a diagnosis" of Group S1 during the *ex post* workshop.

The collective capacity of the group to identify management issues together was only slightly higher than the first time (the mean is equal to 0,80 for the *ex post* workshop, compared to 0,77 during the *ex ante* workshop) but less consensual (SD of 0,2 here against 0,08 the first time). We understand from these data that the group still had the capacity to perform a diagnosis of the socio-ecosystem state together. Nevertheless, the value given to the collective capability "being able to make a diagnosis" consensually decreased for almost all the players except two ($P6_{S1}$ and $P8_{S1}$). Consequently, the average value given by the group to this capability also decreased. This is illustrated by a mean of 0,78 instead of 0,91 during the first workshop. One player ($P4_{S1}$) even rated, during the *ex post* workshop, the collective capacity of the group to make a diagnosis and the value given to this freedom.

The decrease in the value of the capacity "making a collective diagnosis", even though the collective capacity does not change, could be explained by several reasons:

(1) *The impact of the theoretical course on IWRM*: students might have realized during the course that other steps of an efficient participatory process for WRM were more important than making a collective diagnosis (even though no ranking of importance between these different steps was asked).

(2) *The impact of the group work realized in the frame of the course:* group works might have gone wrong and students might have started to dislike each other, which would have reflected lessened value given to collective work. This option is invalidated by the answers given by players when asked to rate the atmosphere in the group, which they

consensually considered good. The median of the answers is the same for the *ex ante* and the *ex post* workshops (0,80) and the SD is only slightly higher for the *ex post* workshop (0,13 instead of 0,07).

(3) *The deterioration of the atmosphere among the group*: the answers given by players concerning the atmosphere during the group contradict the observations of the facilitator. He, in fact, reported an atmosphere evolving from "*quiet*" at the beginning of the *ex post* game to "*combative*" during the last tours, with players on opposite sides of the table arguing. It is possible that because of a tense yet playful atmosphere, players did not give importance to understanding nor discussing together the system and rather focused on collective or individualistic strategies to win the game.

GROUP S2

External observations do not report specific discussions concerning the functioning of the lake or its uses by players. One observer noted that "*there were few questions on the rules of the game or the functioning of the lake*". We argue that players remembered the main rules of the game from the *ex ante* workshop and consequently did not need as much information to start playing as they did the first time.

The data extracted from the questionnaire show that players had a consensual opinion concerning the shared understanding of the way the river works, which is illustrated by a rather low SD of 0,17 and a high median of 1. The SD shows that the group answered more similarly than during the *ex ante* workshop. Players discussed in a contrasted way the reasons behind the lake's issues (SD of 0,25 for a median of 1). $P7_{S2}$ is the only player to report that he very seldom discussed them, which is related to his low capability for self-expression. Once again, the SD shows that the group answered more similarly than during the *ex ante* workshop. All players stated that the discussions were rather helpful (median of 0,67, SD of 0,17) in understanding the functioning of the lake and possible problems faced during the game – even though external observations show that the discussions during the game mainly tackled the reduction of pollution and water consumption.

During the *ex post* workshop, players individually identified in a rather contrasted way actions to modify the game situation, which is shown by a SD of 0,27 for a median of 0,75. Four players ($P2_{S2}$, $P3_{S2}$, $P4_{S2}$, $P5_{S2}$) were particularly creative and stated that they identified "*a lot of actions*". Two players notably improved their score: $P1_{S2}$ reports a rating of 2 on this [1;3] scale instead of 1,5 during the *ex ante* workshop and $P7_{S2}$ reported a rating of 2 instead of 1 during the *ex ante* workshop. The group was more consensual when it came to the perception of the helpfulness of interacting with other players to identify those actions, which is illustrated by a SD of 0,18.

The observations and players' answers indicate that there is an improvement compared to the *ex ante* workshop concerning the frequency of discussions on understanding and identifying actions. It shows that the group was united and probably did not need to openly

make a diagnosis together because they were already on the same page concerning the game functioning.

When we compare the collective capability of the group during the *ex ante* and the *ex post* workshop, we observe a decrease in the global collective capacity to make a diagnosis, even though the value given to it is stable. This is illustrated on Figure 59.

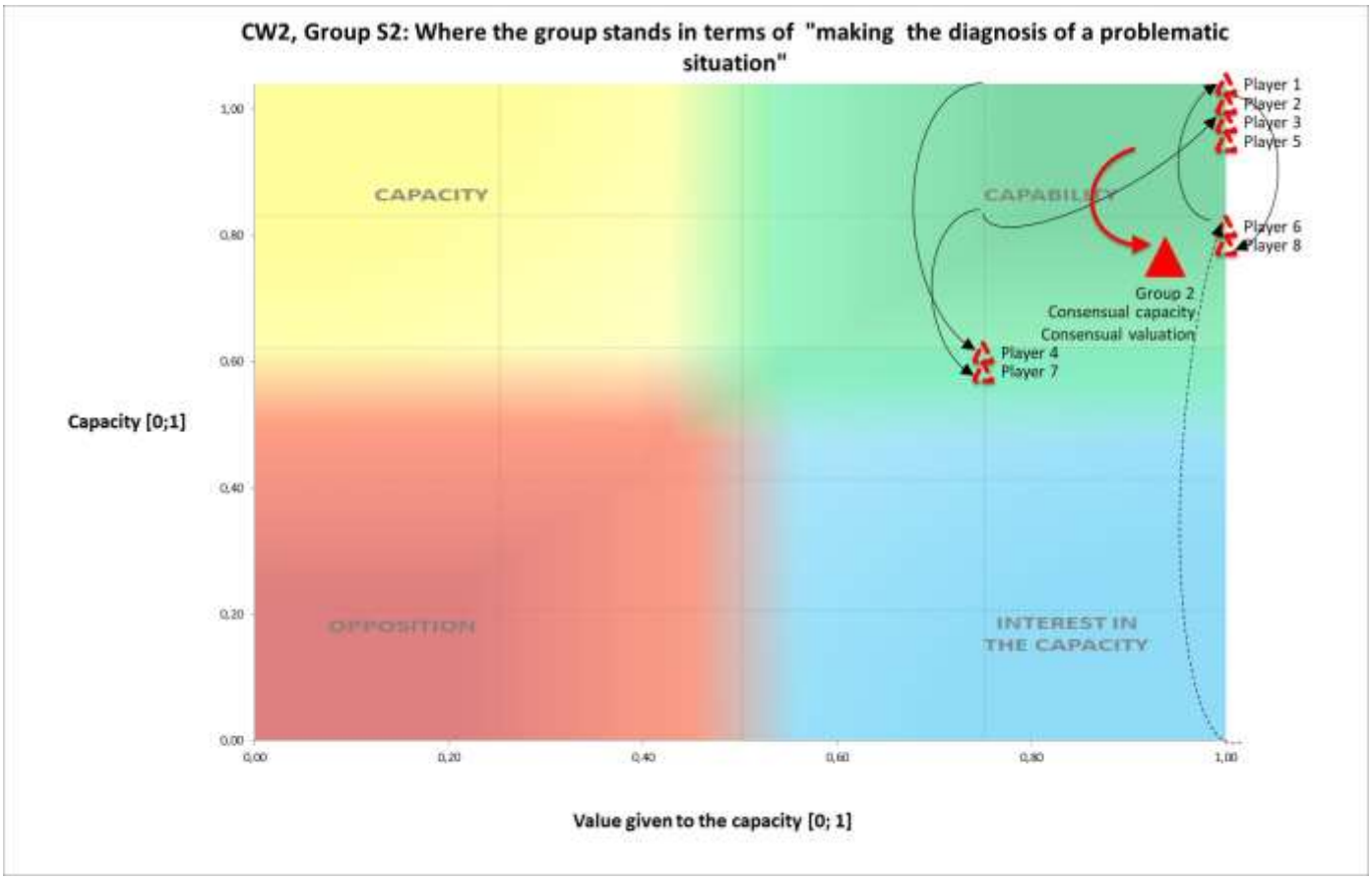

Figure 59: The collective capability "being able to make a diagnosis" of Group S2 during the *ex post* workshop.

Indeed, $P4_{S2}$, $P7_{S2}$ and $P8_{S2}$ reported a decrease in the group capacity to make a diagnosis, which is the reason why the overall average of players' individual answers on the group capacity decreased. This can be explained by the fact that even though players had shown an improvement in their comprehension of the game and had more ideas about changing it, they were faced with an important pollution issue during the game that they could not manage to control by themselves (the facilitator had to intervene so that the game could go on). This highlights the fact that understanding the game, discussing it and having ideas does not guarantee an efficient impact on the game.

We consequently consider that Group S2 did diagnosis collectively and together the situation but that the diagnosis was not sufficiently good or precise so that they could manage to regulate the ecosystem and avoid environmental fines.

GROUP S3

External observations do not report specific discussions concerning the functioning of the lake or its uses by players.

The data extracted from the questionnaire show that players did not have a consensual opinion concerning the similarity of their understanding of the way the lake and its uses, and those of the group, work. Indeed, four players ($P4_{S3}$, $P5_{S3}$, $P7_{S3}$ and $P9_{S3}$) thought that there was no shared understanding between themselves and the rest of the group, while two other players ($P2_{S3}$ and $P6_{S3}$) thought the opposite. Nevertheless, almost all players (excluding $P5_{S3}$) stated that they often discussed problems experienced during the game (which is demonstrated by a median of 1) and that these discussions were helpful in furthering their understanding of the game.

Similarly, players evaluated in a contrasted way their frequency of actions' identification to modify the game situation, which is shown by a median of 0,50 and a SD of 0,30. Two players in particular ($P1_{S3}$ and $P4_{S3}$) stated that they "never" identified any action. We note here that there is an inconsistency between this statement from $P1_{S3}$ and his report on his monitoring file: he was in fact the first one to think of the transparency rule that was later applied by several players of Group S3. Nevertheless, the whole group except $P3_{S3}$ thought that interactions between players helped them to identify these actions.

Players consensually thought that the capacity of the group to identify these potential management issues was only medium, as shown by a mean of 0,58 and a SD of 0,19 and illustrated on Figure 60.

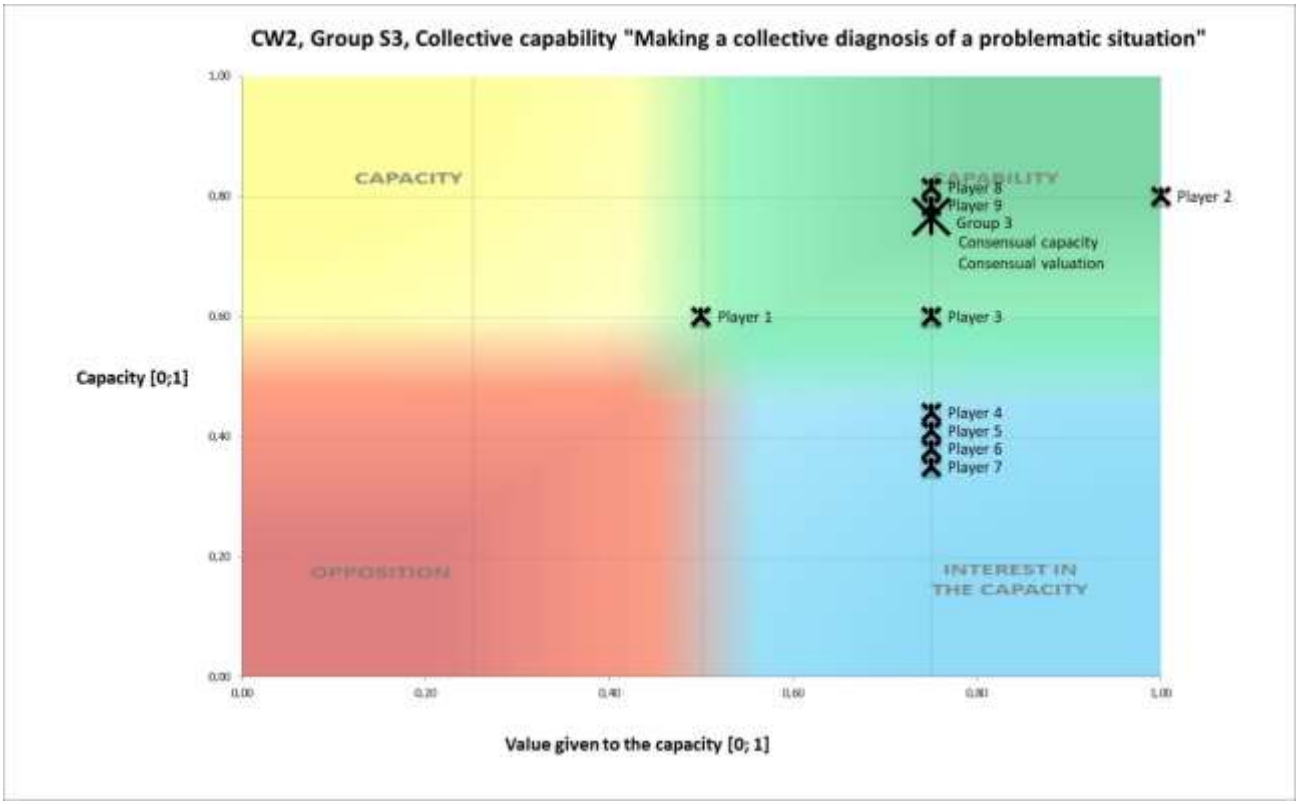

Figure 60: The collective capability "being able to make a diagnosis" of Group S3 during the *ex post* workshop.

The collective value given by the members of Group S3 is slightly higher than the collective capacity (0,75) and also consensual, as shown by a SD of 0,13. We notice nonetheless than one player ($P1_{S3}$) did not give much value to the collective freedom to make a diagnosis in the context of the collective management of water resources.

We argue that, based on the rating of the rest of the group and despite the tense atmosphere prevailing during the game, his position did not prevent the collective capability from existing among Group S3, even though it was not actualized during the CappWag 2 workshop.

GROUP S4

One observer noted that players played rather collectively and that at one point during the game, "*players realized that they [did] not know the rule concerning pollution*" after pollution decreased, instead of increasing as they thought it would. Discussions reported by observers include the state of the system and how to play as well and as collectively as possible. One discussion in particular concerning whether the group should collectively buy information on the unknown pollution dynamics took place ($P2_{S4}$ advocated buying information, $P4_{S4}$ and $P1_{S4}$ were against it and thought paying for extra information was not necessary). Players were aware of what sort of information was hidden from them. Yet they eventually decided not to buy this piece of information but to divest and then invest in activity cards. This shows that they made a diagnosis of the game situation together.

Data extracted from the questionnaire show that players had a consensual viewpoint concerning the shared understanding of the way the river works and discussed, either sometimes or often, the reasons behind the problems experienced during the game. Only one player ($P3_{S4}$, the "sole player") stated that these collective discussions did not help very much in understanding how the ecosystem worked. This did not concern him directly, though, since he decided to play individually throughout the game. During the *ex post* workshop, players individually identified in a rather effective and consensual way actions to modify the game situation. This is illustrated by a SD of 0,11 for a median of 0,80.

The collective capacity to make a diagnosis together remained constant between the *ex ante* and the *ex post* workshops. $P6_{S4}$ and $P7_{S4}$, two downstream players in the *ex ante* game, showed a noteworthy increase in their evaluation of the collective capacity to make a diagnosis. This might be explained by the *ex ante* situation, where the two sub-groups did not interact much with each other and where $P6_{S4}$ and $P7_{S4}$ were not participating in the collective discussion of the upstream players.

We nevertheless observe a slight decrease in the value given to freedom to collectively make a diagnosis during the *ex post* workshop, as shown on Figure 61.

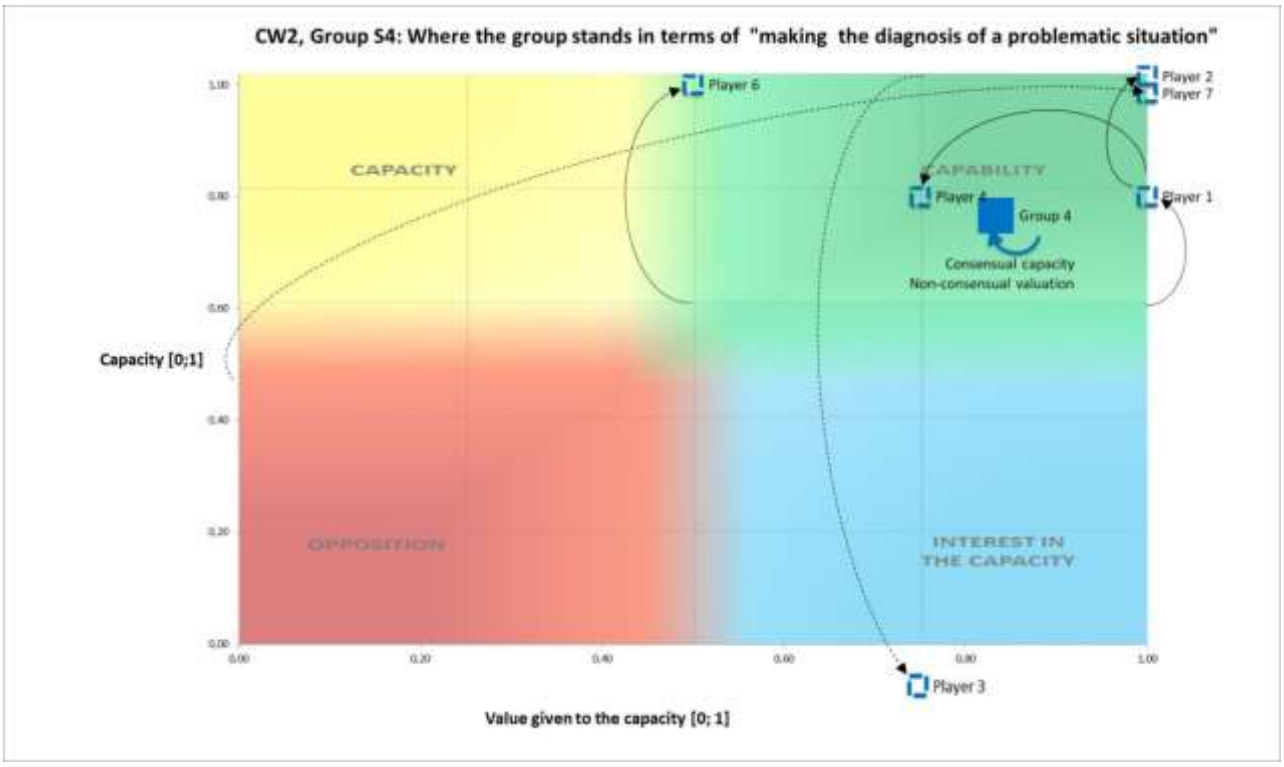

Figure 61: The collective capability "being able to make a diagnosis" of Group S4 during the *ex post* workshop.

$P4_{S4}$ is actually the only player to change his rating, due to which change the mean value of the group slightly decreases. We consequently consider that this is not significant on the scale of the group, that the collective capability "diagnosis-making" still exists and that it does not significantly evolve between the two workshops.

GROUP S5

A distinctive feature of Group S5 is that according to external observations, all of its members played to "*break the game*" rather than to seriously deal with the management of the water resource. For this, they asked the facilitator many questions to understand what, was allowed in the game and what was not allowed. We cannot say that there was a collective diagnosis of the game socio-ecosystem. We can nonetheless affirm that they demonstrated a remarkable collective intelligence and an capacity to organize themselves in order to reach their own objectives. There consequently was another type of collective diagnosis that was realized during the game and that targeted the game's settings and its potential flaws.

Answers from the questionnaire reveal that players did not have a consensual opinion concerning the shared understanding of the way the river works, which is illustrated by a SD of 0,33. This is mostly due to the answer of $P4_{S5}$, who is the only one (the median of the answers being 0,67) to state that, according to him, the group did not understand at all how the lake and its uses worked.

Similarly, all players stated that they discussed, often ($P1_{S5}$, $P2_{S5}$, $P3_{S5}$, $P6_{S5}$) or at least sometimes ($P7_{S5}$, $P8_{S5}$), with other players the reasons behind problems experienced during the game, except $P4_{S5}$ who said he "*never*" did so. $P4_{S5}$ also did not think the discussions with the group helped him to understand the functioning of the lake and possible problems faced during the game, contrary to all the other players. All players stated they identified actions to modify the game situation, even though some ($P1_{S5}$, $P4_{S5}$ and $P8_{S5}$) seem to have had more ideas than others ($P2_{S5}$, $P3_{S5}$, $P6_{S5}$ and $P7_{S5}$). All players considered that interactions with the rest of the group were helpful in identifying game-changing actions, except ($P7_{S5}$).

The multiple contrasts between players' answers coupled with the external observations suggest that there was no collective functioning "making a diagnosis of a problematic situation" made on the scale of the whole group during the ex post game.

Finally, players all consensually gave high ratings to their collective capacity to identify potential management problems in the game, which is illustrated by a mean of 0,74 and a SD of 0,15 and represented on Figure 62.

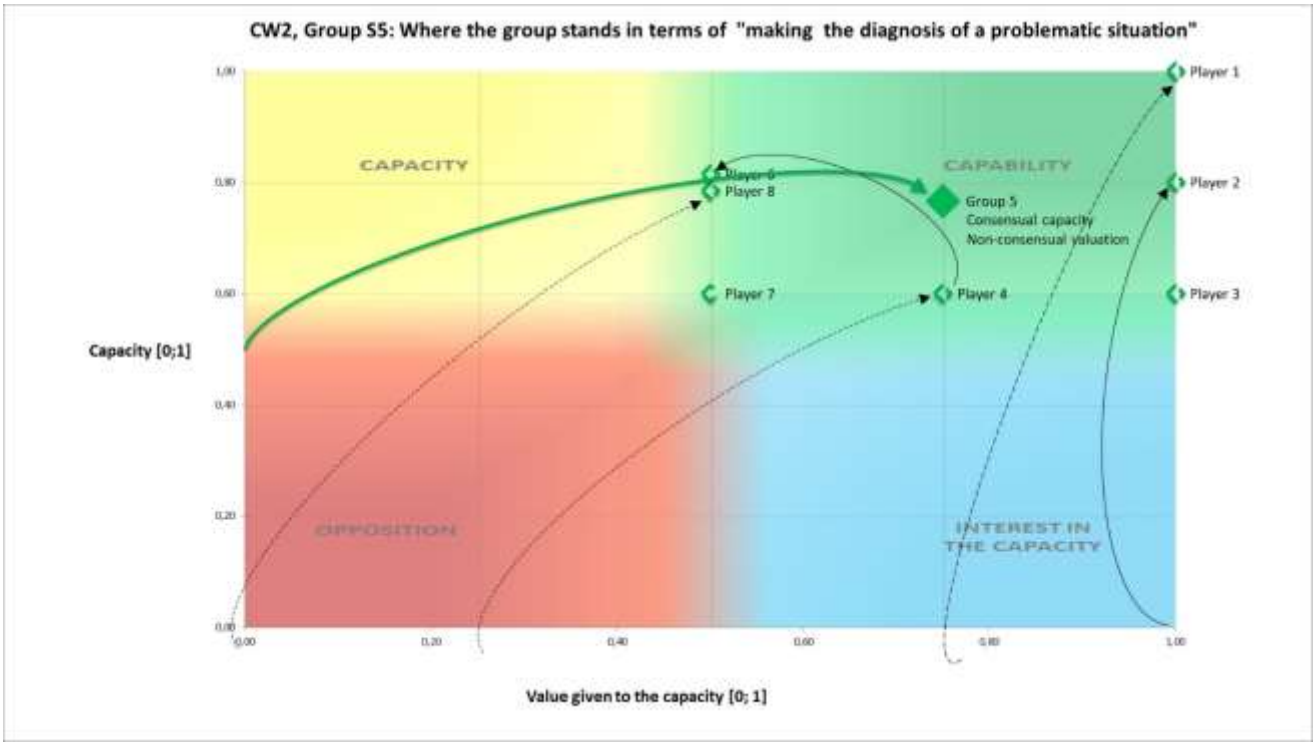

Figure 62: The collective capability "being able to make a diagnosis" of Group S5 during the *ex post* workshop.

The value given by players to the freedom to share their vision of the problem and then make a common diagnosis of the situation is less consensual. Three players ($P1_{S5}$, $P2_{S5}$ and $P3_{S5}$) gave it the highest value, but three others ($P6_{S5}$, $P7_{S5}$ and $P8_{S5}$) gave it only medium interest. This is still a great improvement when compared to the *ex ante* workshop. Indeed, not only has the mean capacity of collective improved, but no player any longer thinks that there is no value in being able to make a collective diagnosis for a group.

We can therefore say that the collective capability "diagnosis-making" of Group S5 significantly improved between the *ex ante* and the *ex post* workshop.

4.3.4. RESOURCES AND CONVERSION FACTORS

Just like players' capabilities, resources and conversion factors may also have been impacted by the three-month IWRM training that they undertook.

GROUP S1

Players consensually rated the atmosphere during the *ex post* game as rather high, as demonstrated by a median of 0,80. This is similar to the *ex ante* median ($P3_{S1}$ was the only player to report a better atmosphere during the 2nd workshop: "*I thought there was more communication all together, not only in groups of two or three players. […] I had the impression that we were talking more*"). Just as the first time, comments concerning this

atmosphere were generally positive ("*friendly*", "*dialog*", "*exchanges*"). Only one player ($P4_{S1}$) reports "*a contentious atmosphere*" and two ($P3_{S1}$ and $P9_{S1}$) "*competition*" among players. Nevertheless, external observations and a few comments report a tenser atmosphere than during the *ex ante* workshop, with a certain pressure to play collectively (even though this time more players played individually). We understand that even though the group atmosphere was friendly, this important conversion factor had also slightly degraded since the first time.

Two main social conversion factors guided the behavior of players during the *ex post* game. All of the players stated that they did want to win the game but, at the same time, kept in mind the well-being of other players. This represents a significant evolution from the *ex ante* game. During this first game, players had instead favored winning coupled with the respect for environmental objectives, but few players had clearly stated that they wanted to win the game. According to $P2_{S6}$, this was related to the perceived selfishness of several players during the first game. He explained that these behaviors angered other players and discouraged them from pursuing a collective strategy during the second game: "*during the first game, it was not our objective to win, but we were very disappointed that there was no general agreement over reaching the collective [environmental] objectives. Because we played with the same group the second time, […]since it did not work out the last time, this time we did not care anymore and we wanted to win*".

During the *ex post* game, the players reported that they were mainly influenced by one resource: their knowledge of the personality and the values and interests of other players, which is a significant change compared to the *ex ante* game. At the time of the *ex post* game, they had been following Master's courses together for three months, and several of them had had the opportunity to study and work together in the frame of various examinations. In contrast, fewer players (five during CappWag 2 against nine during CappWag 1) report their "collective spirit" to be an influencing conversion factor. The four players who were the least influenced by it were $P3_{S1}$, $P6_{S1}$, $P7_{S1}$ and $P9_{S1}$. Not a single player stated that his leadership was the main social resource used during the *ex post* game, contrary to the first game during which two players had mentioned it ($P3_{S1}$ and $P9_{S1}$ – we consider the answers of $P2_{S1}$ as invalid, as explained in section 4.2.4).

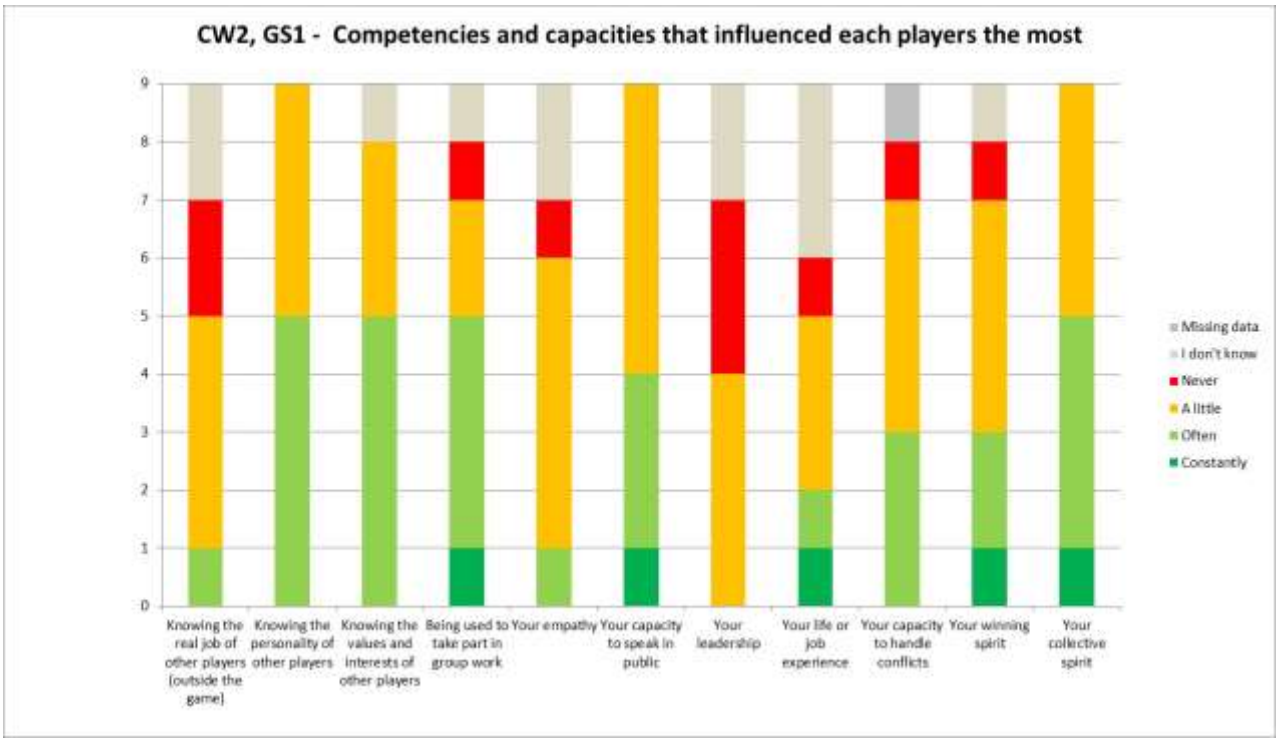

Figure 63: The main resources and conversion factors that influenced the behavior of the players in Group S1 when they played the ex post CappWag game.

The comparison between the way players perceived their behaviors and the way they perceived the behavior of the whole group shows different patterns. Players thought that the winning spirit, the presence of group leaders and the capacity to speak were the main assets that influenced the whole group attitude. On the contrary, the knowledge of the personalities and the values and interests of other players were not considered as shared resources by the group of players. This confirms the fact that the group atmosphere was good but rather tense, with intense conversations.

Only a handful of players ($P1_{S1}$, $P2_{S1}$, $P7_{S1}$ and $P8_{S1}$) in Group S1 considered that the theoretical and practical IWRM course had an impact on their attitude during the game. This corresponds to the observations made during the *ex ante* and *ex post* game. Group S1 was indeed already acting collectively during the *ex ante* game and, instead of improving, this group dynamic somehow deteriorated during the *ex post* game, with more players playing individually to win the game on their own. Moreover, we notice that among these four players, three are the foreigners who were the least involved in the debates and presented some of the lowest individual capabilities.

GROUP S2

Just as in the *ex ante* workshop, the members of Group S2 considered that the atmosphere among the group was very good, which is demonstrated by a median of 0,80 and a low SD of 0,12. This time, the players were unanimous and only described the group atmosphere in

positive qualifying terms. As $P4_{S2}$ summarized it: "*we did not try to win but instead to help each other clean up the lake*".

There is a clear improvement in the group atmosphere compared to the *ex ante* game.

Two players ($P6_{S2}$ and $P7_{S2}$) openly stated that they wanted to win the game, whereas three of them ($P3_{S2}$, $P4_{S2}$, $P8_{S2}$) stated the very opposite. The respect for environmental objectives without the individual reward of winning the game is the mindset common to the highest number of players, more than half of the group. This shows that during the ex post game, the atmosphere was less centered on winning the game individually and more on fixing the environmental issues (here the pollution increase). In second place comes the intention of winning without putting any player into a difficult position ($P3_{S2}$, $P5_{S2}$, $P6_{S2}$ and $P7_{S2}$). These various interests demonstrate the importance of the collective aspect of the group even during the difficult *ex post* game where the pollution level was very high, and despite the individualistic game of certain players.

During the *ex post* game, the players reported that they were mainly influenced by two resources: their knowledge of the interest and values of other players, as well as their personality, and their capacity to speak in public, which both relates to a social skill and is a result of personal or academic or professional experiences. This is illustrated on Figure 64. Half of the players also evoked their leadership skills to act in the game. Finally, the collective spirit of all of the players was a major conversion factor that helped them play. These four resources and the conversion factor have positively evolved since the *ex ante* game.

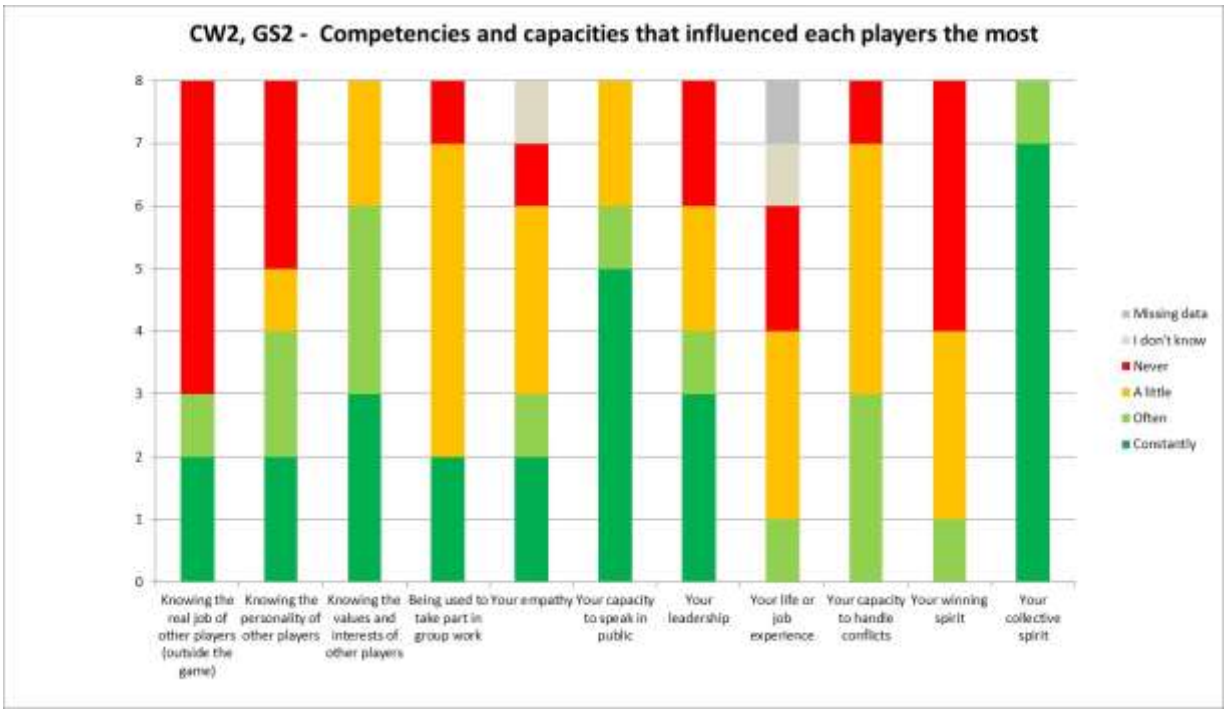

Figure 64: The main resources and conversion factors that influenced the behavior of the players in Group S2 when they played the ex post CappWag game.

In contrast, the knowledge of other players' professions outside of the game had decreased compared to the *ex ante* game. We explain this decrease by the fact that they probably knew each other better during the *ex post* game and were aware that all of them were "mere students" without substantial professional experience.

Moreover, according to the players themselves, all of those of Group S2 principally used their knowledge of each other's values, their capacity to discuss and participate in conversations, their empathy one for another and, finally, their sense of collectivity. Interestingly, it is the empathy of the group that seems to have evolved the most positively between the *ex ante* and the *ex post* workshops. As the external observations reported, Group S2 did play collectively and "stuck together" to face a series of environmental fines that they did not manage to block.

Six players out of eight in Group S2 stated that the IWRM course influenced them when they were playing during the *ex post* game. Only $P1_{S2}$ and $P2_{S2}$ explained that the IWRM course did not impact their attitude during the game. They were certainly acting very cooperatively during the *ex ante* game and therefore did not improve nor change their behavior during the ex post game.

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GROUP S3

During the *ex post* workshop, the members of Group 3 considered that the atmosphere among the group was rather good (as shown by a median of 0,70). Important disparity appears between players: while two players ($P5_{S3}$ and $P6_{S3}$) gave it a low rating, four other players ($P2_{S3}$, $P3_{S3}$, $P1_{S3}$ and $P8_{S3}$) gave it a high rating. $P2_{S3}$ explained that "*there were many discussions. […] Even during the second game when we took the game less seriously, we wanted everyone to be able to play*", which demonstrates a certain fairness among players (everyone should be able to play without necessarily wanting to win). Many players referred to the atmosphere as playful ("*funny*", "*entertaining*") and animated ("*debates*", "*lively*", "*cooperation*", "*loud*", "*dialogues*"), but also to the incapacity of the group to agree on collective actions or strategies ("*contentious*", "*disorganized*", "*odious*", "*bad faith*" or "*stingy*"). This effectively reflects the tensions between collective and individualist interests that were discussed in the previous sections and that defined the group dynamics during the whole CappWag 2 workshop.

Consistently with this dynamic, players had different goals during the game. The main objective of some players was to win the game on their own, even though only one of them ($P8_{S3}$) mentioned this as their only objective without also including special attention to environmental objectives or helping the players who struggled the most during the game.

Members of Group S3 relied on various types of resources and conversion factors at the individual level. The resources most called for by players were their knowledge of other players' personality, values and interest and their skill at speaking in public, as well as taking part in group work. As $P1_{S3}$ noted, because "*players knew each other [prior to the ex post*

workshop], it was easy [for him] to communicate" with the rest of the group. The collective spirit of the group is the conversion factor most evoked by players, but we notice that four players ($P2_{S3}$, $P5_{S3}$, $P8_{S3}$ and $P9_{S3}$) stated they "constantly" had in mind winning the game. Interestingly, only three players considered that the rest of the group demonstrated a collective spirit, but six of them considered that the winning spirit of other players dictated their actions. The capacity of players to speak in public and their knowledge of each other's interests and values were also considered as the main drivers of the group dynamic.

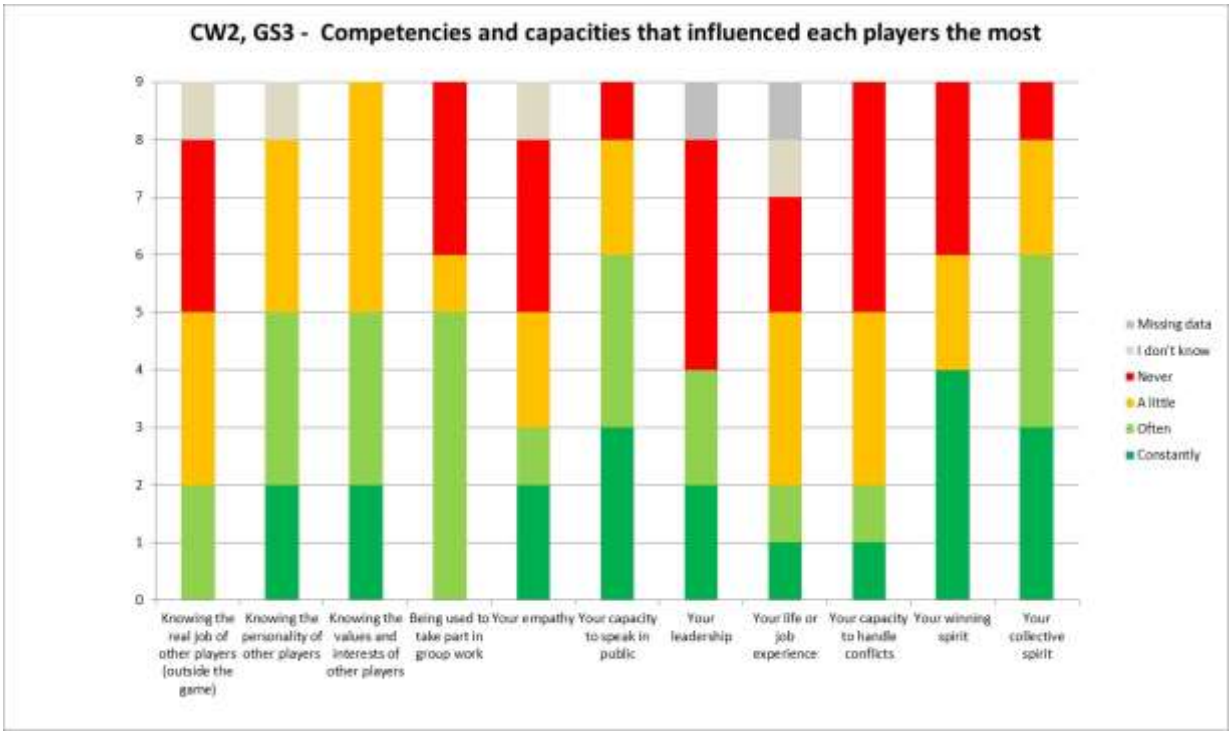

Figure 65: The main resources and conversion factors that influenced the behavior of the players in Group S3 when they played the ex post CappWag game.

The players of Group S3 were not consensual concerning the impact of the theoretical and practical IWRM course on their behavior, as illustrated by a median of 0,50 for both variables and respective SDs of 0,31 and 0,21.

GROUP S4

During the *ex post* workshop, the members of Group 4 considered that the atmosphere in the group was worse than during the *ex ante* workshop. This is reflected by a median of 0,65 instead of 0,80 and a SD of 0,17. Two players chose negative qualifying terms to describe this: "*miserly, tense at times*" ($P1_{S4}$) and "*distrust, imbalance*" ($P3_{S4}$). The rest of the group chose instead positive qualifying terms.

The one mindset with a consensus among the group was the will to win the game while taking into account the financial and social well-being of other players. Only $P1_{S4}$ stated that he did not want to win the game, but rather respected the environmental objectives. He also said that he was too absorbed in the game and did not try to win at all – the latter answer being also given by $P2_{S4}$, the group leader. This shows that this time, in contrast to the *ex ante* workshop, players in Group S4 did play collectively and made sure none of them was unable to play.

During the *ex post* game, players reported that they relied on various types of resources and conversion factors at the individual level. As seen on Figure 66, these range from the knowledge of other players' personality, values and interest to their capacity to speak in public. This time, and in contrast to the *ex ante* workshop, all players stated that they used this social asset to play the game and interact with the group. But in contrast to the *ex ante* game, leadership, personal experience and to some extent the capacity to solve contentious situation were the least influential resources for the players.

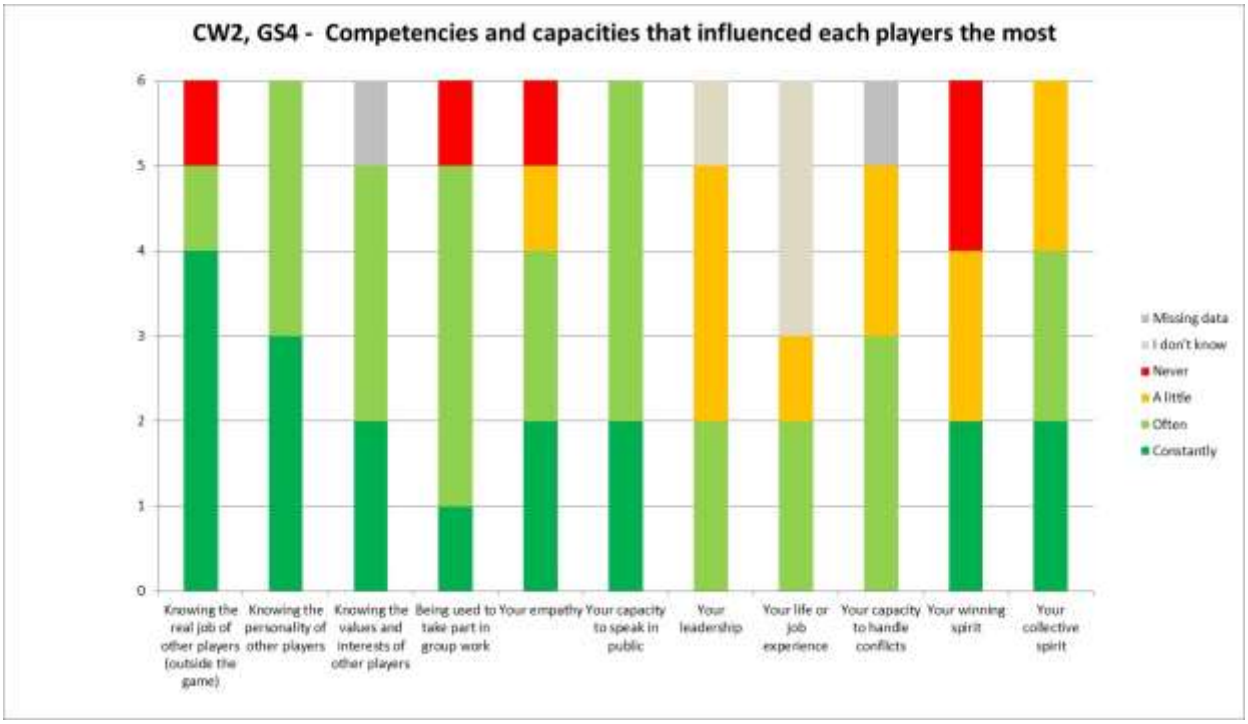

Figure 66: The main resources and conversion factors that influenced the behavior of the players in Group 4 when they played the ex post CappWag game.

Finally, the players of Group S4 were quite consensual on the positive impact of the theoretical and practical IWRM course on their behavior. But, even though they recognized its positive influence, this was not always visible in the way they acted together, in particular for $P2_{S4}$. He stated that the IWRM course influenced him a lot but he was reported as being particularly controlling and aggressive during the game, which does not go hand in hand with the principles of participatory management. This contradiction also appeared during his interview, since he explained that according to him, the group "*optimized as much as possible the discussions phases during the game in order to gather everyone's ideas and find a solution*

to the issues". The discrepancy between the vision of the second workshop of $P2_{S4}$ and hence his related self-reporting and his behavior as reported by external observers will be further discussed in Chapter 5 (section 5.2).

GROUP S5

The external observations showed that the group was quite playful during the *ex ante* workshop and that this was even more the case during the *ex post* workshop. Instead of playing the game "seriously" and putting effort into the management of the lake, they rather spent time discovering flaws in the game in order to invent a new management system. Indeed, the members of Group S5 considered that the atmosphere among the group was once again very good, which is demonstrated by a median of 1 and a very low SD of 0,08. All players used positive words to describe this atmosphere, such as "*friendly and motivated*" ($P1_{S5}$) or "*spontaneous, [spirited], collaborative*" ($P7_{S5}$).

During the *ex post* game, only one conversion factor was favored by half of the group, as illustrated on Figure 67: their collective spirit. Even if no specific resource or conversion factor stands out as consensually evoked by players, we see that, compared to the *ex ante* workshop, their level of influence and importance for players have generally and noticeably improved.

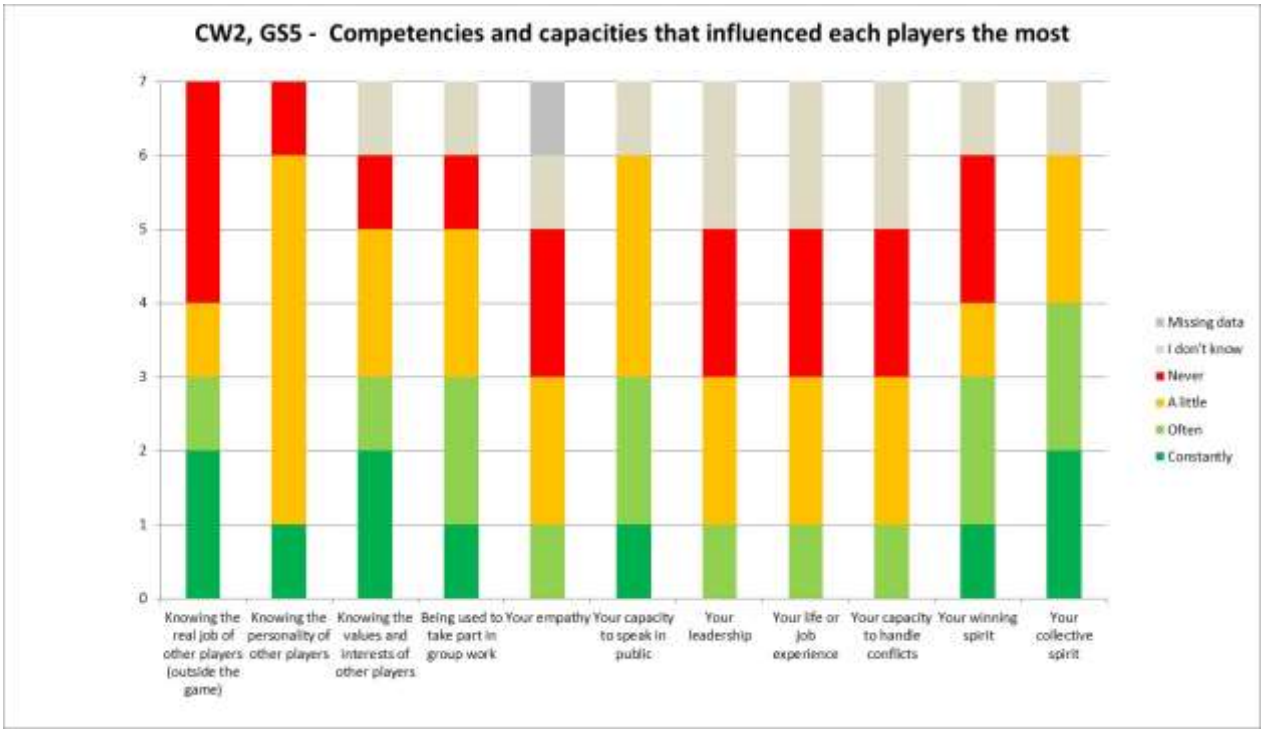

Figure 67: The main resources and conversion factors that influenced the behavior of the players in Group S5 when they played the ex post CappWag game.

If players stated that they themselves held few capacities and competencies, they considered that the group did have many of these (except personal or professional experiences, which makes sense because they were still students). This shows that in general, players considered that the group itself possessed way more resources thanks to its various players than they as individuals did.

The group was extremely divided concerning the impact of the IWRM theoretical and practical course on their behavior during the game. Half of the players ($P2_{S5}$, $P6_{S5}$, $P7_{S5}$ and $P8_{S5}$) considered that it impacted their behavior and the way they acted during the game, while the other half stated the opposite.

4.3.5. A COMPARISON OF THE *EX POST* COLLECTIVE CAPABILITIES BETWEEN FIVE GROUPS AND THEIR EVOLUTION OVER TIME

Just like during the *ex ante* workshop, the five groups of students participated in identical and controlled CappWag *ex post* workshops. This time, the treatments were all identical (see Table 13) and the evaluation of the capabilities of the five groups were made possible.

4.3.5.1. THE COLLECTIVE RULE-MAKING AND RULE-IMPLEMENTATION

The evolution of the collective capability "being able to make and implement a rule" is positive for three of the four groups observed during the *ex ante* and the *ex post* CappWag workshops. As shown on Figure 68, each of the groups present a significant improvement of either (i) the perceived collective capacity of the group by its members (G_{S4} and even more spectacularly, G_{S5}) or (ii) the mean value given by the players of the group to the freedom to make and implement its own rules in a real collective process of water management (G_{S2}).

The improvement of the perceived collective capacity in Group S4 can be related to the fact that players talked together during the ex post game, while they remained separated into two distinct groups during the ex ante game. This change in group interaction must have positively impacted their perception of their collective capacities in terms of rule-making and implementation. Even if one player ($P3_{S4}$) decided not to follow the transparency rule chosen and applied by the rest of the players, the majority of the group still managed to reach a level of collective organization that was non-existent during the *ex ante* workshop). The improvement in the perceived collective capacity in Group S5 is even more impressive. The group did not work together during the *ex ante* workshop and all the players reported this on their monitoring files and questionnaires, as well as during the collective debriefing. During the *ex post* game, very much to the contrary, all players teamed up to "*break the game*" and the atmosphere was more collective. Even if no NMR was implemented during the second CappWag game, players felt that this time they had the capability to that if they wanted to.

The collective capability "rule-making and implementation" of GS2 was absent during the *ex ante* workshop because one of its members ($P5_{S2}$) did not value it positively. He significantly changed his opinion during the *ex post* workshop, which positively influenced the collective value and the overall collective capability. It is interesting to notice that even if the collective

value had been simplified to a simple mean of players' answer, it would still have increased between the two CappWag workshops.

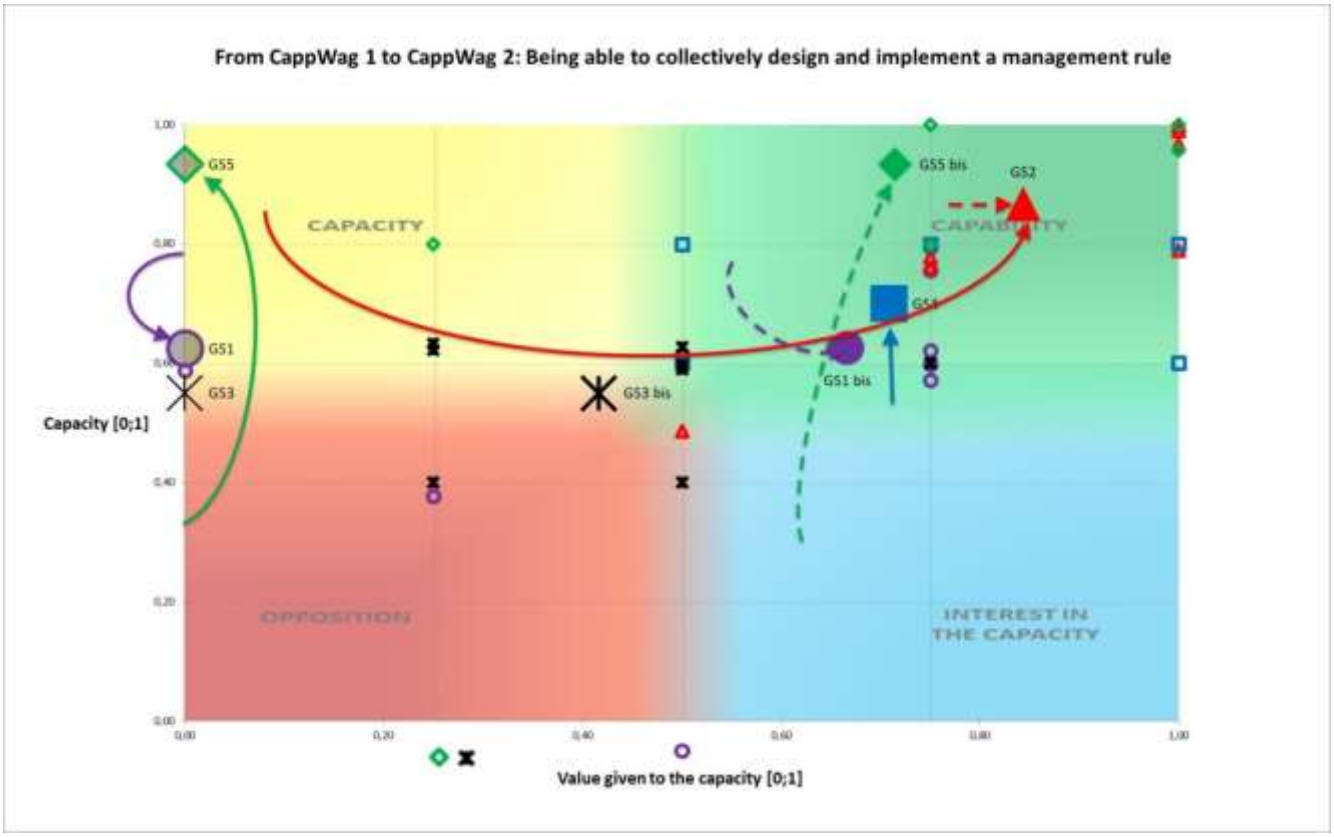

Figure 68: The evolution of the collective capability "rule making and implementation" of Groups S1, S2, S4 and S5.

GS1 is the only group to present, according to its members, a decrease of its collective capacity to make and implement rules. This can be explained by the fact that players acted more collectively during the *ex ante* game than during the ex post game. This is illustrated, for example, by the fact that no NMR was implemented during the *ex post* game, whereas one was made during the *ex ante* game. This probably caused several players to believe that they were less able to do this than during the first game, even though they actually valued the related freedom more.

4.3.5.2. THE COLLECTIVE DIAGNOSIS OF A PROBLEMATIC SITUATION

The evolution of the collective capability "diagnosis making" is more contrasted and in general rather negative. This is distinctly visible on Figure 69. Only one group (GS5) demonstrated a substantial improvement in its collective capacity, as perceived by its members. Just as for the collective capability "rule-making and implementation"; even though no collective diagnosis concerning the state of the socio-ecosystem was realized *per se*, the group showed much more interest in discussing together and playing collectively. Its

collective capabilities (as well as, to a certain extent, the individual capabilities to express themselves of its members) improved in consequence.

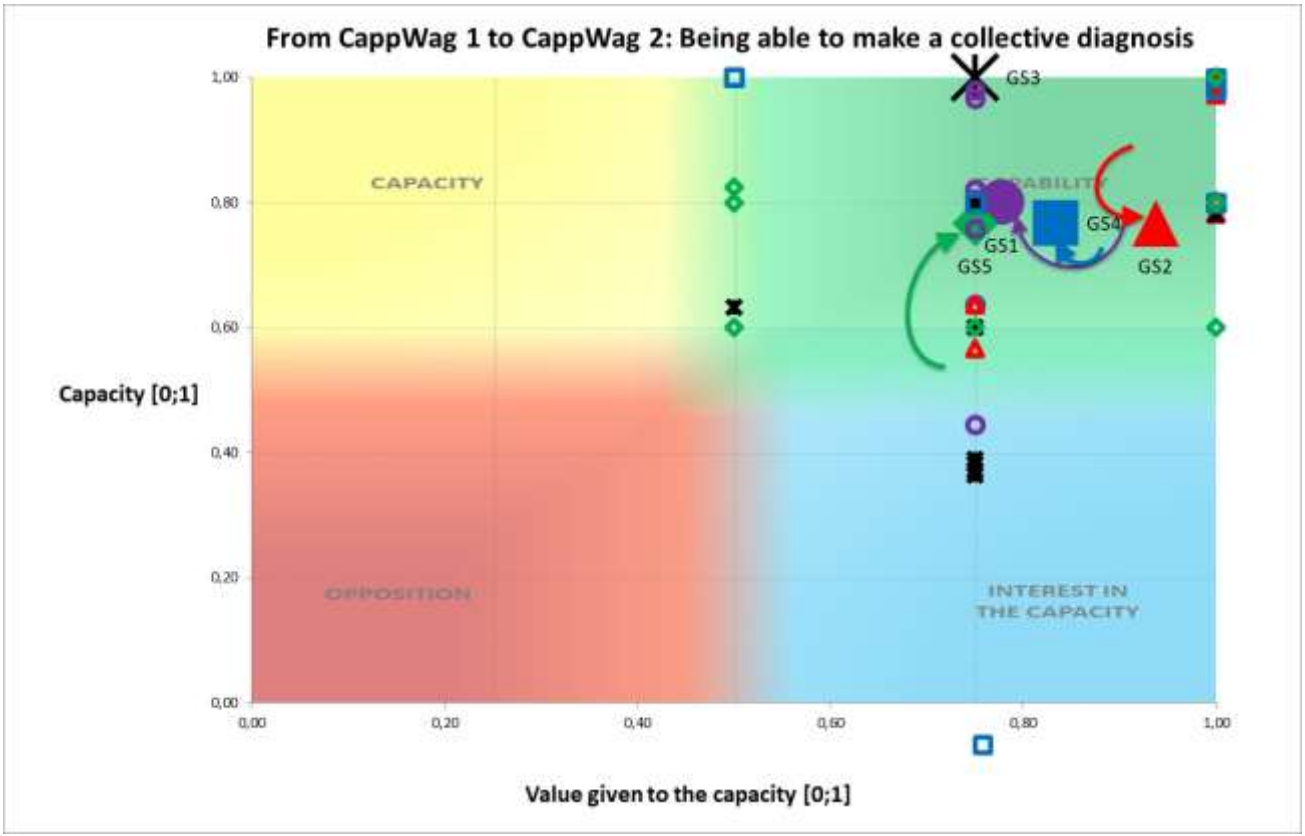

Figure 69: The evolution of the collective capability "making a diagnosis" of Groups S1, S2, S4 and S5.

The collective capacity of GS2 decreased between the two workshops, which is probably related to its difficulties in containing the pollution increase and the multiple fines they received.

GS1 and GS4 show decreases in the value given by their members to the freedom of making a diagnosis for a group of people managing a water resource together, without giving specific reasons for these changes.

4.4. THE GENERAL IMPACT OF THE IWRM COURSE ON THE CAPABILITY SPACE OF STUDENTS

The Master students were the only ones to follow the complete *ex ante ex post* CappWag procedure. As a result, the evolution over time of their capability spaces and its relation with the IWRM course was discussed in section 4.3.4. The data analyses showed that there was a mixed perception among students of the impact of the course on their capacity and interest in self-expression among their group, collective rule-making and implementation and collective diagnosis-making.

Several players acknowledged the changes that occurred during the *ex post* game, compared to the *ex ante* game. We summarized these changes on Table 15: the green ticks indicate a positive impact of the IWRM course on the behavior of students during the ex post game; the red ticks indicate the absence of impact of the IWRM course on their behavior during the ex post game. The black bullets indicate an absence of consensus among players concerning the impact of the IWRM course on their behavior as players or a lack of data to determine whether the course had an effect or not.

	Impact of the IWRM course (theoretical course and group work)
Group S1	✗ Less than half of the group ($P1_{S1}$, $P2_{S1}$, $P7_{S1}$ and $P8_{S1}$) considered that the course had an impact on their attitude during the *ex post* game. ✗ Group S1 was already acting collectively during the *ex ante* game. Instead of improving, the group dynamic deteriorated during the *ex post* game.
Group S2	✓ Most of the group (six players: $P3_{S2}$, $P4_{S2}$, $P5_{S2}$, $P6_{S2}$, $P7_{S2}$ and $P8_{S2}$) considered that the IWRM course influenced them during the *ex post* game. ✓ But they were already acting cooperatively during the *ex ante* game and did not improve nor change their behavior during the *ex post* game.
Group S3	• The players of Group S3 were divided concerning the impact of the theoretical and practical IWRM course on their behavior. ✗ Because of the frustration of the collective players towards the selfish players at the end of the *ex ante* game, more people acted individualistically during the *ex post* game. The impact of the course on their behavior was hence not visible.
Group S4	✓ Most of the players identified a positive impact of the course on their behavior during the *ex post* game. • This positive impact of the IWRM course was not always visible in the way they acted together, particularly in the case of $P2_{S4}$.
Group S5	• The group was divided concerning the impact of the IWRM course on their behavior during the game. • They played very collectively during the *ex post* game but did not take it seriously. Hence, the impact of the IWRM course was not visible.

Table 15: A summary of the impact of the IWRM course for each group of students as evaluated by the students themselves and a discussion of the reasons behind their evaluation.

The groups of players played either:

(i) more collectively. For example, $P4_{S2}$ explained during the *ex post* collective debriefing that the *ex post* game was "*better*" than the *ex ante* game and that he set collective objectives for himself right from the beginning of the game);

(ii) less collectively. $P4_{S1}$ for example noticed that he played more individually the second time: "*Even more the second time than the first time,* I was *part of a group which tried to win and to respect the environmental norms".*

(iii) The same way. Contrary to his colleague, $P2_{S2}$ considers that the group dynamic did not fundamentally change from one game to another: "*Many of us said that we played the same way the first and the second time"* ($P2_{S2}$).

We identified two main factors of influence related to the Master's degree context explaining the evolution of the group dynamics between the *ex ante* and the *ex post* workshops. The identification of these factors is crucial for the course supervisors, since it directly tackles the effectiveness of the training in influencing students' behaviors towards a better understanding of participatory and collective management issues, as well as towards a better capacity and interest in collective work. We will discuss in detail the other variables that explain these evolutions and that do not directly relate to the Master's degree context in Chapter 5 (sections 2 and 4).

4.4.1. THE IMPACT OF THE THEORETICAL COURSE AND THE PRACTICAL ASSIGNMENT

The individual interviews conducted with several students allow for understanding the impact of the IWRM course better. Of the nine students interviewed, four players ($P2_{S2}$, $P6_{S3}$, $P1_{S4}$ and $P2_{S4}$) evoked the impact of the IWRM on their behavior during the *ex post* game, either in a positive or, in one case, in a negative way. During the collective debriefing of Group S2, players mentioned that the course "*changed the mindset of the group*", "*fostered cooperation*" and "*made them aware of the importance of the dialogue between actors*". $P2_{S2}$, a member of the "Water and society" section, confirmed this group evaluation during an individual interview: "*during the first game, several players played to win. […] During the second game, we played all together instead to try to protect the aquifer*". Even though he stated that the course had no impact on him, he observed its influence on other players: "*There may have been an increase in the awareness [of players] and [at the same time] we just followed a course on IWRM and it would not make sense to play individually after spending a week working on a participation course […]. I think one player at least, $P8_{S2}$, said that he played more collectively during the second session than during the first one*". For his part, $P2_{S2}$ did not act differently in the *ex post* game in relation to his participation in the IWRM course: "*After a week spent in an IWRM course, I know more things, I understand more things. But in terms of actions… I was already aware of these issues [the first time] and I probably acted the same way [in both games]*".

$P1_{S4}$ also acknowledged the influence of the IWRM course on Group 4's behavior during the *ex post* game: "*Participating during the course and following the course units […] put us in a participatory state of mind. We talked participation, ate and drank participation and participatory actions for several weeks. So yes, we were keener to play properly*". He added: "*we worked with IWRM during several weeks, even in the evenings, to be able to hand in our assignments. We were 100% IWRM*". $P2_{S4}$ also evoked this positive impact of the IWRM on Group 4 during an individual interview: "*we played the second game right after finishing the IWRM course, so we tried right away during the first round to look for solutions and to create common strategies*". According to this player, "*the IWRM course made it possible to understand better how "consultation" works, as well as everything that goes with it. The objective is to build common strategies in accordance with this participative aspect. […] During the first game, as we did not know it, we were disorganized. Ideas were flying everywhere. They were mostly individualistic ideas rather than collective ideas and it was difficult to bring them together. During the second session, at the end of the IWRM course, it was much*

simpler. […] At the end of the first round, we knew what we were going to do in the second round to reduce the pollution". He also recognized that the composition of his group might have partly explained this collective behavior during the *ex post* game. Indeed, half of the group consisted of students belonging to the "Water and Society" section of the Master's degree. Because this section trains students in water governance issues, P2S2 thought that all its players were probably even more influenced by their Master's courses than the rest of the students: "*We were three students [four actually: $P1_{S4}$, $P2_{S4}$, $P6_{S4}$ and $P7_{S4}$] from the "Water and Society" section in our group. […] We were maybe a little bit more interested than others [in the issues tackled by the game]. It influenced our group, since we have had more courses on these issues*". Finally, he explained that the rest of Group 4 shared his opinion on the IWRM course: "*We decided quickly what to do and said, "we must do this right away, buy cards for another person […] or sell cards". We did it directly, quite instinctively. This clearly is thanks to the IWRM course. Everyone said so, at least in our group*".

Finally, one player ($P6_{S3}$) considered that the IWRM course probably affected the behavior of Group 3 during the *ex post* game in a negative way. He explained during an individual interview that the group was "*a little fed up with group work*", after spending several weeks (especially one week right before the day of implementation of the *ex post* workshops) working on a similar subject, sometimes in tense conditions. This explanation shows how the ex post workshops captured the fatigue of Group 3's players. This tends to increase the efficiency of the workshop as a proxy for real-life collective work.

Other players did not consider that the IWRM influenced their behavior during the *ex post* game. $P4_{S1}$ for example did not observer any change in Group 1's behavior related to the IWRM course: "*I do not think that I played differently the second time. […] I had the impression that it was the same thing for other players. There were always some people very involved in the respect of the environmental standards and some others always focused on winning. I did not feel any fundamental differences*". One unidentified player explained during the *ex post* collective debriefing that the group dynamic and actions had not changed since the first CappWag workshops because they had already played collectively the first time. P6S3 shared a similar opinion concerning his own behavior: "*I do not consider that the course changed my behavior. I was already interested in the first game even though we had not yet started the course. I had understood how it worked and what to do. The course helped me understand how we design it but not how we play it*".

Other players evoked the notable impact of the IWRM course on the players' understanding of the game mechanisms. $P1_{S1}$ in particular discussed this during his interview: "*I think [the IWRM course and group work] influenced the way we played. One of the things that made us play differently was that we designed a game ourselves [during the course]. We had to set objectives, follow a protocol. This made us understand better the machinery behind participation games".* P3S1, shared a similar thought: "*I understood the goal [of the game] better, or rather the mechanisms of the game. But how it impacted my way of playing […] I don't know*". These impacts were not the focus of the CappWag evaluation tool, which was designed to evaluative the capabilities of the individual and groups with regard to important collective actions related to participatory processes. Nevertheless, this shows that (i) students did learn about game design and game mechanisms thanks to the IWRM course, which is

positive for the supervisors of the course; and (ii) that they learned about it through the evaluation tool itself (the *ex ante* game). We will discuss this twofold aspect of the CappWag evaluation tool in depth in Chapter 5 (section 4.1.2.1).

One facilitator (in Group 1) reported that, for several students, the distinction between these two variables (a better knowledge of participatory and collective management issues and a better knowledge of the game mechanisms) was not clear. Students discussed this distinction during the *ex post* collective debriefing and tended to favor knowledge of the game mechanisms as a more important factor for "playing better" the second time.

This evidence shows that the IWRM course had an impact on students in terms of collective work. Several of them explained that they worked together better because they understood the issues at stake in participatory and collective management of water resources better. However, the three students who made this statement during their interview were also those who were already interested in these issues before the beginning of the course. The three of them are, in fact, members of the "Water and Society" section, which is intended to train students in water management issues through borrowing from human sciences and has a stronger focus on IWRM than the other the sections.

Students from other sections were more toned in their assessment of the IWRM influence on their *ex post* behavior in the CappWag game, whether because they were already aware of collective management and participation issues before the start of the course, because they did not demonstrate in the game or report their potential increase in knowledge, capacity or interest related to collective action, or because they did not benefit from the IWRM course with regard to these specific subjects. One impact of the IWRM course on players' *ex post* behaviors that was not necessarily the center of attention of this research but did come out during the individual interviews of players is how several of them considered the IWRM course (CappWag workshops included) as an efficient training for game designing and socio-ecosystem modeling.

4.4.2. THE IMPACT OF THE STUDENTS' COLLECTIVE WORKS AND SOCIALIZATION

Three students ($P1_{S1}$, $P2_{S1}$ and $P2_{S3}$) identified an improved knowledge of each other and even their new friendship as a major justification for changes in collective dynamics. They expressed this clearly during their interview: "*The fact that we knew each other better helped us work together in the second game for sure*" ($P1_{S1}$); "*we knew each other better [when the second workshop took place] so it was easier to communicate and to discuss in order to solve problems*" ($P2_{S1}$); "*It is also certain that working three months with the same people and handing in a big project at the end necessarily [impacted] the collective dynamic*" ($P2_{S3}$).

$P2_{S3}$ went further and evoked the friendship that was built during the first semester of their studies as a main factor that influenced his behavior during the *ex post* game: "*It is true that the second time, affinities [between players] played a more important role. My roommate was in the group; we obviously know each other well so we tried to work together all the time. There were also people in the group whom I am used to discussing with. We already know*

each other. So obviously yes, we may have talked more. In fact, we more or less all talked together. […] Maybe at the beginning [of the second game] I did talk directly with my friend because we know each other. It was easier to do it like this. But we more or less all discussed, it was fairly homogeneous".

These statements show that the *ex ante ex post* evaluation tool does capture the evolution of people's level of sociability and, in the case of Group 3, tensions among players. Nevertheless, several other factors that are not related to the IWRM course but rather to the evaluation tool itself influenced people's behaviors during the *ex post* game. These will be the subjects of analysis in the following Chapter.

5. CONCLUSION

The results from the twelve CappWag workshops presented in this chapter show that various types of group structures and dynamics, of individual and collective actions and behaviors observed and reported among players. We synthetized in sections 3.2 and 4.1.1 the main features related to capabilities, resources and conversion factors measured in the groups, as well as the evolution of capabilities over time in the case of the Master's students case study.

Overall, the results show a rather wide variety of behaviors and actions made by players in the twelve groups. For instance, while some players remained silent and did not engage in discussions on the diagnosis of the river or the lake's socio-environment, other were particularly vocal about it. At the collective level, while in several groups of players, collective discussions took place about the diagnosis of the socio-ecosystem and one or more management rules were designed and implemented by the group or by subgroups of players, in some other groups none of these actions took place. Similarly, the capabilities evaluated in the twelve groups varied greatly in terms of existence (or absence) and strength (or weakness).

In the Master's students case study, where the full *ex ante ex post* CappWag experiment could be implemented, the evolution of the three capabilities we observed through time is just as diverse. We expected the participation of students in the IWRM course to strengthen their individual and collective capabilities. Instead, results showed that not every players acknowledged changes that occurring during the *ex post* game and related to the course. As a result, the groups of players played either more collectively, less collectively or similarly during the *ex post* game, compared with the *ex ante* game.

Additionally, the analyses of the data also show a first series of weaknesses concerning their robustness, as seen in particular with the inconsistency of data coming from various sources (e.g. written statements from players contradicting external observations from the facilitator or observers) or with the behaviors of certain players during the *ex post* workshops (e.g. the members of Group S5 playing together to find flaws in the game rules set by the facilitator). We discuss these points further in Chapter 5, along with the overall validity of the CappWag experiments.

CHAPTER 5 – ASSESSING CAPPWAG, AN EXPLORATORY TOOL TO EVALUATE CAPABILITIES

1. INTRODUCTION

In this chapter, we discuss the efficiency of the CappWag evaluation tool to capture capabilities at the level of the individual and the group of participants, as well as the evolution of these capabilities over time.

In order to test the tool, we implemented twelve workshops on two case studies during this three-year research. The data collected were complemented by a series of interviews carried out between December 2017 and April 2018 with players from the two case studies, as well as with participants in a CappWag presentation workshop held in the Drôme valley, France, in the frame of the SPARE project. These participants did not wish to pursue their involvement in the CappWag evaluation process further and explained their reasons during the interviews[20].

Thanks to them, we identified the strengths of our tool, its limitations and the improvements that could be made to it. We address them in the following pages. First, we discuss the methodology of analyses that we detailed and used in Chapter 4 to interpret the data (section 2). We then discuss the design of the two *ex ante* and *ex post* experiments (section 3), as well as benefits of, and the difficulties in using a social experiment as an evaluation tool for participatory processes (section 4). We finally discuss the conceptual framework at the origin of this research, its assets but also its limitations for the evaluation of the impact of participatory processes on participants (section 5). In each section, we will suggest guidelines for researchers who may use and further develop the CappWag evaluation tool in the future.

2. DISCUSSING THE METHODOLOGY OF ANALYSIS OF OUR RESULTS: THE THREE DIMENSIONS OF A CAPABILITY AND THE TREATMENT OF THE COLLECTED DATA

In order to analyze the results of the CappWag evaluations, we relied on the six-stance grid presented in Chapter 1 and 4. The "decomposition" of a capability in six possible stances of being and doing undertaken with this grid allowed to characterize the level of capability among the groups of players, both at the individual and at the collective level. It furnishes a framework to go beyond a simple distinction between the absence or the existence of a

[20] This CappWag presentation workshop took place in May 2017. The SPARE (Strategic planning for alpine river ecosystems) project had already begun for six months when the workshop was implemented. By this time, a series of organizational meetings had already taken place and participants were eager to start field works (taking the shape of a participatory diagnosis of the state of the river). The implementation of the CappWag evaluation workshop was hence discussed in a context of "organizational fatigue" and strong demand from participants for "concrete" actions on the field.

capability and instead, understand the various position than an individual or a group of individual can hold on the capability scope.

The analysis of the results showed that this decomposition made sense at the individual level but was more difficult to realize at the collective level. Indeed, a group of players can be divided and made of smaller sub-groups, or individuals acting on their own, and each one of them may be at a different stance in the capability grid.

Moreover, scholars in the field of the capability approach tend to consider the emergence and the strengthening of capabilities (and their related concepts) as a medium to long-term process (e.g. Castillo 2014; in Frediani, Boni, and Gasper 2014). However, because the shape of the CappWag experiment resembles that of a participatory process (especially through the use of a RPG), these stances are not entirely fixed but rather dynamic and it is not excluded that they may evolve during the course of the game. For example, a player may learn to take the floor during the course of the game (even through short moments of discussions) and like this, improve his capacity to express himself in front of a group of people. Similarly, one or several players may change their opinion concerning the importance of the being able to make a diagnosis of the socio-ecosystem or to make and implement management rules for a group of participants to a water management project. In this way, the value they give to these freedoms may evolve through the experiment itself. It may be a challenge for players to evaluate both the state of their individual capabilities and of the collective capabilities of their group, as well as their values, through questions which do not take into account this evolution criteria. The triangulation of the data allowed by the multiple information sources does not fully answer this last issue, which should be addressed during the collective debriefing in order to better understand it.

The use of quantitative data allowed to give the evaluator and participants themselves a precise evaluation of their capabilities, especially through their graphical representations. However, at the collective level, the size of the groups and the consequent use of small-number statistics (means, medians and standard deviations) limits not only the scope of the quantitative analysis but also its representativeness of the group's state. The mean is especially sensitive to "extreme" data (i.e. individual data greatly varying from the majority and that may strongly influence the mean), which is why we often used medians as a first approximation of the collective position concerning the observed capabilities. One solution would be to use non-parametric methods, instead of the previously discussed ones. Non-parametric methods rely on the ranking of the numbers used, rather than the numbers themselves (Siegel and Castellan 1988). Because they are less sensitive to these "extremes", they may provide more reliable information to compare groups' results (e.g. through the use of tests such as the Wilcoxon-Mann-Whitney one). A remaining drawback is that these tests can hardly be applied to very small groups of players (e.g. less sans eight). This is problematic for the evaluation because as we showed with our case studies and will discuss further in this chapter, it may be difficult to gather that many participants for a CappWag evaluation, even more so for a full *ex ante ex post* evaluation.

Finally, the double representation on the graphs of both (i) the mean of the individual value given by the members of a group to a freedom, regardless of their importance (i.e. low and

high values alike); and (ii) the mean of the individual value given by all the members of a group to a freedom, minus the low values (that is to say the ones representing a lack of interest or an opposition from one or more players) should be improved for future uses. Indeed, players who took part in the Tunisian workshop and were later presented with the results found this representation confusing and expressed their interest for clearer graphs (this is particularly important because participants to the CappWag workshops should be able to fully understand the results of their evaluation).

3. THE DESIGN OF THE CAPPWAG EVALUATION TOOL

Based on the results presented in Chapter 4, we discuss in this second section the design of the two games CAPPWAG-RIVER and CAPPWAG-LAKE, as well as their complementary apparatuses to measure the three capabilities.

3.1. THE DESIGN OF THE TWO ROLE-PLAYING GAMES

3.3.1. THE SCENARIO OF THE GAMES

The scenarios of the two games are a central element that ensures the effective proceedings of the workshops. As discussed in Chapter 3, a major challenge during the design phase was to find a balance between (i) a thought-provoking and complex but difficult game, involving various unknown variables to players, and (ii) an easy and engaging but unchallenging game. External observations report that the *ex ante* game was not very challenging for only two groups (S1 and S2) out of seven. Indeed, they played collectively all along and hence did not face any environmental issues. The external observations for the *ex post* workshops were more nuanced: out of five groups, only two groups (S1 again and S4) found the game unchallenging and one group (S2) found it, on the contrary, extremely difficult to play because of calibration issues that prevented players from getting rid of cards or purchasing them.

Design issues that make a game too easy or, on the contrary, too difficult to play negatively affect the internal validity of the evaluation tool. Even though the display of functionings by players related to the three observed capabilities does not depend on the accumulation of cards or the avoidance of environmental fines round by round, but instead on personal involvement in the discussions and collective organization, they are an important part of the players' discussions. The incentives to compete and cooperate integrated into the game (see chapter 3 section 4.1.2) give players a reason to discuss their group organization and the regulation of the game socio-ecosystem. However, external observations and players' statements showed that during the limited discussion phases, these two functionings (self-expression and collective rule-making) were prevalent compared to collective diagnosis-

making. The lack of difficulties encountered by several groups of players may have meant that they had no reason to discuss the way the socio-ecosystem worked.

In a general way, the imposed phases of silence during the game may have limited the content of the discussions of players, and led them to prioritize the subjects they found the most urgent or important to discuss in order to keep playing (e.g. card acquisition, wealth loans between pairs of players). This may very well have been to the detriment of other subjects of conversation (e.g. diagnosing the system, taking the time to discuss or develop complex management rules). It is likely that no solution exists to increase the duration of the discussion phases without making the data collection more tedious for the facilitator (unless part of the data collection is computerized, as we already discussed in Chapter 3 and will come back to in the conclusion of this thesis).

3.3.2. THE GAME SETTING

In CAPPWAG-RIVER, players sit around a table and are located along a linear board. In this configuration, the physical distance (i.e. at the table) between the farthest upstream players and the farthest downstream players may be important in large groups. This realistic spatial organization makes it easier for players to talk with their close neighbors rather than with players further away along the river. Hence, in most of the seven groups (especially in groups T1, S4 and S5), the discussions and agreements between players correlate with their neighboring position (upstream, midstream or downstream of the river). Nevertheless, the spatial configuration of the CAPPWAG-RIVER board did not prevent players from talking to each other, regardless of their position along the river. As $P2_{S3}$ explained: "*during the first session, I mainly worked with the people who were opposite me because we were upstream. We were facing each other and we were more concerned [by similar issues than with downstream players]. It was much more difficult to talk to someone downstream at the end of the table […] even so we could have made the effort [to talk together], that is for sure*". Additionally, groups S4 and S5 participated in the *ex ante* workshop in the same classroom which was small and noisy. This external variable made it easier for players to talk with their direct neighbors because they could not always hear or be heard by players on the other side of the table. This negatively impacted the controllability of the game and the comparability with the other groups of students, since Groups S1, S2 and S3 were not confronted with the same external conditions. In order to avoid the influence of the spatial configuration of the board on players' behaviors, a round table could be used as a support for the game board, especially in the case of CAPPWAG-RIVER.

Several players reported that the changes in the game settings (managing a river and then a lake) during the *ex post* experiment influenced their behaviors. According to them, the circular board in CAPPWAG-LAKE made it easier to communicate with all of the other players, particularly for the two groups previously singled out, S4 and S5. For example, when asked about the higher frequency and inclusiveness of the discussions in Group S4 during the *ex post* workshop, $P1_{S4}$ stated: "*I think it can be explained by one thing only: the round shape of the lake. […] It was easier to talk to everyone because they were almost all equidistant one from another. On the river, because players were located along a linear stream, the first player*

had trouble speaking and being understood by the last player. […] We raised our voices once or twice and then we stopped". Because this uncontrolled variable may have influenced the behavior of several other players such as $P1_{S4}$ (even though he is the only one who mentioned it during the interview), we can say that the internal validity of the *ex post* experiment, and hence of the *ex ante ex post* evaluation, was negatively impacted. However, we note that the positions of players along the river or the lake did not influence the identity of the winner of the games, as we summarized in Chapter 4, sections 3.2 (first case study) and 4.1.1 (second case study).

Another difference between the *ex ante* and the *ex post* games is that there is no pre-defined playing order around the lake in the latter. One player ($P4_{S1}$) noted that this change prevented him and his group from using their knowledge of the *ex ante* game rules to play during the second game, which was the objective of this design feature. However, other players also identified this change as a major variable that influenced their behavior during the *ex post* game. According to $P2_{S3}$, it "*gave everyone more chances to win"* and *"because [their] place around the lake during the second game was random, it forced [them] to make concessions",* since they *"knew less what would happen during the following rounds*" ($P4_{S1}$).

The game settings of CAPPWAGE-RIVER and CAPPWAG-LAKE, when taken separately, thus allow them to serve as a support for a one-time evaluation of capabilities. However, when implemented one after another according to our *ex ante ex post* protocol, the results of the *ex post* workshops implemented with the students are subject to more caution than the results of the *ex ante* workshop. Indeed, the *ex post* CappWag workshop was considered by several players as less challenging than the *ex ante* workshop. Moreover, the circular setting of CAPPWAG-LAKE impacted the behavior of several students and was even considered by them as a major reason for the changes in their behaviors during the *ex post* game. This prevents the evaluator from identifying with certainty changes of their individual and collective capabilities. It consequently limits the validity of the results and, hence, the *ex ante ex post* comparison. This is why, in order to better understand the influence of players' position along the water body on their behaviors and actions during the game, one could test these "location effects" in a dedicated experiment. It would particularly allow to state (1) whether, in CAPPWAG-RIVER, players internalize the importance of the geographical location along the river (i.e. a setting where a logic of upstream priority dominates in terms of water access) and act consequently; and (2) whether it negatively impacts the comparison with players' ex post behaviors in CAPPWAG-LAKE, where there is no such influence of the geographical location around the water body.

3.2. THE ADDITIONAL MEASUREMENT TOOLS

The measurement of the three capabilities and their associated resources and conversion factors was made possible thanks to the RPGs and its two complementary devices. We also discuss in this section their content and the difficulties encountered in qualifying the two collective capabilities that we were focusing on, especially the collective capability "being able to make a diagnosis of a problematic situation".

3.2.1. THE MONITORING FILE AND THE QUESTIONNAIRE

Two shortcomings concerning the formulation of the questions in the monitoring file and the questionnaire were brought to our attention during the CappWag workshops.

The first is the precision of the questions. Indeed, the definition of a "group" can be understood differently and relates either to (i) the whole group of players or (ii) sub-groups of players within the whole group. Not asking players to always specify whether they acted as parts of the whole group or sub-group was a trade-off made in order not to discourage them from answering all of the questions in the monitoring file and the questionnaire. Nevertheless, several players did consider the latter as the definition of a group and answered accordingly. The triangulation of the data (made possible thanks to the multiple collection devices) allowed for establishing the correct scales of action when these were unclear because of this vocabulary confusion. External observations made by the facilitator or observers were particularly interesting for that matter.

A second shortcoming is the lack of hierarchy among the questions in the questionnaire. Many players skipped one or more questions (because they were not attentive or because they lacked time). Some of these questions were crucial to identify their capabilities and no other alternative data could be collected elsewhere (e.g. questions concerning players' capacity to act or the value given to these capacities). When these data were missing, it was not possible to make a complete analysis of players' capability space, or to compare its evolution over time. Design options involving oral descriptions by players, round after round, of their behavior were ruled out during the design phase of CappWag for practical reasons (see Chapter 3 section 4.2.4). Instead, a possible solution to the shortcoming above-described would consist in computerizing the questionnaire and make sure all questions are answered in order to complete the workshop.

3.2.2. THE COLLECTIVE DEBRIEFING

The collective debriefing is an essential part of the workshop because it is the only moment during which players can interact with the facilitator and among themselves to reflect on their behaviors, as well as the positive or negative feelings generated during the play (e.g. satisfaction, accomplishment, desire to win, group belonging or frustration, anger, etc.) (Crookall 2014). For example, during the *ex ante* debriefing of Group S3, the behavior of some individualistic players was bitterly pointed out by the rest of the group and this impacted their behavior during the *ex post* workshop, since they did not want to provoke another argument.

The collective debriefing is also the moment during which players can discuss the game mechanisms and potential issues encountered in the game or shortcomings they noticed, as well as the link between the game and reality. For example, during the *ex post* collective debriefing of Group S3, one player said that he considered the game as "*anti-IWRM*" because

of the existence of several individualistic incentives. The collective debriefing ensured that this player did not leave the workshop with the feeling that the game was poorly designed and instead allowed the facilitator and other players to react to this opinion (we discuss the perception of the game further as "*anti-IWRM*" in section 4.3.3).

Finally, the *ex post* collective debriefing should be the moment when capabilities are discussed with players, so that they understand better the use of the many questions they were asked during the workshop and the specific game features designed to facilitate measurements (e.g. the silence phases).

Yet, more often than not during the *ex post* CappWag workshops implemented with the Master's students, additional time was given to players to fill in their questionnaire and the debriefing was therefore shortened. As we will list below in our guidelines for future implementation, facilitators should ensure that they keep a sufficient amount of time for the collective debriefing at the end of every CappWag workshop.

3.3. DEFINITION OF THE CAPABILITIES AT THE CENTER OF THE EVALUATION TOOL

The analyses of the data and the interview with several players showed that, despite the attention given to the design of the experiment and of the vocabulary chosen, the definition of the two collective capabilities still needed to be improved.

3.3.1. THE DEFINITION OF A "NEW MANAGEMENT RULE"

Despite a paragraph of definition inserted in the questionnaire specifying the meaning of a "new management rule" (see Annex VI), this expression remained unclear to several players. They mistook short-term agreements (e.g. two players who team up to buy an Activity card together) for management rules and hence answered the questions according to this interpretation. The monitoring file and the external observations provided cross-checking data to counter this confusion. For example, $P6_{T1}$ explained that he "*refused once to team up with all players and […] kept [his] association with* $P4_{T1}$ *because [he] was satisfied and did not need to invest to buy more innovation cards*". This statement relates to a short-term agreement, even though the question tackled long-term management rules. Another player, $P4_{S1}$, confirmed during his interview that his definition of a management rule was different from that of the evaluator. To him, it corresponded to "*the establishment of a voting procedure, or a constraining rule*". The latter corresponds to one of Crawford and Ostrom's components of an institutional rule (*"the sanctions to be imposed for not following a rule*") (1995, 584).

In addition to this confusion, the *ex post* questionnaire did not specify that "new management rules" were considered as new even if they had already been implemented during a previous CappWag workshop. None of Group S2's players for instance reported the transparency rule

they implemented during the *ex post* game because they had already implemented it during their *ex ante* game. This lack of clarity concerning the definition of a NMR may have led other players to fill in their questionnaire with short-term agreements in mind. Once again, the triangulation of the data made it possible to retrace the process, when it existed, of emergence and implementation of new management rules in every group.

Annex IX goes over the content and conditions of design and implementation of these rules. During the twelve CappWag workshops implemented in the frame of this research, the players of six of the seven evaluated groups made and implemented at least once a new management rule. In these six groups, the "transparency rule" was made and implemented at least once by players. In three groups (T2, S1 and S3), it was the only new rule ever made and implemented. In only three groups, players designed a NMR that did not relate to transparency but rather to collective management (T1 and its associations and the river management committee); economic principles (S2 and the polluter-pays principle during the *ex ante* workshop) and justice principles (S4 and the water quotas during the *ex ante* workshop). None of the student groups designed original management rule during the *ex post* workshops.

The variety of rules that were designed and implemented in the seven groups, as well as the various scale of design and implementation (sub-groups or entire group of players) show that the space given to players to regulate their simulated socio-ecosystem was sufficient to allow them to express their collective capability.

3.3.2. THE CASE OF THE COLLECTIVE CAPABILITY "MAKING A DIAGNOSIS"

The cross-analysis between players' monitoring file and questionnaire allowed for following precisely the design and implementation of management rules during the experiments. It proved more difficult to track the collective capability "being able to make a diagnosis of a problematic situation". Three reasons explain this difficulty:

(1) The two understandings of what a "group" has (see section 2 above) made it difficult to know whether a diagnosis was made by all players or by sub-groups of players;

(2) There may have been confusion among players between making a diagnosis, either right or wrong, and making a good diagnosis. Players may have made a wrong diagnosis and realized later during the game that they were wrong. Since they evaluated themselves through the questionnaire, they may have lowered the rating associated to their capacity, depending on the accuracy of their diagnosis. Evidence indicates that this probably happened in Group S2 during the *ex post* workshop. The group was confronted with a high level of pollution during the game and could not contain it, despite their numerous collective discussions and attempts. Most of the players consequently demonstrated high diagnosis indicators (such as a similar understanding among group members of the way the lake socio-ecosystem worked or helpful discussions about the lake socio-ecosystem that allowed players to identify

management issues) but low self-evaluated ratings concerning their capacity to make a diagnosis.

(3) The ambiguity of the terms used to observe people's capability to make a diagnosis is a partial cause of the weakening of the results' validity. For instance, and unlike the two other capabilities, the collective capability "diagnosis-making" was not tracked with three mirroring questions in the questionnaire tackling: (1) the functioning; (2) the capacity to realize this functioning and (3) the value given to this capacity. Instead, the extensive analyses of the results showed that the formulation of the questions was ambiguous. Functioning questions addressed players' shared understanding; discussions with other players and their helpfulness in understanding the system and the identification of actions to modify the game; the capacity questions addressed the identification of management problems and, finally, the value question addressed player's shared understanding and making a common diagnosis. These various formulations were not centered on one clear definition of what a diagnosis is and instead, tackled various aspects related to it. That is why we suggest that the identification of the collective capability "diagnosis-making" should be based on these three mirroring questions and on one single and consistent definition throughout the questionnaire (e.g. encompassing all three aspects of a diagnosis-making process)[21].

3.4. LEARNING HOW TO PLAY THE GAME: AN INEVITABLE FEATURE OF CAPPWAG

We have assumed that knowledge of the game rules and mechanisms of players between the *ex ante* and the *ex post* workshops was non-scalable (i.e. that the memory of the *ex ante* game would minimally impact the conduct of players during the *ex post* game), thanks to a change in the game settings (see Chapters 2 and 3). Thus, the only variables that would have explained a change of behavior during the *ex post* game would have been a change in the capability space of players.

Nevertheless, several players from the student groups remarked during their interviews that their knowledge of the mechanisms and the rules of CAPPWAG-RIVER had influenced them when they played CAPPWAG-LAKE.

For instance, players learnt during CAPPWAG-RIVER how to manipulate the marbles on the board, how to read the Activity cards, how to obtain units of social capital and which actions they could or could not carry out during the discussion phase. $P1_{S4}$ explained that: "*we knew*

[21] We note that a formulation error slipped into the questionnaire (see Annex VI). Indeed, question n°25 tackling the value given by players to the collective capacity to make a diagnosis of a problematic situation slightly differed from the two other questions. It tackled the importance of the capacity, instead of the freedom to hold this capacity. However, because the question tackling the value given to diagnosis-making was inserted in between two other questions tackling the other two observed capacities and because the difference in the formulation is minor, we consider it a negligible error that did not influence the answer of players.

the rules and how to play, even if the management was different because we were on a lake and not on a river anymore. Contrary to the first game, we did not need time to understand how the wags, the pollution, the smileys and the social capital worked, which actions got us smileys and when, etc. We knew almost all of the rules, even if we needed to be reminded of two or three tricks […]. We could focus more on participatory management and the improvement or the preservation of water quality […] [This knowledge] influenced us because we already knew the game and so we could get 100% in it". The process of learning the game rules and mechanisms took place during the course of the *ex ante* game, as $P2_{S2}$, a foreign student who did not master the French language well at the time of the *ex ante* workshop, explained (he understood the purpose and how to win the game after one hour or so of gaming). The implementation of CAPPWAG-LAKE was consequently quicker. We also note that since the IWRM course followed by Master's students involved the design of a RPG, it is very likely that they also learnt through it how to better manipulate marbles and cards. Nevertheless, we argue that this rapidity of implementation and better manipulation of the game's features did not negatively nor positively impact players' actions in the game related to the three capabilities because they are not directly related to how good players fair in the game but instead how they interact together.

Additionally, during the *ex post* game, players recalled remembering the main events and strategies that had taken place in their group during the *ex ante* game. This influenced their behavior during the *ex post* game, either because they tried to play according to the winning strategies they had identified (e.g. $P6_{S3}$: "*we already knew how to play and it should have helped us. […] During the second session, we could have played all together right from the beginning since we somehow already knew the solutions of the game"*) or because very much to the contrary, they wanted to play differently (e.g. $P2_{S3}$: "*we were upset by the outcomes of the first game and the lack of global agreement to set collective objectives. Since we played with the same people the second time, [we played] rather individualistically. […] We wanted to win the game since [collective work] did not work the first time*").

However, not all players shared this understanding. Several of them mentioned that even though they had the *ex ante* game in mind when they played the second time, they did not necessarily try to reproduce how they played the first time or, on the contrary, to play in an opposite way ($P1_{S1}$, $P1_{S4}$). Moreover, observers of the *ex post* workshops report in several group the oversight of some chore rules shared by both RPGs.

These various levels of familiarity and memory of the *ex ante* game mechanisms and strategies during the *ex post* game make us consider that using two RPGs to make an *ex ante ex post* evaluation is possible, as long as, as we discussed in Chapter 2 section 5, the games are carefully designed and not too similar nor too different. The CappWag workshops with the Master's students has showed that despite the use of two different RPGs separated by a three-month span, players' learning of game strategies was an undesirable variable that explains a non-negligible part of their behavior during the *ex post* workshop.

Improvements should consequently be brought to the design of the *ex post* game to avoid this learning effect (e.g. lighter game rules to ensure players dive equally quickly in the play in both games).

3.5. GUIDELINES FOR FUTURE RESEARCHERS AND PRACTICIONERS

Based on the design assets and limitations discussed above, we identify five changes that could improve the CappWag evaluation tool and strengthen its internal validity.

(1) *The simplification of the rules of the game:* suppressing the game options that were never or seldom discussed or used by players during the workshops (e.g. buying information during the game, the "0" cards). This would decrease the complexity of the game rules and hence the amount of time devoted during the game to understanding them. It would also increase the similarity of the engagement of players in the play between the *ex ante* and *ex post* workshops (i.e. how long it takes players to completely understand the rules and take full advantage of the opportunities offered to them in the game). In this way, a more efficient collective organization in an *ex post* workshop than in an *ex ante* workshop could, for example, be more reliably attributed to an improvement in the collective agency of the group, rather than to their improved control of the game rules.

(2) *Making the socio-ecosystem mechanisms represented in the ex post game more complex*: with such a design, the learning effect of the game mechanisms may be better avoided. It would ensure that players still have unknown mechanisms within the *ex post* socio-ecosystem to discuss and understand together, if they wish so. However, a higher socio-ecosystem complexity should not be detrimental to the time needed for players to engage in the game, as initially discussed in Chapter 3.

(3) *The simplification of the monitoring and evaluative forms*: the balance between external observations and self-reporting is essential to crosschecking the reliability of the data. In order to ensure that players understand and answer all of the questions related to the direct measure of their capabilities, we argue that only three questions should be kept for them to tackle. These should be the questions related to (1) their functioning; (2) their capacity and (3) the value they give to this capacity. With these three questions, a scale of measurement can be built and players' statements can be compared. The shortening of the monitoring and evaluative forms should free time that could be used to extend the collective debriefing (or at the very least ensure that it does last fifteen minutes no matter what the conditions of implementation are). We also recommend using a more precise rating scale (e.g. ten-level Likert items) for

these questions, in order to facilitate the use of non-parametric statistics to analyze the obtained data (when the groups' size allows it).

(4) *The improved clarity of the vocabulary used in the questionnaire*: if additional explanations concerning the definition of a "new management rule" seem unnecessary because of the already existing paragraph of explanation inserted into the questionnaire, future evaluators should consider the specification of what a "group" and a "diagnosis" are.

(5) *The use of round tables as supports for the board games during the ex ante and ex post workshops:* this may ensure that the spatial configuration of the board does not influence players' behaviors during the games.

4. THE USE OF A SOCIAL EXPERIMENT TO EVALUATE PARTICIPATORY PROCESSES: DISCUSSING THE VALIDITY OF THE DATA AND THE PRACTICITY OF THE TOOL

4.1. THE INTERNAL VALIDITY OF THE TOOL

4.1.1. THE APPROPRIATION OF A SEMI-ABSTRACT GAME BY PLAYERS

The realism of the game was often discussed during the collective debriefings and the interviews conducted with CappWag players. The feedback was often positive and a majority of players felt that CappWag realistically simulates the management of a river or a lake. Several game mechanisms and players' behaviors were deemed realistic, such as tensions between individualistic and collective strategies of stakeholders, economic and environmental issues, negotiations taking place during the game, the link between consultation and collective action, etc. $P2_{S4}$ stated for example during his interview: "*I do not think we considered the game simply as a game. It was like a case study, like a real problem*".

During their interview, the vocabulary used by several players to describe the game showed that they appropriated the game settings. For example, instead of talking about the management of a lake, one player ($P2_{S2}$) talked about the management of an "*aquifer*", a water body that was never mentioned by the facilitators during the CappWag workshops. Tunisian players in Group T2, who were all involved in the administrative management of water and land resources in Tunisia, referred to themselves as "*farmers*" and members of a

"*village*", while the river they managed was assimilated to a "*wadi*" (a dry riverbed in North Africa that contains water only during the rainy season[22]).

Yet other players evoked, on the contrary, the lack of realism of the game, mainly because of its perceived simplicity in terms of management and trade options, as well as actors represented in the game (e.g. the absence of State representatives in the game, or the possibilities to offer, lend or borrow money *ad infinitum*). Its simplified representation of the relationships between stakeholders was considered as "idealistic" by some players because its incentives for individualistic behaviors were not strong enough and hence not realistic enough (e.g. $P2_{S1}$: "*I think that in a real situation people are more concerned with their own interest. […] In a real situation I do not think that people are going to be that nice*"). Several players consequently expressed a wish that the game would have consequently been more realistic and considered its increased contextualization as a condition for its use as an evaluation tool (e.g. $P7_{T1}$ who explained that *"[an evaluation with such a game] depends on the [the specificities of] cases, which can vary*").

In order to understand better the perception of the game's realism by players, it should be tested with more stakeholders (i.e. more groups of players), and more diverse ones (e.g. citizens, elected representatives, but also farmers, environmentalists, etc.). The link between the level of game realism and its impact on the expression of player's capabilities should also be explored. Among others, an initial presupposition behind the semi-abstraction of the two CAPPWAG games was that with such a design, players' discussions and actions may not be entirely related to their defined roles or to the specificity of the water body represented in the game. Instead, they would focus on more universal management issues (see Chapter 3 section 4.2.1). The various perception of this semi-abstraction by players consequently also questions this presupposition. While we maintain that an increased contextualization of the games would negatively affect their adaptability to different types of stakeholders and implementation contexts, additional tests should confirm or infirm whether it would indeed change the nature of players' discussion and actions.

4.1.2. AN EVALUATION TOOL AND AN ELEMENT OF THE PARTICIPATORY PROCESS: THE TWO TRAITS OF THE CAPPWAG EXPERIMENT

4.1.2.1. CAPPWAG, A DUAL WORKSHOP WITHIN A PARTICIPATORY PROCESS

The data collected during the interviews with players from both case studies highlighted how the players considered the CappWag workshops not as mere sessions of evaluation, but rather as meetings where various views of water management could be discussed and debated, i.e. as a participatory arena itself.

This is particularly true in the case of the *ex ante* workshop. The time of the first evaluation ideally corresponds to the first (or one of the first) time participants meet in the frame of the

[22] Source : https://www.merriam-webster.com/dictionary/wadi; retrieved on 13/08/2018).

participatory process, potentially even the first time they meet at all. Players may already use the meeting opportunity offered by the evaluation workshop to introduce themselves and learn to know each other. In the case of the Master's students for example, the *ex ante* CappWag workshops corresponded to the first class of the IWRM course, which was itself one of the first courses of their first year of Master's.

In Tunisia, because the workshop was implemented in the framework of a long-term participatory project, the organizers made an effort to relate the *ex ante* CappWag workshop to its potential use both as an evaluative tool, and as a participatory diagnosis tool, within the project. For this reason, many Tunisians explained that they would rather use a more contextualized game on the field with real Tunisian farmers. In Group T2, a player ($P2_{T2}$) even decided for pedagogical reasons to take on the role of an individualistic farmer resistant to cooperation. By doing so, he wanted to make the play look tenser and hence more realistic (in the words of $P1_{T2}$: "*he played the reality*"). For him and for other players, the CappWag workshop was a way to discuss river management and participation issues. He reminded other players of this during the game when they criticized his behavior, telling them that: "*we are talking about reality, do not take it personally*" (in the sense that he was not responsible as an individual for the artificial behavior he reproduced in the game).

Similarly, several students (especially students from the "Water and Society" section) envisioned the RPGs as a participatory tool that they should master because they may use similar ones in their future jobs (e.g. $P2_{S4}$: "*we have been studying the field of environmental management for two, three, four, five years […]. We forced ourselves to play these games properly because this is potentially what we will be doing in one, two or three years for our future work. […] We prepare as best as we can for this moment"*). Other students had a similar interest in understanding the game mechanisms because they also had to design their own game during the IWRM course and hence used CappWag as an example.

Finally, several Tunisian participants and French stakeholders who attended a presentation of CappWag in the framework of the SPARE project mentioned during their interview that it was a relevant evaluative tool, but that they would rather use it in their field as an educational tool. $P1_{T2}$ for example explained that he would prefer CappWag to show players the benefits of collective management. $P6_{T2}$ shared a similar view of the evaluative tool and explained that it would be useful in the field with farmers, if only it had pre-set outcomes that players could aim at reaching (i.e. farmers should "*learn positive things […] about water and land conservation*"). Similarly, a stakeholder from the SPARE project explained that they: "*thought that this staging allowed for putting various actors around the table and seeing what skills are there and which one are missing and needed*", but also that: "*if everyone stays in their corner, I do not see the point. If we play one, two, ten rounds and reach the same conclusion, it is not interesting. I do not think that it will solve a situation of tension or conflict*". Just like several Tunisian players, the three SPARE stakeholders interviewed would have rather implemented a more contextualized and educational RPG to raise long-term awareness among other stakeholders about socio-environmental issues.

This vision of the CappWag games as an educational tool can be explained by its implementation context. In the case of the PR-OSCAR project, players were being trained to participation tools that they would afterwards use on the field with local farmers (see Chapter 4). It is very likely that they bore this objective in mind when taking part in the CappWag experiment. This explains their interest in a game that would further encourage players to cooperate and be more centered on the benefits of participatory management for the sustainability of environmental resources. In the case of the SPARE project, the workshop that players attended was not an actual evaluation of their capabilities. Instead, it was a demonstration of the tool's content and evaluative objective to a small group of citizens, with a view to convincing players of its evaluative benefits, in order to use it later with other SPARE participants. In this context, players who attended the demonstration voiced their interest in educational tools over an evaluative one, as they deemed it more appropriate at this time of advancement of the SPARE project.

4.1.2.2. THE IMPACT OF THE EVALUATION ON THE PARTICIPATORY PROCESS

Just as the evaluation process may serve as an unintended support for social learning and catalyze the emergence of individual and collective capabilities, it may also have the opposite effect and trigger conflicts that could have a negative effect on them and on the overall participatory process.

For instance, external observations report that tensions arose in two groups of students (G3 during the *ex ante* workshop and G4 during the *ex post* workshop) because of management issues met with during the games. $P1_{S4}$ reported during his interview that "*there was always this problem of players cutting other people off, as well as speech appropriation"*. This behavior is problematic because the CappWag experiment should not put participants into situations by fostering the appearance of conflicts that did not exist beforehand (Laine 2000; Hegtvedt 2014). In a similar way, $P2_{S3}$ reported that in Group 3, two players who played to win without caring for the rest of the group or the environment were "told off" during the debriefing ("*[they] ruined the game. They just wanted to make money. […] Because of these two players, downstream players could not play anymore after three or four rounds. […] We were mad at the two players because […] we did not care about the winner and we just wanted the river to work well. Their behavior revolted us".* Their behavior demotivated other players to play seriously the second time and, while the two players who were told off by the group made an effort to play collectively during the *ex ante* workshop, several others stopped doing so. A SPARE stakeholder discussed this during his interview: by testing people's capacities and values, a RPG such as CAPPWAG-RIVER "*implies players taking positions. […] On a human level, in terms of people's positions and commitments towards each other, it is not easy*". This social positioning evoked by the stakeholder is only partly related to the capability "being able to express oneself in front of group". Indeed, it implies being able to voice one's opinion and potentially defending it in front of other players. However, one could very well discuss with the rest of the group of players without taking clear positions on certain subjects (e.g. a player could discuss with other players how the socio-ecosystem works or what cards

best to buy, without necessarily revealing his motives, values or interests related to the game or to real life).

Tensions that may put players in difficult situations are undesirable because those players might be discouraged from engaging in a second CappWag workshop, or even in the participatory process subject to the evaluation itself. In order to avoid such tensions, the facilitators should ensure that the discussions taking place during the game are respectful (even though it means intervening if necessary in the discussions of players, which represents a certain procedural bias). The collective debriefing at the end of the workshop should also be carefully facilitated and if tensions have indeed arisen during the game, this should be the privileged moment to bring these and the link between players' behavior in the game and in real life into the discussion. However, it is not possible to avoid the emergence of tensions in the CappWag games altogether, precisely because they allow discussions and debates on water and collective management issues. As such, they serve both (i) as a revelator of tensions and give an opportunity to players to voice and discuss their opinions and (ii) as a support for evaluation. As long as the tensions emerging during a CappWag workshop are not disrespectful and stay in line with the issues at stake in CappWag and do not impede the participatory process or the relationship among participants after the workshop, they should not be discouraged.

4.1.3. THE THIN BOUNDARY BETWEEN A SERIOUS AND A PLAYFUL GAME

Data collected during the CappWag workshops and interviews with players revealed that most of them behaved seriously during the course of the evaluation. For instance, $P5_{T1}$ explained during his interview: "*I took the role-playing game seriously. I did not consider it as a game. On the contrary, I put myself in a farmer's place and I really felt the management issues [...] This is why everything I have done [in the game] was like in reality. [...] It looked a lot like a real case. That is why I felt comfortable during this exercise*". According to $P2_{S3}$, the games "*reflect the difficulty of implementing IWRM in real life*". Similarly, $P4_{S1}$ explained that: "*As soon as we could speak, we more or less all agreed on what to do. There was always someone who would think about solutions […] and everyone would agree because everyone had reached the same conclusion […]. I think this is representative of the way we would act together on a project or something else*". These perceptions of the games make us say that the two games are not detached from real life. Instead, reality often influenced, or "*interfered*" (Daré and Barreteau 2003, 10) with it.

However, despite its realistic design, several players did not take the game seriously and acted accordingly. During the first discussions phases of Group T2's workshop, $P2_{T2}$ reminded the rest of the group that there was no need to argue as strongly as they were doing because it was not a real management situation ("*it is a game, we need to calm down*"). Moreover, players reported during their interview that, because there was no real reward at the end of the game, they took the game lightly and instead, tried to shape their group's behavior

according to their own ideals of what water management should be like. These behaviors are similar to the observations made by Daré during his work with Senegalese farmers. For some players, the game is "*a showcase of reality, a place to reaffirm one's position in the real social field*" (Daré 2005, 254), but also to demonstrate one's ideas and values about WRM. This may explain the special care of Tunisian players to work collectively during the game and to maintain good relationships among the group. This may also explain why certain variables that often influence social relationships in Tunisia, such as gender or the position in administrative hierarchy, were not influencing factors that permit to explain players' behaviors during the experiment.

In extreme contrast, the playfulness of the game sometimes made players forget the context in which they were playing and led them to act very selfishly for fun. For example, $P4_{S1}$ reported: *"I think [the group dynamic] was biased because we got caught up in the game […] We started playing and forgot what the game represented*" and, later, "*the game changes what people do a lot. I do not think that it is representative [of real life] because the playfulness adds a lot, which is not necessarily the case in a serious project or work"*. He added: "*As often when we play a game, in a spirit of contradiction, some want to mess the game up. That kind of behavior made it impossible to get something realistic*".

These marked differences in players' behaviors in the games can be linked to the differences in the contexts of implementation of the tool. Indeed, a vast majority of students had not (yet) faced real-life issues such as the ones represented in the game when they took part in the CappWag workshops. Because of this, they may have taken the game less seriously and be more interested in testing its limits than Tunisian players, who are water management professionals and hence more prone to project their experience in the game.

Daré (2005, 252) also remarks that "*the way in which the actors'* habitus *interferes in their interactions during the game is not similar from one individual to another[…] some play more than others*". Similarly, some players saw the game as a representation of their reality and a support to discuss their ideas about water management, while other simply envisioned as a playful moment.

Finally, the implementation of two workshops, even separated by a span of three months, provoked, according to several players, a certain weariness about the game. This led several students, whose attendance at the second workshops was compulsory, to have a lack of serious interest in the proceeding and the outcome of the *ex post*. Instead, these same students played "for fun" (this was for instance reported by $P6_{S3}$ and $P2_{S3}$, the latter stating during his interview that "t*he lake was a little bit forgotten"*). A similar collective behavior was reported in Group S5, but instead of playing individualistically, players attempted to "break the game".

The behaviors of groups S1, S3 and S5 during the *ex post* workshops questions the design of CAPPWAG-LAKE. When players did not consider it as a serious simulation of a socio-ecosystem anymore, the measurement of players' capabilities was negatively influenced. This distorted the link between their actions and opportunities for action in the game and in real life. This is problematic for the validity of the measures because if the play is no longer

realistic, the valued capacities of players measured in the game cannot provide a proxy for their real ones.

4.1.4. THE CONSTRAINED SPACE OF THE RPG TO MEASURE CAPABILITIES

Interviewed players considered their behaviors during the game as representative of their real group dynamics and their interactions among each other (not necessarily of a real watershed socio-ecosystem). $P1_{S1}$ for example (echoed by $P2_{S1}$ and $P3_{S1}$) explained: "*I think [that our behavior in a real management situation, compared to our behavior during the CappWag workshops] would be about the same, because I do not think that the temperament of people in a group necessarily changes in a game or in a real job. I think there would necessarily be a big difference in the relationships in the group*".

However, the analysis of the data showed that the collective capability "being able to make a diagnosis of a problematic situation" was less called for during the games than the two others (as already discussed above in section 3.5.2). Indeed, the short time given to players to discuss together and organize themselves, individually and collectively, for the next rounds, was often dedicated to buying, selling or exchanging Activity cards or discussing collective agreements or rules to avoid environmental fines. On the other hand, as we discussed in section 3.5.1, the diversity of the management rules imagined, discussed and implemented by players in the seven groups indicates that the game did offer a space of opportunities to make and implement rules of various types, if players wished so.

Finally, despite our efforts during the design process, the tool remains complex. It requires a certain level of cognition and literacy (i.e. of education) from players, especially to fill in the various monitoring and evaluative apparatuses. In some contexts, it may consequently prevent players from revealing their capabilities. This could for example be the case if players feel discouraged from writing down their ideas on the monitoring file, or if they do not dare acting in the game by fear of not mastering the game rules properly (the rules are orally explained once by the facilitator and written down on posters and on the monitoring file, an advantage for players who can read and do not need to ask the facilitators for details) or even taking part in the evaluation process altogether. In the first case, this negatively impacts the internal validity of the tool. Indeed, even if the chosen three capabilities that are evaluated with the CappWag tool relate to the capability of managing complex socio-ecosystems, obstacles to engage in the game and group discussions as important as cognition and literacy issues are not desirable if they prevent players from reporting their intentions and actions.

It also raises an ethical question about the purpose of the evaluation tool itself. Indeed, it should serve as a support for practitioners and participants who want to know the state of their capabilities and possibly improve them. People who encounter cognition or literacy issues may be part (but not necessarily, depending on the context) of the persons who could benefit the most from the improvement of their individual capabilities, as well as the collective capability of their group.

4.2. THE EXTERNAL VALIDITY OF THE TOOL

4.2.1. THE FACILITATION AND THE OBSERVATION OF THE GAME

Because a CappWag evaluation workshop is a controlled experiment with a very specific set of rules and a sequence of action that players must respect; it requires at least one person to facilitate it.

In the two case studies, despite the time given to the facilitators to master the game rules before the beginning of the workshops, the complexity of the rules as well as the many questions asked by players led some of them to adapt to the group they were working with and alter the rules. This adaptation took several forms:

(1) *Oversight of the game rules*: because the time given to implement the workshop was limited or because the facilitator was over-solicited, they forgot to ensure the implementation of some rules. For example, the facilitator in Group S5 forgot to write down his observations during the *ex ante* experiment.

(2) *Modification of game rules:* the facilitators may have faced a difficult situation during the game that required some improvisation, so that players would not lose their motivation or their interest in the game. For example, during the *ex post* workshop of Group S2, players continuously faced high levels of pollution that they did not manage to contain, despite their collective efforts to do so. The facilitator consequently stepped in and declared himself "*representative of the government*", in order to modify the fine rules in favor of the players and maintain their motivation in the game.

(3) *Changes in the perception of the game by the players*: in order to facilitate the comprehension of the rules by players, the facilitators may have contextualized them. In the example discussed above in Group 2, the "*government*" introduced into the game became part of the representations that players made of the socio-ecosystem. Players might have tried to appeal to this new actor during the rest of the game and to cease to fear environmental fines. This questions how much, in such a context, players relied on this knowledge during the rest of the game and acted accordingly.

The modification of the experiment settings and rules negatively impacts the comparison between the *ex ante* and the *ex post* behavior and actions of a same group. It also prevents the evaluator from comparing the capabilities of several groups taking part in the same CappWag workshop. However, the implementation of the CappWag workshop showed that despite its high level of control, facilitators needed to possess adaptation capacities, in order to face calibration issues or difficulties that could prevent the game from taking place (e.g. players who do not understand the rules, when the justification of the rules' existence is required by players, etc.).

In the case of the Master's 1 case study, several facilitators were also professors intervening during the IWRM course or during other Master's courses. The hierarchical relationship usually qualifying professor-students relationships might have impacted the behavior of players. They could indeed have believed that they must act according to the professor's expectations (i.e. in a collective way), even though they would act differently if they were left alone or assisted by an unfamiliar facilitator. For example, one observer of Group S2 during the *ex post* game observed a "*willingness to do well*" from the players, which may be related to the fact that their facilitator was the professor in charge of the IWRM course. Such a reaction in relation to the nature of the observers has been qualified by some as the "observer effect", or "Hawthorne effect" (Adair 1984; Wickström and Bendix 2000). One player ($P2_{S2}$) denied the influence of the facilitator's identity during his interview, but the amount of rules discussed, made and implemented by this group during the *ex ante* and the *ex post* workshops (see Annex IX) cause us to question this statement.

Another bias is related to the presence of one or more external observers during a CappWag game. Players may already know these people and act according to the nature of their relationship (e.g. when their friends are observing them, players might be tempted to act less seriously or more boldly than normal). Moreover, the fact that no external observers were present during the *ex ante* workshop might also have changed the way players acted when observed during the *ex post* workshop.

4.2.2. TRANSLATING THE CAPPWAG WORKSHOP IN SEVERAL LANGUAGES

The two case studies showed that because the whole workshop had been designed for French-speaking participants, players for whom spoken French was a second language were sometimes lost or felt limited in their actions.

In Tunisia, the mother tongue of players was Arabic but most of the players spoke French fluently. In Group T2, the use of the French language among players appeared to cause more difficulty than in Group T1 and their conversations in Arabic during the discussion phases were therefore recorded and later translated. In order to ensure the quality of the recording, players were asked not to speak at the same time as other players during the discussions phases, which may have artificialized the discussions (e.g. the evaluator cannot know if the effort by players to talk one after another and sometimes in a precise order is related to this demand or to an equitable way of speaking between all players). In a similar manner, answers given by players in the monitoring file or the questionnaire may have been misunderstood and hence be either inaccurate or non-existent.

In the same way, a good command of the French language is necessary to understand the rules of the game because that is a prerequisite to measuring capabilities. At least one foreign student ($P2_{S1}$) did not understand them right away ("*the first time, I did not manage to understand well [the rules] […]. Then I gradually understood the goal and what we would do [with the other players]*"). It is consequently an external factor explaining his behavior during the first part of the *ex ante* workshop. However, once the rules of the game are understood by everyone, the language issue no longer prevents the measurement of capabilities.

Whether players will help a foreigner who does not understand their discussions is constitutive of the collective dynamic within the group. We consider that the inclusiveness of a group is a realistic feature of the way a group works and is directly related to their collective agency (i.e. to their capacity to define together common representations and goals, including in the process all the members of the group) (Pelenc, Bazile, and Ceruti 2015).

4.3. THE INCLUSION OF THE CAPPWAG EXPERIMENT IN PARTICIPATORY PROCESSES

We discuss in the next pages what the process of searching for case studies taught us about the transferability of the CappWag experiment. We complement this discussion with issues related to the shape of the evaluation tool itself (a two-hour-and-a-half double-workshop based on a game), which may limit its adaptability to various types of stakeholder.

4.3.1. THE IMPORTANCE OF WINNING THE INTEREST AND ENGAGEMENT OF PRACTICIONERS AND PARTCIPANTS TO ENSURE THE IMPLEMENTATION OF THE TOOL

The interest of practitioners in the evaluation tool and their willingness to include it in the participatory process they manage is the first step to ensure the effective implementation of the CappWag workshops.

Discussions and interviews with players, stakeholders who witnessed a presentation of the experiment and practitioners shed light on their perception of the CappWag workshops, considered as a relevant evaluation tool (albeit too abstract). For example, one participant ($P5_{T1}$) in the Tunisian case study explained during his interview that he would like to use it with local Tunisian farmers ("*If I can adapt this tool, […] it is a way to evaluate very clearly how people can collectively manage a real resource*"). Other practitioners and stakeholders mentioned changes that should be made to the CappWag experiment in order to ensure its practical implementation in the field.

However, in several case studies considered to be part of this research, the time and political or administrative support required for the implementation of the CappWag evaluation tool was not available. Indeed, operational actors who manage participatory processes face constraints, such as:

(1) *Ensuring the long-term participation of stakeholders:* it is often a challenge for practitioners to mobilize the stakeholders in their territory and ensure their presence in several workshops. Adding two evaluation workshops to a program requires even more energy and may scatter the participants who would then not come to other workshops or meetings. An interview of a participant in the SPARE project highlighted this practical issue. He attended a presentation workshop of the CappWag experiment and subsequently decided not to support its implementation within the project: "[it] *is going to mobilize the resources of [the project] members […]. I already see the time,*

the energy and the money invested so far, from our own personal resources […]. If it is only a punctual element [in the project] […], it cannot lead to anything very interesting".

(2) *Adding the experiment to an already packed program of participation*: the human and logistic resources required to implement the two workshops were deemed insufficient to ensure its organization and the attendance of a sufficient amount of participants in one potential case study.

(3) *The redundancy of RPGs within the participatory process*: the participatory processes and the participation training considered as case studies during this research were all based on the CoOPLAage methodology (see Chapter 2 section 3.2). This methodology already includes modeling exercises based on RPGs that share a number of similarities with CAPPWAG-RIVER and CAPPWAG-LAKE. Several practitioners met during this research feared that this combination might prove too repetitive for players. Stakeholders from the SPARE project as well as Master's students interviewed shared the same feeling.

(4) *Communicating beforehand on the evaluation tool to practitioners and participants:* the simplified yet faithful explanation of the evaluative objectives of CappWag and its interests for practitioners and participants emerged during this research as an essential variable to ensure their engagement. After the presentation workshop of CappWag held within the SPARE project, one citizen explained that he did not understand the purpose of the game nor its interest in the participants. This need for a comprehensive and accessible explanation of the use of the CappWag workshops was salient in the feedbacks from three SPARE participants. They perceived CappWag as a tool meant solely to evaluate people's capacities, whereas they themselves were more interested in a contextualized and educational evaluation tool, with concrete results on people's vision of their water resources.

(5) *Communicating during the evaluation process to practitioners and participants:* during an *ex ante* workshop, the facilitator explains to the players that information on the results of the evaluation will be discussed during the *ex post* workshop, thanks to the collective debriefing. This ensures that players' *ex post* behaviors during the game and answers to the questionnaire are not adapted to the *ex ante* results: they might otherwise seek to improve their conduct and "do better", based on what they know is looked on favorably by the evaluators. The drawback of this choice is that it may negatively impact the motivation of players to return for a second session of evaluation. They may also feel like (a) mere "guinea pig" (as explained by a stakeholder from the SPARE project) if they are not satisfied with the amount of

explanation concerning their evaluation, compared with the time they invested in the workshop.

These reasons explain why the participatory processes initially considered as case studies for this research were eventually abandoned. The difficulties met with during the pre-implementation phase of CappWag question the universality of our evaluation tool.

Our experience during this research suggests that implementing CappWag with "*captive participants*" (Etikan, Musa, and Alkassim 2016, 2) such as professionals or students is doable, while implementing it with non-captive participants (such as stakeholders who attend meetings during their free time and whose only motivation is personal interest in the workshop) is much more difficult. It is easier to gather captive participants twice because they have strong external incentives and time set aside to take part in the workshops.

In the case of the Tunisian case study, all of the participants were professionals working in the field of water and land management. Their presence at the workshop was part of their job. The CappWag workshop was the occasion to discover what a RPG for environmental management looks like. Many participants had in mind that it could be adapted and implemented on the field with farmers in an educational and participatory perspective. In the case of the Master's student case study, students received a grade for their work during the IWRM course. Even though the CappWag workshops were not graded, it is possible that several students still understood it as a way to demonstrate their knowledge or interest in the course. These two contexts of implementation might have pressured players to play "well" due to hierarchical or academic pressure (this phenomenon has been called by several scholar the "Pygmalion effect", or "Rosenthal effect" (Mitchell and Daniels 2003))[23].

In contrast, the presence of non-captive participants relies on their personal motivation and their available time, and may conflict with other aspects of their life. Implemented with non-captive participants, the shape of the evaluation tool could discourage some of them to participate. Moreover, the inclusion as observers of additional students who joined the IWRM course after the *ex ante* workshop would be replicable in a participatory process with more difficulties, since local stakeholders may prefer do something else than observing the game if they cannot take part in it.

4.3.2. THE DIFFICULTY OF USING A GAME AS AN EVALUATION TOOL IN A PARTICIPATORY CONTEXT

Several players and stakeholders welcomed the use of a RPG to evaluate people's capabilities. They expressed their interest in the evaluation methodology as a way to observe the evolution and the content of the collective discussions during the game ($P1_{T2}$), but also as a tool to gain knowledge of the interdependencies at stake in a socio-ecosystem.

[23] However, the *ex post* workshops with the students was implemented during the very last day of the IWRM course, right before the final course examination. This may, in inverse proportion to the "Pygmalion effect", have taken the mind of students out of the workshop ($P2_{S1}$ and $P2_{S3}$ evoked it during their interview).

However, during the pre-implementation phase we also observed the intrinsic reluctance of several stakeholders to engage in a serious game, which was associated with traditional board games (a SPARE stakeholder explained that "b*oard games and games in general [were not his] thing*") and hence not taken seriously. The game dislike may disappear once participants start to play, as the same SPARE participant later explained during his interview ("*After we played the game, [we] said '*it is actually quite fun'"). But if the game is not taken seriously, as discussed in section 4.1.3 above, the validity of the data collected is likely to be negatively impacted.

The reluctance of several people to take part to the CappWag workshops questions the shape and the goal of the evaluation tool. As we have already discussed, the collective evaluation part of the CappWag evaluation was the most theoretically and technically challenging. But in terms of interest for stakeholders and players, it may also be the most accepted one. Indeed, stakeholders may not want to engage in an activity where they will be individually evaluated and where the results will be shared with the rest of the group.

Moreover, the implementation of a CappWag evaluation tool within a participatory process with non-captive participants (particularly with stakeholders who have a strong interest in WRM and are willing to give several hours of their time to attend an evaluation workshop), implies that the protocol carefully designed to ensure the controlled collection of data on people's capabilities may not always be respected by the facilitator. Indeed, participants may expect to attend a workshop where they will discuss together the state of their socio-ecosystem and its management, just like they would during non-evaluative participatory workshops. For example, during the game, information about the game rules and possibilities of action is delivered in a specific order by the facilitator, at given moments of the game. Facing many questions from players at other moments of the game, and envisioning a potential disinterest from them if their questions are not answered, the facilitator may have to improvise and give more information than allowed by the protocol. We said in Chapter 3 section 3.7 that the facilitator should ideally be skilled when facilitating a CappWag workshop: ensuring the balance between the strict respect of the protocol and the players' expectations from the workshop is one of these required skills.

Stakeholders voiced their interest for a workshop that would be both evaluative and part of the participatory process' activities. A way to answer their demand would be to ensure they can quickly receive the results of their evaluation (i.e. by the end of the evaluation workshop and not several weeks or months later through a report or a dedicated feedback workshop). This would require additional work to improve of the analysis process, but also improve the acceptancy of the evaluation tool by participants and practitioners and create a "*synergy*" (Daré and Barreteau 2003, 13) between the game and its context of implementation. Indeed, as Webler et al. (2001) put it, *"more than anything else, a participatory decision-making process is a learning experience. Both participants and process organizers need to take time to reflect upon the experience and to feed these insights back into the design, so that the process can be improved".* By doing so, researchers would also contribute to the field of research on the evaluation (particularly self-evaluation) of participatory processes (Hassenforder et al. 2016).

That is why, in order to ease the integration of the CappWag evaluation workshops in a participatory process, they should provide participants with the opportunity to debate the

real water issues at stake on their territory. This moment could be announced at the beginning of the workshops and take place during the collective debriefing. This may require additional time, but it would also increase for participants their interest in taking part to the evaluation workshops. In this way, the “recruitment issues” that we faced to implement the tool on real participatory processes may be countered.

Finally, we add that the use of a game as an evaluative tool may be difficult within participatory processes where other games are used, this time as participatory tools (e.g. for participatory modeling). Game fatigue may be even more likely to appear during the *ex post* workshop, if two games already have been played in the previous weeks or months.

4.3.3. DISCREPENCIES BETWEEN THE VALUES ADVOCATED BY THE EVALUATED PARTICIPATORY PROCESS AND THE GOAL OF THE CAPPWAG GAMES

Finally, several players reported during collective debriefings or interviews a discrepancy between the values and the types of management advocated by IWRM and those that they perceived were conveyed by CAPPWAG games. Participatory processes for water management, at their highest level, just like participation trainings, are normative and promote a concerted management, respectful of the environment and the needs of different users. They aim at "better managing together" the water resource.

The CAPPWAG games, on the contrary, do not promote a concerted management type and instead leave the choice up to the players to act collectively and to evoke their capabilities in the game, or not.

Moreover, the goal of the game focuses on individual wealth accumulation. Several players (as well as SPARE stakeholders) brought up this feature during the collective debriefings and the individual interviews. They would rather have engaged in a game promoting collective and participatory management. Other players found it realistic and that, on the contrary, its realism would increase if it was even more focused on individual interests. These criticisms overlap with those already discussed in section 3.2.2. (about the importance of collective debriefings to gather and discuss the thoughts of players on the experiment) and 4.1.2 (about the similarity of the CAPPWAG RPGs with participatory tools usually used for raising awareness on the management of water resources).

Once again, these differences in the interpretation that players made of the game should be further discussed during the collective debriefing. This would ensure that participants do not feel at odds with the content of the evaluation tool and maintain their interest in attending a second *ex post* workshop. It would also provide material to serve the real discussions that take place in the framework of the participatory process.

4.4. GUIDELINES FOR FUTURE RESEARCHERS AND PRACTICIONERS

In order to facilitate the implementation of the CappWag evaluation tool on future case study, we suggest a series of improvement to strengthen its internal and external validity:

(1) *The inclusion of the CappWag evaluation tool in the programs of targeted participatory process from the beginning*: this would favor the inclusion of CappWag in the calendar of participation and leave sufficient time to discuss its usefulness and implementation conditions with practitioners and participants. A way to better integrate the evaluation tool in the process would be to highlight the benefits of the collective debriefings for participants and practitioners, in the context of the participatory process or training. The duration of the collective debriefing could also be increased, in order to have sufficient time to tackle game-related and real life-related management issues.

(2) *The improvement of communication about the advantages of using the CappWag experiment as an evaluation tool in the participatory process*: the use that practitioners can make of the evaluation results should be highlighted more clearly in future. The evaluator should make more explicit the benefits of the evaluation tool for practitioners and participants (i.e. the improved understanding of participants' capacities and values, the monitoring of impacts on the participatory process on these capacities and values over time). The evaluative nature of the workshops should remain transparent. As suggested by a SPARE stakeholder, using a specific vocabulary (such as "simulation" or "model" instead of "game") could capture the attention of people who would otherwise not be interested in knowing more about it. Moreover, improved communication on the benefits of evaluation for participants could also help ensure that those who attend the *ex ante* workshop are also present for the *ex post* workshop (if they understand the importance of *ex ante ex post* evaluation, they may be more prone to engage in both workshops instead of only one).

(3) *The simplification of the rules of the game:* with fewer game rules to grasp, the experiment may be easier to manage for the facilitators. This would help them follow the game instructions strictly and strengthen both the internal validity of the experiment (players' behaviors during the game would not be related to the facilitator's influence) and its external validity (the comparison of various groups of players undertaking the very same experiment would be more reliable).

5. THE CAPABILITY APPROACH AS A FRAMEWORK FOR THE EVALUATION OF PARTICIPATORY PROCESSES: ASSETS AND LIMITATIONS

5.1. THE UNIVERSALITY OF THE CAPPWAG EVALUATION TOOL: TAKING INTO ACCOUNT THE SPECIFICITIES OF THE IMPLEMENTATION CONTEXTS

We designed the CappWag experiment as a generic evaluation tool based on an *ex ante ex post* protocol that could be implemented with various types of participatory processes, as long as they were transformative enough to foster people's capabilities.

As discussed in Chapter 1 (section 3.1), people's capabilities are rooted in a specific context. Thus, an individual capability or a collective capability that exists in a given socio-political context may not exist when this context is modified.

Evaluators should consequently be attentive to (i) the participatory context in which the CappWag workshops take place (i.e. the evaluated participatory process itself) and (ii) the broader external context in which the evaluated participatory process takes place. Concerning the study of the participatory context in the analysis of the capability space of participants, the CappWag tool indirectly collects data through players' written statements in their questionnaire during the time of the experiment and during individual interviews, as well as through facilitators' reports. However, facilitators are not required to follow the progress of the evaluated participatory process or training in order to be involved in the facilitation of an *ex ante* or/and an *ex post* experiment. This makes the depth of the data collection process related to these subjects reliant on the behavior of the facilitator. For example, two facilitators out of five who managed *ex post* CappWag experiments with students were not present at the *ex ante* workshop nor did they closely follow the three-month IWRM course. Concerning the study of the broader context in which the evaluated participatory process or training takes place**,** the CappWag evaluation tool again indirectly gathers data through players' statements and facilitators' notes. Once again, there is no obligation for facilitators to be aware of the global socio-political context in which the CappWag experiment takes place in order for them to manage the workshops.

The lack of inclusion of information on this global socio-political context in the analysis of the capability spaces of participants negatively affects its thorough understanding. Hence, it also negatively affects the quality of the evaluation results provided to participants and practitioners, should they wish to use it in order to strengthen these same capabilities.

It is also problematic because it may prevent evaluators from fully understanding certain behaviors and actions of players during the CappWag workshops. Indeed, the CAPPWAG RPGs were voluntarily designed to adapt to different water management contexts and cases. The shape of the RPGs and the type of decision-making process reproducible during the game (i.e. a participatory arena with no simulated social hierarchy between players and where everyone may have a thing to say about the management of the eco-system) does not leave space for others, such as traditional resources management (e.g. when a traditional leader is in charge of taking the main decisions concerning the management of the resource). For instance, $P6_{T2}$ explained during his interview that decisions related to the management of land and water resources were often discussed and decided upon at the family level in Tunisia, which is not depicted in CAPPWAG-RIVER nor in CAPPWAG-LAKE ("i*n Tunisia, there are traditions in families, related to decision-making [for water and land management]. In this case, families have the floor*"). Another Tunisian player, $P7_{T1}$, explained that in Tunisia, real-life decision-

making processes on the local scale concerning the management of water resources seldom brought all of the stakeholders together, contrary to what is simulated in the CAPPWAG RPGs ("*on the field, you cannot gather all the partners together when you organize a meeting. You only get 70% or 50% of them […]. The game is not realistic in the sense that it allows all partners to discuss with each other at the same time*"). These statements show that it is necessary for the evaluator to understand the similarities and discrepancies between the game and real-life management contexts, since these may have a direct impact on the existence or the absence of capabilities evaluated during the CappWag workshops. We add that, in an operational perspective, these discrepancies are also important to understand. Indeed, the experiment reveals contextual features of water management that are central in the eyes of players and that could be a subject of debate in a real-life context. In Tunisia, for instance, $P6_{T2}$'s feedback may be highly valuable for practitioners and allow them to understand better contexts of collective actions that would otherwise not be directly discussed by participants.

It is also essential to understand the external context of the evaluated participatory process or training in order to fully comprehend players' behaviors during the experiment. In Tunisia, for instance, gender and position in the administrative hierarchy are variables that could have impacted the behaviors of players towards each other during the CappWag workshop (even though it was not the case in our case study). In general, it should not be seen as separate from the analysis but rather as a part of it.

Furthermore, the specificities of a participatory context or training cannot be ignored when it may be contentious. We discussed in section 4.1.2.2 why the evaluation tool should by no means create or reinforce conflicts between players that would percolate into their real-life interactions in and outside of the evaluated participatory process or training. The implementation of the CappWag experiment in a participatory context, which is already contentious, should be carefully thought through by the organizers of the process and the evaluators. On the one hand, instead of ignoring already existing conflicts, the experiment could be a moment that is "disconnected" from reality and allows to make the underlying tensions in the group explicit. In this way, it could provide a discussion platform, help the group to solve these conflicts, and even strengthen their capabilities. On the other hand, such an experiment may not be appropriate for every type of contentious context because, by putting players directly in interaction with each other to discuss realistic management issues, it may also provoke or foster tensions and lead to decreased capabilities.

The limits of the data collection with regard to the importance of the participatory and socio-political context in which the evaluation experiment takes place show that the evaluative framework should take more into account information on them, on the relationships of power and the local specificities that may impact the group's structure, dynamics and eventually their decisions concerning water management.

5.2. A SUBJECTIVE EVALUATION: THE RELIABILITY OF THE COLLECTED DATA IN QUESTION

Because data collected during the course of the game (through the monitoring files and external observations) is not sufficient to capture counterfactuals, additional tools relying on players' assessment of their behavior and of that of their group were used. The multiple data sources allowed their triangulation and the strengthening of the analyses concerning the capability space of participants. They often proved to be coherent, but on a number of occasions they gave opposite or contradictory indications. This makes us questions the reliability of the data sources (e.g. over-assessment or under-assessment of players' capacities or false assessments)

5.2.1. THE RELIABILITY OF SELF-REPORTING BY PLAYERS

The self-evaluation of players' capacities, values and influencing resources and conversion factors depends on their own perception and interpretation. As discussed in Chapter 2, we designed an experiment based on a RPG in order to crosscheck the data obtained through self-reporting.

Some players may forget to report, or judge uninteresting what the evaluator considers as information important for tracking their capabilities or, on the contrary, report facts they interpret differently from the rest of their group. This concerns for instance the implementation of a rule, as in the *ex post* game of Group S2; or votes that took place during a discussion phase. This last case happened during the *ex ante* or *ex post* CappWag workshop of five groups (Groups T1, S1, S2, S3, S4). These uncertainties cast doubt on the actual existence of a voting process in these groups.

Players may also interpret their behavior in the game differently from external observers and give biased and even confusing information. For example, during their *ex ante* collective debriefing, several players from Group S2 discussed their inclusiveness and considered that everyone had talked during the game, even though external observations report that one player ($P7_{S2}$) actually never did so. In the same way, one player ($P2_{S4}$) evoked his strong interest in collective action in the game during his interview ("*When I work in a group, I prefer thinking together right from the start, rather than individually. That is what directly happened in our group*" during the *ex post* game), even though external observations described his behavior as coercive towards other players.

Finally, the sincerity of players' answers can also be questioned. It cannot be excluded that players answered their files so as to "please" the evaluator (see section 4.2.1. on the influence of facilitation on players' behaviors).

Complementing players' self-reporting with external observations allowed for cross-checking the data and ensuring its coherence on several occasions. The usefulness of mixing evaluation methods with a RPG. However, untangling the actual course of actions and decisions from contradictory data has proven time-consuming, which is a clear drawback for the practicality of the evaluation tool, despite the hierarchization of the data depending on their sources. Additional observations of participants' behavior during the real participatory process or training may help solve apparent contradictions between external observations during the

experiment and self-assessments by players. It could indeed provide information on players' potential motives for behaving in a certain way in the game and reporting different behaviors in the self-assessment apparatuses.

On a different note, we argue that it is likely that the CappWag evaluation tool impacted on the measure, but that this is inherent to its very nature. Players may understand while answering their monitoring files or their questionnaire what the researchers are specifically evaluating (i.e. capabilities, resources and conversion factors). They may answer or act according to what they believe is expected from them (the potential impacts of the facilitation and the observation of players when they participate in a CappWag workshop is similar – see section 4.2.1. for further discussion). Even if we did not identify in our twelve CappWag workshop such a behavior related to the content of the monitoring file and the questionnaire, it cannot be assumed that it did not exist or that it would not exist in different groups of players.

5.2.2. THE RELIABILITY OF EXTERNAL OBSERVATIONS

The external observations are provided by the facilitator(s) and the observer(s). The data they provide is the most reliable in terms of tracking of functionings. Yet, we question their reliability for two reasons:

(1) The interpretation of the facts reported by the facilitator or the observer can differ. They may describe a group as more or less cooperative or individualistic, a player as more or less talkative, etc. They may also miss decisive specificities in players' behavior needed for the analysis of their capabilities. We observed this during the students' *ex post* workshops: no observers in Group S1 noted the isolation of the three foreign students, which is information important to understanding the group structure and dynamics as well as the capabilities of players. Finally, the observation provided by observers who know the people they observe can be biased. Depending on their relationship (friendship or antagonism for example), some behaviors may be suppressed or exaggerated.

(2) A facilitator implementing a CappWag workshop by himself may have difficulties in reporting all of the information needed for the evaluation, while animating the game at the same time. For example, several players of Group S4 reported the implementation of a NMR during the *ex ante* workshop. The facilitator did not mention this rule in his monitoring file because he did not hear players discussing it. This raises the question of the possibility of an unassisted facilitator providing complete observations on all the noteworthy actions of the players during a game. In order to do this, at least one observer should accompany the facilitator so that the tasks (game facilitation and players' observation) can be split.

It is very likely that no method exists to improve the reliability of the external observations without compromising the initial ambition of the CappWag evaluation tool. As Scharpf puts it,

"*the reliable reconstruction of subjectivities is an extremely difficult and work-intensive task in empirical research*" (Vowe 1993; in Scharpf 1997, 60). The observation process could be reinforced in order to increase the reliability of the data collected (e.g. through audio and video recording of the game sessions; discussions of the recordings with external researchers and practitioners in order to cross-check the interpretation of players' behavior; systematic presence of at least one person to assist the main facilitator). However, this would considerably increase the time required to process and analyze the data and hence its practicability for researchers and practitioners. Observations of the real participation process or training could also be used to triangulate the data, even though they would also require additional time to be analyzed.

5.3. MEASURING VALUED FREEDOMS WITH AN EXPERIMENT: THE CASE OF COLLECTIVE CAPABILITIES

5.3.1. THE SCALE OF EVALUATION

To ensure the controllability of the experiment, the size of the group taking part in CappWag workshops was limited to ten people. It is very likely that the number of participants in a participatory process or training may be greater than the "evaluation capacity" of the tool, as illustrated on Figure 70.

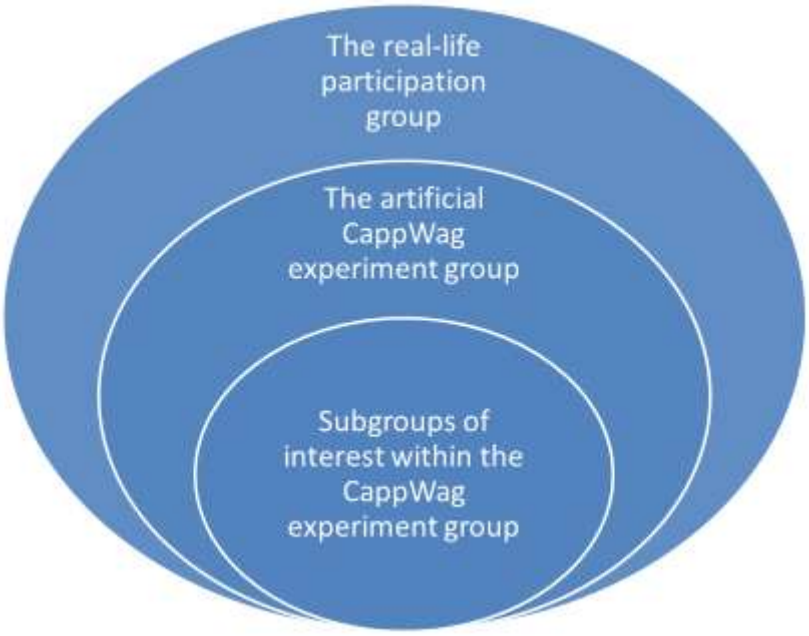

Figure 70: The overlapping of formal, artificial and interest groups around a CappWag experiment.

This means that the evaluation made with the players of the experimental group cannot be extrapolated to the rest of the greater participation group. Whether it concerns individual or collective capabilities, the presence or absence of one single person in the group can dramatically change the context, the resources and the conversion factors available to an individual and to the group itself. In this situation, the CappWag tool furnishes a reading to the practitioners that is only valid in the context of the experiment, and incomplete to understand the capabilities of the whole participation group. Nevertheless, even if the capabilities of one group of players cannot be extrapolated to the greater group of participants, they still furnish an indication about players' interests and values. They may also give matter for discussion to practitioners, researchers and stakeholders, potentially guiding them towards capability-building in some areas highlighted by the evaluation or by players themselves.

Moreover, in accordance with the capability literature, we set as a precondition to the existence of a collective capability at the CappWag group level that each of its member should value it or be neutral to it (Pelenc, Bazile, and Ceruti 2015). Based on this precondition, we highlighted the existence of collective capabilities on the scale of subgroups of players within the CappWag experiment group. However, it is unclear whether sharing a collective interest in and sense of the importance of a freedom is enough to create a sense of collective agency among people and hence the creation of a group owning a collective capability. Similarly, even though the qualification "subgroup" was used to describe coalition of players that took decisions and acted together in the course of the game, they did not always share a similar value for the freedoms related to these actions.

5.3.2. THE SPECIFICATIONS MADE DURING THE PROCESS OF DESIGNING THE MEASUREMENT TOOL

Before and during the design phase of the CappWag experiment, a series of specifications were made regarding the choice of the evaluated capabilities (see Chapter 1 section 5):

(1) *The focus on the capability space of participants, instead of their agency:* this thesis mainly focused on the capability space of participants, that is to say on their opportunity freedoms, instead of their process freedoms (Pelenc, Bazile, and Ceruti 2015). While capabilities address the opportunities of being and doing of participants, agency focuses instead on the process to reach these opportunities. The concept of agency, both individual and collective, may be interesting to integrate further in the experiment because it could allow to highlight in a more detailed way the reasons behind players' choices and the constitution of a collective agency among a group. It may be interesting for practitioners and participants to have more information on their agency as an individual and as a group and on the process of emergence of this agency, regardless of the opportunities that they could obtain thanks to it.

(2) *Favoring the "expert" choice of the capabilities to focus on (made by researchers and based on the literature), instead of a participatory choice made by participants themselves:* The latter option may have led to higher values and interests given by

players to the chosen capacities related to water management, since they deemed them the most valuable for their group. However, in light of the theoretical, technical and practical issues met during the design and the implementation of the CappWag tool, we maintain that pre-identifying capabilities related to collective water management and widely considered as major by researchers and practitioners was the most efficient way to realize the evaluation.

(3) *The choice of the final three evaluated capabilities to evaluate*: the three capabilities evaluated with the CappWag experiment were chosen out of a larger list of capabilities related to collective and participatory management of natural resources (see Annex I). The experiment was consequently specifically designed to measure them. However, we argue that it could rather easily be modified to evaluate other capabilities from the above-mentioned list. The game would require minor modifications because it simulates a decision-making arena where many capacities, valued or not, may be used to manage the socio-ecosystem. The complementary evaluation apparatuses (monitoring file, questionnaire, focus group, observations) would have to be adapted to the new evaluated capabilities as well, but as discussed in section 3.2.1, several of them could also be largely simplified (especially the questionnaire).

(4) *The level of precision of the three evaluated capabilities*: we explained in Chapter 1 section 5.3.1 why we chose three "broad" capabilities to evaluate. We did not ask players during the workshops or during individual interviews what they thought of the evaluation of these three capabilities, instead of more detailed ones. However, the feedback received during the workshops tend to bolster our initial choice. Players were indeed interested in broad capabilities related to collective management and saw rather easily their interest in the field.

5.3.3. THE CAPABILITY APPROACH AS AN EVALUATION FRAMEWORK FOR WATER RESOURCES MANAGEMENT PROCESSES: WHAT IS LEFT TO EXPLORE

The innovative use of the capability approach as an evaluative framework for WRM has shown the benefits to focus on both capacities of being and doing as well as the value given to them, for researchers, practitioners and participants.

The focus on participants' capacities allow to directly tackle issues of capacity-building and empowerment (Duraiappah, Pumulo, and Parry 2005; Makkaoui and Dubois 2010). The focus on participants' values allow to raise the question of which capacity to focus on, depending on what they consider important for the collective management of their environment. Here lies the heart of empowerment (Sen 2000a; 1992; Frediani 2010).

Moreover, we note that the capability approach is complementary to social learning (Pahl-Wostl et al. 2007; Seguin 2016), another framework often used in the field of NRM to characterize the transformation of people over time. Focusing on social learning would also

have shed light on the transformations undergone by participants during a participatory process. Social learning corresponds to the process of (i) "learning together" (e.g. about the environment and how a watershed works, the governance issues at stake in the management process, the options available to stakeholders and institutions in charge of the management process, the procedure established to implement a participatory process, etc.) and (ii) "learning about the social" (e.g. about each other, about one's position, interest and power in the participative and decision arena, about policies and institutions, about ruling or desirable justice principles, etc.). By taking part in a participatory process, participants may learn to modify their knowledge, their practices, attitudes and behavior, as well as their values and vision of the rules shaping and defining their socio-environment. We do not focus on what kind of learning has taken place, to what extent, between whom, when, and how (Armitage, Marschke, and Plummer 2008). This may eventually impact their capacity to manage water resources together (Douthwaite, Alvarez et al. 2007, Pahl Wostl et al 2007). Despite their relevance in evaluating the state and the evolution of participants' knowledge and skills, the capability approach was at the center of this thesis because of its focus on knowledge, expertise or social skills, but also on participants' value for them and hence, for the interest they have in owning them and being free to transform them into achieved functionings. By understanding the reasons behind these choices or behind the lack of choices of participants, one should be equipped to improve their access to resources and conversion factors, in order to help them attain the capabilities they value.

However, the social learning framework may be less sensitive to the presence or absence of one person in a group of participants because it is not concerned by the "positive value" issue that we discussed previously in Chapter 1. The importance of the value given to our three freedoms proved particularly difficult to integrate to a social experiment, but also at times to interest players when they were presented with the results of their evaluation. The two approaches could therefore be combined in a dual evaluation in which both capabilities and social learning related to these capabilities could be evaluated.

This leads us to our final comment regarding the capability approach used as an evaluation framework for participatory processes. The fact that the value given to an individual or a collective freedom is always individual questions its use through an experiment in which only a limited number of persons can take part in. Unlike qualitative studies that would focus on long-term agency and capability-building and follow a water management process thoroughly, the CappWag experiment creates artificial groups of players that may not have worked together in real–life. The importance of the individual value given to collective freedoms may at times make it difficult for practitioners and participant to fully appreciate their level of freedom, since it suffice of one person not valuing it to make the whole group "un-capable". This is due to the constitution of the CappWag groups, which are ephemeral (i.e. they may be gathered *ad hoc* for the experiment) and fictitious (players working together in the experiment may not have interactions in real-life, e.g. in the case of large-scale participatory processes). The next step to pursue this research on collective capabilities and participatory management would consequently be to evaluate groups of participants who are also working together in real life.

5.4. GUIDELINES FOR FUTURE RESEARCHERS AND PRACTICIONERS

(1) In order to ensure the reliability and scope of the contextual data captured by the facilitator, at least one observer should accompany him during the evaluation workshops so that the tasks (game facilitation and group observation) can be split.

(2) The collection of data related to the socio-political context in which the evaluation experiment takes place should be encouraged. The data may complement the CappWag experiment and allow to better understand players' capabilities.

(3) The study of social learning among participants, in relation to the participatory process they take part in, could be used as a complementing framework to the capability approach

(4) Other individual and collective capabilities could be evaluated with the CappWag tool (or adapted versions of it), in order to explore further the possibility to use a social experiment to evaluate complex processes such as participatory processes for water management.

GENERAL CONCLUSION

The research work presented in this thesis was exploratory for several reasons. First, the capability approach and the concept of collective capabilities have seldom been applied to evaluate participatory processes for water management. Second, we opted for a social experiment based on a mixed-method evaluation tool to make this evaluation. Third, the CappWag evaluation tool can be used as a one-time evaluation tool, but it also based on an *ex ante ex post* protocol, which allows to closely follow the evolution of participants' capabilities.

The innovative format of the CappWag evaluation tool partly explains the difficulties we faced to implement in its original context of evaluation, that is to say participatory processes for water management. Instead, we implemented it on two case studies: one in Tunisia with local administration officers, and one in France with first-year Master's students. The theoretical background, the design process and the results that we discussed in the last chapter of this thesis lay the foundations for further research to improve and develop CappWag and pursue its evaluative ambitions.

1. KEY CONTRIBUTIONS FROM THE THESIS CHAPTERS

Chapter	Key contributions
Chapter 1: The capability approach: a theoretical framework to evaluate participatory processes	The capability approach covers vast field of research, made of intricate definitions and practical uses. A theoretical overview of the approach has led us to believe that it is a relevant framework in which to look at participatory processes' effects on individuals and groups. It puts an emphasis on autonomy, collective action and empowerment dynamics, which are essential to strengthen a sustainable involvement of the population into WRM. Three individual and collective capabilities related to collective action were carefully chosen to be part of our evaluation tool: *being able as an individual to express oneself in a determined social context; being able to collectively identify and put into words a problematic situation and make a diagnosis of it; and being able to collectively make rules to manage a socio-ecosystem*. An efficient participatory process would focus not only on the quality of the final decision, but also on the strengthening of people's capabilities. Reciprocally, an effective group of participants would possess these three capabilities, which would enable them to participate fruitfully and therefore ensure a better decision-making process.
Chapter 2: A social experiment to evaluate capabilities	The specifications discussed in Chapter 1 made us consider an evaluation tool based on mixed methods (both quantitative and qualitative) and several measurement apparatuses as a relevant option to evaluate individual and collective capabilities in a participatory context. The use of a social experiment based on a role-playing game, a questionnaire and a focus group provides a desirable compromise between controllability and the transferability of the experiment on various case studies. Using mixed methods of evaluation also ensures

	the triangulation of the data. The behaviors and actions of players observed during the course of the game will be either validated or invalidated by the data from the two other devices. Finally, the mirror effect provided by the game should allow researchers to grasp participants' actions related to the three capabilities observed, and hence achieved functionings. We stressed in this chapter the particular attention that should be brought to the link between participant's behaviors and actions in the game and in real life, which is why individual interviews will also be conducted in the frame of this doctoral research.
Chapter 3: The design of the evaluation tool CappWag	The design of our evaluation tool presents a series of challenges that we discuss in this chapter, such the quasi-absence in the literature of games designed for the measurement of valued freedoms, or the very subject of measurement of the game: the freedoms of being and doing that may not be actuated by players during the game, that is to say, counterfactuals. During the design process, internal and external validity were thought through the prism of its practical implementation, and in addition to the collection of valid data on participants' capabilities, it also took into account playfulness and engagement issues. The design process of the experiment subsequently relied on a series of assumptions that we listed in this chapter, among which: the assumption that inhibitions for players to engage in the game would be relatively marginal; or the assumption that the interference of the measurement tool with the behavior of players would be minimally intrusive. We designed an evaluation experiment based on two semi-abstract role-playing games: CAPPWAG-RIVER and CAPPWAG-LAKE. We designed the two workshops as independent evaluation apparatuses that can be used separately one from each other and provide evaluators and participants with a measure of their individual and collective capabilities at a given time, but also capture the evolutions of these freedoms through. The two semi-abstract opportunity-generating games represent an NRM dilemma situation. They are designed so that players are free to exercise their collective agency and discuss together, make a diagnosis of the situation and make and implement management rules, if they so choose. Complemented with additional measurement tools (a questionnaire and a debriefing), they allow for observing participants' achieved functionings in a simulated situation of management, but also of non-achieved ones.
Chapter 4: The implementation of CappWag: results and analyses of two case studies	The CappWag tool was designed to be implemented with various types of stakeholders, from water managers to citizens. Two participatory processes taking place in France were initially targeted as case studies for this doctoral research. However, because of a series of internal constraints independent from this thesis work, they had to be abandoned. Two new case studies were consequently found to replace them: (1) one with local government officers in Tunisia, in the frame of the PR-OSCAR project; and (2) one with first-year Master's students in

	France, in the frame of a three-month course on IWRM. The results from the twelve CappWag workshops presented in this chapter show a rather wide variety of behaviors and actions made by players. For instance, while some players remained silent and did not engage in discussions on the diagnosis of the river or the lake's socio-environment, other were particularly vocal about it. At the collective level, while in several groups of players, collective discussions took place about the diagnosis of the socio-ecosystem and one or more management rules were designed and implemented by the group or by subgroups of players, in some other groups none of these actions took place. Similarly, the capabilities evaluated in the twelve groups varied greatly in terms of existence (or absence) and strength (or weakness). In the Master's students case study, where the full *ex ante ex post* CappWag experiment could be implemented, the evolution of the three capabilities we observed through time is just as diverse. We expected the participation of students in the IWRM course to strengthen their individual and collective capabilities. Instead, results showed that not every players acknowledged changes that occurring during the *ex post* game and related to the course. As a result, the groups of players played either more collectively, less collectively or similarly during the *ex post* game, compared with the *ex ante* game.
Chapter 5: Assessing CappWag, an exploratory tool to evaluate capabilities	In this chapter, we discussed the efficiency of the CappWag evaluation tool to capture capabilities at the level of the individual and the group of participants, as well as the evolution of these capabilities over time. The methodology we used to analyze the data proved to be an interesting compromise between the collection and treatment of the data and the precision of the final results delivered to researchers, but also practitioners and participants. The evaluation of a collective capability was the most difficult part of the analyses, because of the multiple group configuration that can take place during a workshop. However, a series of weaknesses were identified in the design of the experiment, among which the complexity of the initial rules of the game and the heaviness of the monitoring and evaluative forms. We provide guidelines to tackle each one of them and hence, facilitate the future use of the tool. We then discuss the benefits of, and the difficulties in using a social experiment as an evaluation tool for participatory processes. Despite the efforts undertaken to make the evaluation tool as appealing as possible to participants and practitioners, its inclusion within participatory processes could still be improved, in order to ensure its double implementation (*ex ante* and *ex post*). Finally, the capability approach that serves as a conceptual framework in this research does present strong assets to capture the motivations, interests and capacities of participants in terms of WRM and collective action. In order to be even more useful to practitioners and participants, our evaluation tool would benefit from the collection and treatment of additional information concerning people's involvement in the real-life evaluated participatory process or training and to the

	events and social dynamics taking place outside of the evaluation tool.

Table 16: Key contributions to research from each chapter.

2. ADRESSING THE RESEARCH QUESTIONS

In the introduction of this thesis, we presented the main research question at the origin of this doctoral work: *is it possible to use a social experiment based on a role-playing game to evaluate the impact of participatory processes for water management?* We divided this interrogation into two sub-research questions that we will now answer.

(1) Can we measure individual and collective capabilities related to collective action for water management among a group of participants in a participatory process for water management?

The evaluation of the individual or collective capabilities available to a people or a group of people required the operationalization of the approach. The innovative evaluation method explored in this thesis was the combine use of several measurement tool, together forming an *ex ante ex post* experimental evaluation tool. The results of the twelve evaluation workshops implemented in Tunisia and in France showed that they allowed to evaluate capabilities at a given time, through the measurement of functionings, capacities and values. The quality and the amount of data collected during a CappWag workshop allowed their triangulation and strengthened the validity of the result. This allowed the evaluator to identify people whose actual behavior during the game did not correspond to his or her answers in the questionnaire or during the collective debriefing and, hence, called for further discussion and analysis (e.g. through individual interviews). Nevertheless, additional work is still required to ensure the robustness of the data and, hence, of the evaluation.

A main asset of the CappWag evaluation tool is that the graphic representation of players' position within the group, as well as the group itself, in terms of capacity, value and capability, is sizeable by participants themselves. It enables them to share with the evaluator their perceptions of their results and discuss possible points of improvement in terms of resources, conversion factors and capabilities, thus orientating the course of the participatory process they are involved in.

A restitution meeting organized with the Tunisian participants in the PR-OSCAR CappWag evaluation workshop particularly revealed the interest that the results of the CappWag evaluation could spark off[24]. Indeed, after the presentation of the results derived from their evaluation workshops, participants expressed their interest in the graphical representation of their capability, their capacity and their value positions, as individuals among their respective group (T1 or T2), but also in the compared results of the two groups, as well as in the

[24] The restitution meeting was held the 6th of March 2019 and funded by the successor of the PR-OSCAR project, the PACTE program ("programme to adapt vulnerable areas to climate change").

comparison with other groups of players was participated to similar workshops as part of the thesis. Their feedbacks were encouraging concerning the benefits of the evaluation results for the evaluated persons themselves and for the future uses that could be made of the CappWag evaluation tool.

They also highlighted the already identified needs for a refined design of the tool. As we discussed it in our "guidelines for future uses" sections, the thorough data collection requires time and energy from participants, which may be a drawback for its implementation and the accuracy of the data collected. Moreover, Tunisian participants pointed out the difficulty they envisioned to implement the tool with illiterate stakeholder. A series of improvements may allow to overcome this issue, such as the simplification of the game rules and the questionnaire, or the extension of the debriefing that allow people to talk about their behaviors and actions instead of writing about them.

(2) *Can we evaluate over time, following an ex ante ex post protocol, the evolution of the same individual and collective capabilities and their link with the participatory process people take part in?*

The results from the *ex ante ex post* CappWag evaluation that were led with the Master's students is more nuanced than for a single, one-time CappWag evaluation. They showed that it was not entirely possible to separate the influence of the evaluation tool itself during the *ex post* evaluation (i.e. playing once again a game in which a water resource must be managed, which induces game rules learning or a certain fatigue) from the influence of players' involvement in the IWRM participation training.

Moreover, the influence of the immediate external context during the *ex post* evaluation of the Master's students (i.e. a graded oral for all students, right after the evaluation workshop) was also an uncontrolled variable that affected their behaviors and actions during the game, thus "interfering" with changes related to their actual course.

Consequently, the changes in people's capability spaces that were identified through the *ex ante ex post* analysis may be related to uncontrolled variables, which strongly questions their validity.

In order to improve the accuracy of the *ex post* evaluation and, hence, of the *ex ante ex post* comparison, the same guidelines discussed above should be followed. Additionally, ensuring that the workshops not implemented in a stressful external context that may drive the attention of the participants away from their content is important.

3. ADDITION OF THIS DOCTORAL RESEARCH TO KNOWLEDGE

3.1. THE OPERATIONALIZATION OF THE CAPABILITY APPROACH

The main methodological contribution of this thesis lies in the innovative operationalization of the capability approach and in the bridge built between human development and the field of participatory environmental management.

The use of mixed methods to operationalize the approach to evaluate individual and collective capabilities related to participatory environmental management allows the evaluator to triangulate the data and reinforces their validity. The use of a RPG as a simulation of a management and decision-arena goes further and allows the evaluator to compare observation of players' behaviors and actions when confronted to a problematic situation of water management with their own self-assessment, regarding their capabilities and their capability space.

The decomposition of a capability, or opportunity freedom, in three main dimensions and six stances represents a second contribution to the approach. It allows their measurement and their graphical representation, thus not only furnishing information to the evaluator but also to participants themselves.

3.2. THE USE OF A ROLE-PLAYING GAME AS A SUPPORT FOR EVALUATION

This thesis also brings a methodological contribution to the field of game design. In order to make an *ex ante ex post* evaluation of capabilities, that is to say counterfactual valued capacities, two RPGs were designed *ad hoc*. This innovative use of such a mixed-method tool raises a series of questions concerning its internal and external validity. We discussed many of them thoroughly in this thesis. Yet, several questions remain concerning the link between players' behaviors in the game and outside the game and the relation that can be inferred between the two, as well as the transferability of the evaluation tool in various cultural, political or social contexts and with various types of stakeholders.

4. SHORTCOMINGS OF THIS THESIS AND AGENDA FOR FUTURE RESEARCH

We discussed in Chapter 5 a certain number of guidelines that would improve the CappWag evaluation tool in terms of facilitation, data collection or effective implementation. These guidelines, derived from observations during the workshops and feedbacks from participants, requires a minimal amount of time to re-design the evaluation tool. We now discuss shortcomings and evolutions for the tool that would require further research and long-term development.

4.1. TOWARDS MORE AUTONOMOUS IMPLEMENTATION

The initial research proposal at the origin of this thesis included a focus on an autonomous evaluation of participants themselves through the use of the CappWag tool. Two objectives laid behind this focus:

(i) ensuring the "technical autonomy" of the tool: the group of players should be able to use the tool by itself without the presence of a facilitator. This would save time and costs for the practitioners and it may ease the implementation of the tool in the field, since participants would be able to choose their own time and place of implementation, regardless of the facilitator's obligations;

(ii) ensuring the "conceptual autonomy" of the tool: this would allow participants to analyze themselves their results and evaluate themselves without the external intervention of researchers, evaluators or practitioners.

Based on the research work undertaken with this thesis, "technical autonomy" could be improved thanks to the simplification of the overall data collection system within the evaluation tool (e.g. of the game rules, of the questionnaire). The partial computerization of the experiment, that is to say the use of a computer or a tablet to replace parts of the board (such as the water, pollution, money or social capital tokens), the monitoring file or the questionnaire (which would incidentally ensure that all players would answer the questions), represent a possible way to strengthen technical autonomy. However, we already envision two difficulties that should carefully be tackled by future researchers: the first one is the computer-literacy that may be required from participants, thus potentially excluding some people from the evaluation process. The second one relates to the computerization of the game and the subsequent work required to do it. Finally, implementing the tool without the presence of a skilled facilitator may require specific changes in the experiment design, since he is the guarantor of its controllability. "Conceptual autonomy" may reveal itself much more difficult to reach, mainly because of the complexity of the concepts related to the capability approach.

4.2. EXTENDING THE SCOPE OF EVALUATION

4.2.1. IMPLEMENTING THE CAPPWAG EVALUATION TOOL ON A "REAL" PARTICIPATORY PROCESS

The CappWag evaluation workshops were initially designed to evaluate the impacts of participatory processes involving various stakeholders, among them citizens. However and as explained in Chapters 4 and 5, the two case studies presented in this thesis eventually took place in the context of a training to participatory methods for water management. A further step for research would be to implement the CappWag evaluation tool within the participatory processes it was designed to evaluate, with varied groups of participants involving several types of stakeholders.

Moreover, it would also be interesting to compare the evolution over time of stakeholders involved in a participatory process in terms of capabilities, conversion factors and resources to the evolution over time of persons who are not involved in such processes. The results obtained with control groups like these would allow to differentiate better the influence of the participatory process on participants.

4.2.2. EXTENDING THE SCOPE OF EVALUATION: MEASURING OTHER CAPABILITIES

Finally, a further development of the CappWag evaluation tool relates to the three capabilities it measures. While we specifically designed the tool to tackle the individual capability to express oneself in front of a group, the collective capability to make a diagnosis out of a problematic situation and the collective capability to make and implement management rules, others could be evaluated. Other capabilities related to participatory water and more generally to environmental management could be integrated to the CappWag evaluation tool, such as being able to take initiatives within a participatory process, being able to collectively reach an agreement or being able to collectively manage a budget, etc. It is very likely that the CappWag evaluation tool could be adapted to many of these capabilities, thanks to the relatively generic settings of the RPG. The questionnaire and the focus group would also need to be adapted to the new capabilities evaluated.

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ANNEXES

ANNEX I: A LIST OF INDIVIDUAL AND COLLECTIVE CAPABILITIES RELATED TO PARTICIPATORY MANAGEMENT FOR NATURAL RESOURCES.

Scale (individual/collective)	Thematics	Capability	References
Individual	Attendance	Being able to take part and commit to a participatory process	(Duraiappah, Pumulo, and Parry 2005; El-Harizi and Klemick 2007; in Frediani 2015)
Individual	Attendance	Being able to physically participate to a participatory process (to be present)	(Duraiappah, Pumulo, and Parry 2005; in Frediani 2015)
Individual or collective	Autonomy	Being able to take imitative within a participatory process (e.g. integrate the process, take risks, offer solutions,...)	(Max-Neef 1991; Duraiappah, Pumulo, and Parry 2005; El-Harizi and Klemick 2007; in Frediani 2015)
Individual or collective	Autonomy	Being able to act autonomously	(El-Harizi and Klemick 2007)
Individual or collective	Cognition	Being able to communicate about one's ideas (to identify them, express them, defend them)	(Duraiappah, Pumulo, and Parry 2005; in Frediani 2015)
Individual	Cognition	Being able to understand an information, a point of view, one's environment	(Duraiappah, Pumulo, and Parry 2005; Crocker 2008; in Frediani 2015)
Individual	Cognition	Being able to use the information collected in a PP to make rational choices	(Crocker 2008; in Frediani 2015)
Individual	Cognition	Being able to adapt the participation context (being flexible)	(Max-Neef 1991)
Individual or collective	Collective action	Being able to make the diagnosis of a situation	(El-Harizi and Klemick 2007)
Collective	Collective action	Being able to launch a collective action and to put one's ideas in the political arena ("joining or forming a new	(Levy 1996; in Frediani 2015)

		political constituency")	
Collective	Collective action	Being able to designate representatives among formal political structures	(Levy 1996; in Frediani 2015)
Collective	Collective action	Being able to have an impact on legislation/action plans and their implementation	(Levy 1996; in Frediani 2015)
Collective	Collective action	Being able to elaborate an action plan (agree of the decision process, collect information and make a diagnosis of the situation, define the problem to tackle, identify the actors related to this problem, debate over the problem, propose solutions and strategies, evaluate them, choose which solutions and strategies to implement, choose together an action plan and an implementation method, implement it, monitor and evaluate the implementation, adapt and revise the initial plan.	(Levy 1996; in Frediani 2015; Hassenforder 2015; Hassenforder et al. 2016)
Collective	Collective action	Being able to learn and train one selves (independent learning)	(Levy 1996; in Frediani 2015)
Collective	Collective action	Being able to launch or participate to local research program (e.g.: "participatory research techniques"), to gather and create knowledge	(Levy 1996; in Frediani 2015)
Collective	Collective action	Being able to manage a budget	(El-Harizi and Klemick 2007)
Collective	Collective action	Being able to manage a natural resource	(El-Harizi and Klemick 2007)
Collective	Collective action	Being able to reach a collective agreement (consensus, majority vote,…)	(El Harizi 2008)
Collective	Collective action	Being able to lobby, defend and promote a position with external actors	(Max-Neef 1991; Levy 1996; Drèze and Sen 2002; Duraiappah, Pumulo, and Parry 2005; El-Harizi and Klemick 2007; El Harizi 2008; Crocker 2008; in Frediani 2015)

Collective	Collective action	Being able to make and implement management rules and to ensure their respect	(Ostrom 1990; Ostrom, Gardner, and Walker 1994; Crawford and Ostrom 1995)
Individual or collective	Freedom of speech	Being able to express one's opinion, to agree or disagree freely with someone/something	(Max-Neef 1991; Drèze and Sen 2002; in Frediani 2015)
Individual or collective	Mobilization	Being able to mobilize human resources, financial resources, material resources.	(Duraiappah, Pumulo, and Parry 2005; El-Harizi and Klemick 2007; in Frediani 2015)
Individual or collective	Relationships, cooperation, "working with"	Being able to defend one's point of view (to have authority, to convince other people, to be confident, to ally with other people/institutions,...)	(Duraiappah, Pumulo, and Parry 2005; in Frediani 2015)
Collective	Relationships, cooperation, "working with"	Being able to communicate and share experience and feedbacks outside of the participation structure	(Frediani 2015)
Collective	Relationships, cooperation, "working with"	Being able to transfer knowledge from the participation structure to the external actors	(Frediani 2015)
Collective	Relationships, cooperation, "working with"	Being able to build alliances with other actors to act on common subjects	(Frediani 2015)
Collective	Relationships, cooperation, "working with"	Being able to adapt a legal, political, economical, environmental, social context	(El Harizi 2008)
Individual or collective	Relationships, cooperation, "working with"	Being able to team up/cooperate with other persons/organizations to work/share ideas/defend a cause together.	(Max-Neef 1991; Duraiappah, Pumulo, and Parry 2005; El-Harizi and Klemick 2007; in Frediani 2015)
Individual or collective	Relationships, cooperation, "working with"	Being able to discuss and debate with other people/parties (being open to discussion, being able to listen to others, to understand and discuss their arguments, to be respectful)	(Max-Neef 1991; Duraiappah, Pumulo, and Parry 2005; in Frediani 2015)

Individual or collective	Responsability	Being able to be responsible for a given task in a participatory process (e.g. write the minute of a meeting, manage a budget,...)	(Max-Neef 1991; Duraiappah, Pumulo, and Parry 2005; in Frediani 2015)
Individual	Responsability	Being able to represent people who have chosen/or elected us	(Drèze and Sen 2002; Crocker 2008; in Frediani 2015)
Collective	Responsability	Being able to distribute power and responsibilities fairly among the different members of a group	(Drèze and Sen 2002; in Frediani 2015)

ANNEX II.1 : CAPPWAG (RIVIERE ET LAC) - INSTRUCTIONS POUR L'ANIMATEUR

Temps de jeu : 90 minutes

- Préparation de la table de jeu : Avant l'arrivée des joueurs, le facilitateur dépose à la place de chaque personne (i) un post-it avec un numéro (1 ;2 ;3 ; etc. jusqu'au nombre total de joueurs) ; (ii) un sachet opaque à l'intérieur duquel se trouvent 4 WAGs, (iii) un stylo, (iv) une fiche de suivi individuelle à remplir entre chaque tour de jeu, (v) une carte Activité par joueur.

- Les cartes placées autour de la table sont les suivantes (paquet « cartes à placer autour de la table avant le début du jeu ») :

CappWag-rivière

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10
Carte 1	x					x				
Carte 2				x					x	
Carte 3		x					x			
Carte 4					x					x
Carte 5			x					x		

CappWag-lac

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10
Carte 1										
Carte 2		x					x			
Carte 3			x					x		
Carte 4	x					x				
Carte 5										
Carte 6				x					x	
Carte 7										
Carte 8										
Carte 9										
Carte 10					x					x

- Les joueurs se placeront autour de la table de jeu au hasard. S'il y a moins de 10 joueurs, les cartes destinées aux joueurs absents ne sont simplement pas distribuées.

- Au mur sont accrochés des posters format A3 des cartes « INNOVATION » et des règles du jeu. Les posters sont à accrocher en double pour chaque groupe.

Facilitation pendant le jeu

Lors de chaque nouveau tour de jeu, un panneau avec le numéro du tour au verso et le climat au recto est brandi par le facilitateur. Ce dernier indique en même temps le nombre de bille disponibles dans la rivière ou le lac au début du tour.

	CappWag-rivière	CappWag-lac
TOUR 1	Climat HUMIDE	Climat HUMIDE
TOUR 2	Climat NORMAL	Climat NORMAL
TOUR 3	Climat SEC	Climat SEC
TOUR 4	Climat NORMAL	Climat NORMAL
TOUR 5	Climat NORMAL	Climat SEC
TOUR 6	CLIMAT SEC	CLIMAT HUMIDE

Le jeu se complexifie au fur et à mesure que les tours passent :

A partir du TOUR :	**Ajout d'un nouvel élément dans le jeu**
1	• Ø
2	• Achat et vente de cartes possibles
3	• ACHAT POSSIBLE D'INFORMATION sur le système et les joueurs
4, 5, 6	• Ø

Nb de joueurs	Nombre de billes d'eau à l'amont au début du tour	Nombre de billes de pollution dans le stock au début du tour	Début du tour : Nombre de billes d'eau dans le lac	Début du tour : Nombre de billes de pollution dans le système
4	Humide : 10 Normale : 8 Sec : 6	Humide : 3 Normale : 7 Sec : 5	Humide : 11 Normale : 9 Sec : 8	En toute saison, déjà 2 billes dans le sachet.
5	Humide : 11 Normale : 9 Sec : 7	Humide : 3 Normale : 7 Sec : 5	Humide : 12 Normale : 10 Sec : 9	
6	Humide : 12 Normale : 10 Sec : 7	Humide : 7 Normale : 6 Sec : 3	Humide : 13 Normale : 11 Sec : 10	
7	Humide : 12 Normale : 10 Sec : 7	Humide :-0 Normale : 4 Sec : 1	Humide : 14 Normale : 12 Sec : 11	
8	Humide : 13 Normal : 12 Sec : 10	Humide : 0 Normal : 3 Sec : 1	Humide : 16 Normale : 14 Sec : 13	Taux de renouvellement de la ressource : +25%
9	Humide : 14 Normal : 13 Sec : 10	Humide : 0 Normal : 3 Sec : 1	Humide : 18 Normale : 16 Sec : 15	
10	Humide : 15 Normale : 14 Sec : 12	Humide : 0 Normal : 3 Sec : 1	Humide : 19 Normale : 17 Sec : 16	

Infos pratiques

- /!\ Si un joueur n'a pas assez de WAGS pour payer une amende, il est acquitté de la dette.
- Une action ou une décision collective concerne 2 personnes ou plus. Elles sont valorisées par un smiley à chacune des personnes y ayant pris part.
- Décompte final : les cartes « 0 »valent 0 points ;

Séquence de jeu

1. Mettre le nombre correct de billes d'eau dans le sachet transparent et de billes de pollution dans le sachet opaque ;
2. Annoncer le début du nouveau tour de jeu, l'année climatique et le nombre de billes d'eau dans la rivière ou le lac ;
3. Pendant que les joueurs jouent, s'assurer qu'ils manipulent correctement les billes et qu'ils ne parlent pas du jeu pendant la phase de silence ;
4. Lorsque tous les joueurs ont joué ou qu'il n'y a plus d'eau, annoncer la fin du tour ;

5. Compter devant les joueurs le nombre de billes et de pollution ;
6. Si amende, récupérer les wags et les smileys ;
7. [Pendant le 1e tour uniquement : faire remplir aux joueurs la première page de leur Fiche de suivi (N° de joueur, nom) puis leur lire la 2e page : « Fiche de jeu : ce que vous pouvez faire »] ;
8. Faire remplir aux joueurs la partie « bleue » du tableau de suivi ;
9. Phase de discussion : gérer les achats de carte, suivre les discussions ;
10. Faire remplir aux joueurs la partie « verte » du tableau de suivi ;
11. Préparer le tour suivant : retour à la phase 1 !

Game time: 90 minutes

- Preparation of the board: before the arrival of players, the facilitator puts in front of each seat (i) a post-it with a number (1; 2; 3; etc. up to the total number of players); (ii) an opaque bag containing 4 WAGs, (iii) a pencil, (iv) a monitoring file to fill in between each game round, (v) one Activity Card per player.

- The cards placed on the board are the following (pack "cards to be placed around the table before the game starts"):

CappWag-river

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Card 1	x					x				
Card 2				x					x	
Card 3		x					x			
Card 4					x					x
Card 5			x					x		

CappWag-lake

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Card 1										
Card 2		x					x			
Card 3			x					x		
Card 4	x					x				
Card 5										
Card 6				x					x	
Card 7										
Card 8										
Card 9										
Card 10					x					x

Players randomly sit around the game table. If there are less than 10 players, the cards for the absent players are simply not put on the table.

On the wall hang posters of "INNOVATION" Activity cards (A3 format) and the rules of the game. Posters should be hanged in duplicate for each group.

Animation during the game

During each new game round, a sign with the round number on the back and the climate on the front is brandished by the facilitator. He indicates at the same time the number of marbles available in the river at the beginning of the round.

	CappWag-river	CappWag-lake
ROUND 1	WET climate	WET climate
ROUND 2	NORMAL climate	NORMAL climate
ROUND 3	DRY climate	DRY climate
ROUND 4	NORMAL climate	NORMAL climate
ROUND 5	NORMAL climate	DRY climate
ROUND 6	DRY climate	WET climate

The complexity of the game increases as the rounds go by :

ROUND	**New item added in the game**
1	• Ø
2	• Between rounds 2 and 3, players can now trade / buy activities
3	• Players can BUY INFORMATION on the system and other players
4, 5, 6	• Ø

CappWag-river CappWag-lake

Nb of players	Number of water marbles upstream of the river when the round starts	Number of pollution marbles in the system when the round starts	Beginning of the round : Number of water marbles in the lake	Beginning of the round : Number of pollution marbles in the system
4	Wet year : 10 Normal year : 8 Dry year : 6	Wet year : 3 Normal year : 7 Dry year : 5	Wet year : 11 Normal year : 9 Dry year : 8	For any season, already 2 marbles in the bag.
5	Wet year : 11 Normal year : 9 Dry year : 7	Wet year : 3 Normal year :7 Dry year : 5	Wet year : 12 Normal year : 10 Dry year : 9	
6	Wet year : 12 Normal year : 10 Dry year : 7	Wet year : 7 Normal year : 6 Dry year : 3	Wet year : 13 Normal year : 11 Dry year : 10	
7	Wet year : 12 Normal year : 10 Dry year : 7	Wet year : 0 Normal year : 4 Dry year : 1	Wet year : 14 Normal year : 12 Dry year : 11	
8	Wet year : 13 Normal year : 12 Dry year : 10	Wet year : 0 Normal year : 3 Dry year : 1	Wet year : 16 Normal year : 14 Dry year : 13	Renewal rate of the resource, according to the amount of pollution marbles left in the system during the previous round: + 25%
9	Wet year : 14 Normal year : 13 Dry year : 10	Wet year : 0 Normal year : 3 Dry year : 1	Wet year : 18 Normal year : 16 Dry year : 15	
10	Wet year : 15 Normal year : 14 Dry year : 12	Wet year : 0 Normal year : 3 Dry year : 1	Wet year : 19 Normal year : 17 Dry year : 16	

Additional information

- /!\ If a player does not have enough WAGS to pay his share of an environmental fine, he is acquitted of the debt.
- A collective action or decision concerns 2 persons or more. They are rewarded by a smiley for each person who took part in it.
- Final counting : the "0" cards are worth 0 points

Gaming sequence

1. Put the correct amount of water marbles in the transparent bag and of pollution marbles into the opaque bag;
2. Announce the start of a new game round, the climatic year and the number of water marbles in the river or the lake;
3. While players are playing, make sure they handle the marbles correctly and do not talk about the game during the silence phase;
4. When all players have played or when there is no more water in the river or the lake, announce the end of the round;

5. Count in front of the players the number of marbles and pollution in the bags;
6. If players have a fine, collect the WAGs and smileys;
7. [Only during the first round: have players fill in the first page of their monitoring file (Player ID, name) and then read them page 2: "Game Sheet: What You Can Do"];
8. Have players complete the blue part of the monitoring file;
9. Discussion phase: manage the Activity cards purchases, follow the discussions;
10. Have players complete the green part of the monitoring file;
11. Prepare the next round: back to step 1 of the game sequence!

ANNEX III.1 : CAPPWAG - REGLES DU JEU

Chacun de vous joue le rôle d'un usager de **la rivière/du lac**. Votre but est de gérer vos activités à chaque tour de jeu afin de maintenir ou d'accroitre votre niveau de vie tout en respectant les objectifs environnementaux collectifs qui vous sont fixés.

Dans ce jeu :

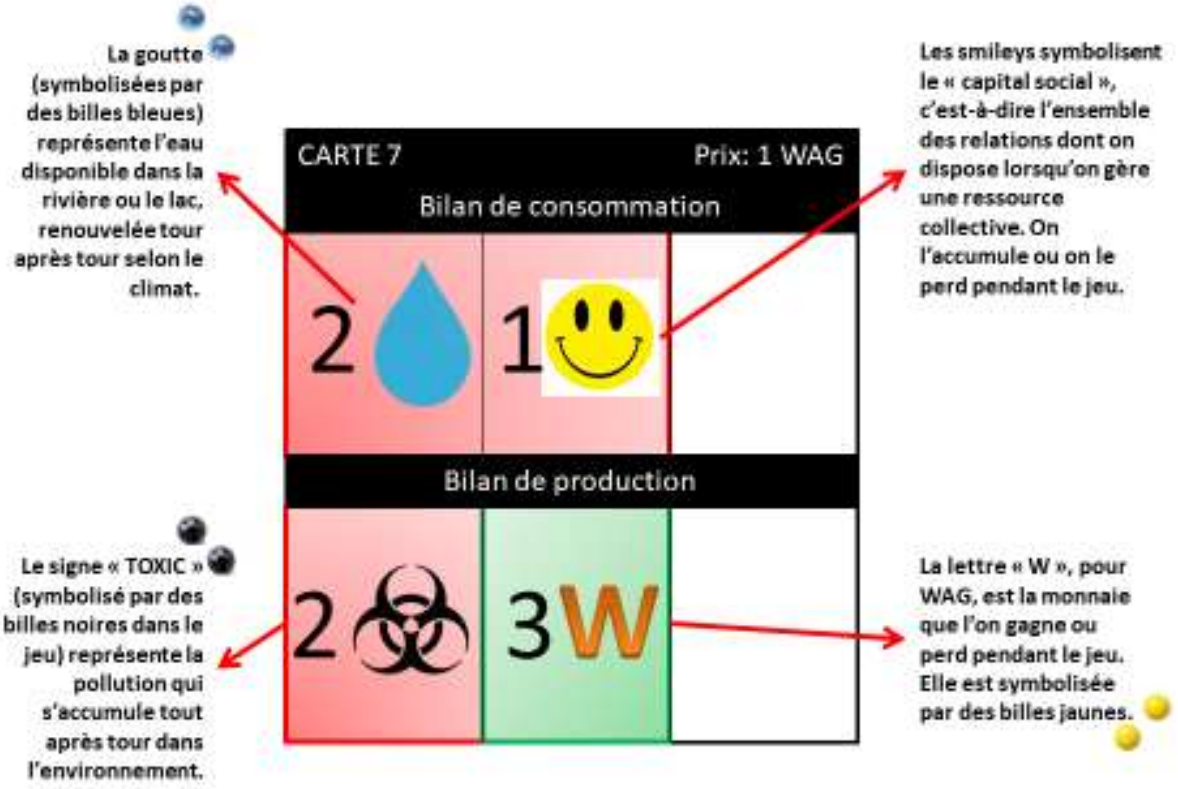
- **la rivière est schématisée par une bande bleue rectiligne au centre de la table. Vous représentez chacun un type d'usager placé d'amont en aval de la rivière.**
- **le lac est schématisé par une zone bleue au centre de la table. Vous représentez chacun un type d'usager et êtes placés en cercle autour du lac.**

Votre activité n'est pas nommée.

Les ressources à gérer

Dans ce jeu, 4 « ressources » principales sont mises en interaction : l'eau de la rivière, la pollution de l'environnement, l'argent et le niveau de sociabilité des joueurs. Ces ressources prennent la forme de billes et de smileys dans le jeu et sont représentées par des symboles sur les cartes Activité.

Les cartes Activité décrivent donc la consommation et/ou la production d'eau, de pollution, de WAG et de capital social de chaque activité en place **le long de la rivière/autour du lac**.



Sur les cartes, il y a des cases de deux couleurs différentes :

- Les cases ROUGES sur la carte désigne les actions négatives que l'ont fait, pour soi ou pour l'environnement: on perd du capital social, on prélève de l'eau dans la rivière ou le lac, on pollue, on perd de l'argent ou du capital social.

- Les cases VERTES sur la carte désignent les actions positives que l'ont fait, pour soi ou pour l'environnement : on gagne du capital social, on rejette de l'eau dans la rivière ou le lac, on dépollue, on gagne de l'argent.

- En haut à droite de la carte apparait son prix. On ne paye qu'une seule fois pour acheter une carte. Sur votre carte Activité de départ, aucun prix n'est affiché car vous ne payez pas pour l'acheter.

  - Pour gagner des WAGs : jouez des cartes Activité ;

  - Pour gagner des smileys : faites des actions en groupe avec d'autres joueurs ! Chaque action ou décision prise à plusieurs vous rapporte un smiley. Ils vous serviront ensuite à avoir accès à de nouvelles cartes Activités.

Les cartes Activité

Lorsque le jeu commence, vous possédez 1 carte Activité. Votre carte est placée face contre table et vous seul pouvez la regarder (vous pouvez le faire dès maintenant). Lorsque vous jouez votre carte, vous jouez, sauf volonté contraire, de façon à ce que les autres joueurs ne puissent pas voir son contenu et/ou vos gains. Vous pouvez pour cela vous aider d'un sachet opaque.

Quand les coupelles arrivent à votre niveau, simultanément vous :

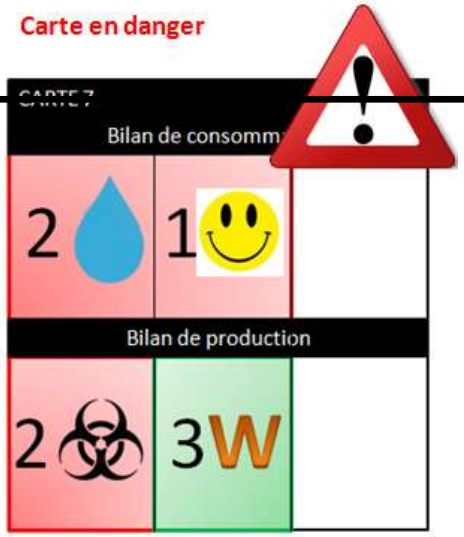
- Prélevez ou rejetez dans **la rivière/le lac** le nombre de billes inscrites sur votre carte ;
- et/ou produisez ou faites disparaitre un certain nombre de billes de pollution;
- et/ou gagnez ou perdez des WAGS, que vous accumulez durant le jeu ;

- et/ou gagnez ou perdez des smileys, que vous accumulez durant le jeu.

Lorsqu'une carte Activité a été jouée, les coupelles circulent ensuite jusqu'à la prochaine activité. Un tour de jeu prend fin lorsque tous les joueurs ont joué.

Lorsqu'il n'y a plus d'eau dans la rivière ou le lac, le tour de jeu prend fin, même si vous n'avez pas pu jouer. Si vous n'avez pas pu jouer votre carte Activité, elle est « en danger ». Vous collez alors un symbole «danger » sur votre carte.

Si vous ne pouvez pas jouer votre carte Activité durant deux tours de jeu consécutifs, elle est perdue et vous est retirée. Elle est alors remplacée par une carte neutre dites « carte 0 ».



Objectifs à remplir à la fin de chaque tour de jeu

Comment gagner ?

A la fin du jeu, le joueur avec le plus de WAGs gagne le jeu.

/!\ Une carte Activité installée = 4 Wags à la fin du jeu.

L'objectif environnemental à respecter à la fin de chaque tour de jeu est de :

- **Au moins 3 billes d'eau restantes à la fin du tour dans la rivière ou le lac**
- **Rivière : Pas plus de 10 billes de pollution dans le stock collectif.**
- **Lac : Pas plus de 15 billes de pollution dans le stock collectif.**

Si ces conditions ne sont pas respectées, vous êtes tous sanctionnés et devez payer une amende de 1WAG + 1 SMILEY.

/!\ Cette amende est croissante ! A chaque nouvelle amende, vous devrez payer 1 wag et 1 smiley en plus par rapport à l'amende précédente.

Communication

DURANT LES TOURS DE JEU : vous n'avez pas le droit de communiquer oralement. Il faut pour cela attendre les phases de discussion, qui ont lieu entre chaque tour !

A LA FIN D'UN TOUR DE JEU

- 2 MINUTES vous sont laissées pour remplir votre fiche de suivi (partie bleue) et réfléchir **en silence** à ce que vous souhaitez dire et/ou faire durant le temps de parole collective. *Ex : quelles propositions vous souhaitez faire au groupe, quelles activités vous souhaitez acheter, etc.*

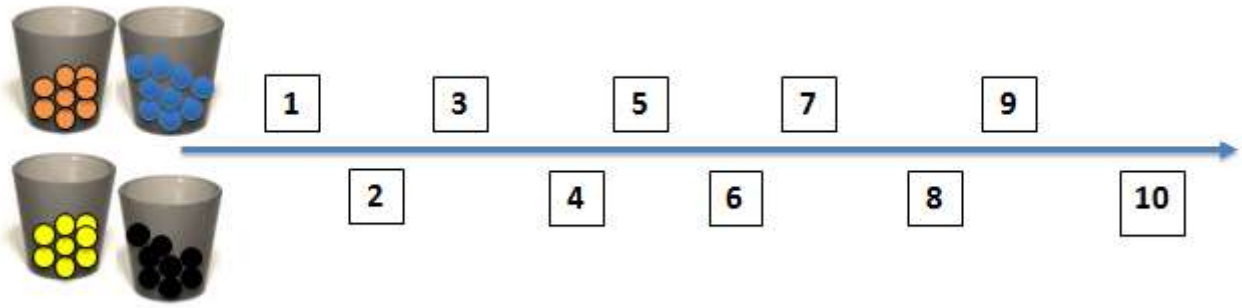
- **7 MINUTES (3 premiers tours) / 5 MINUTES (à partir du 4^{e} tour) vous sont ensuite laissées pour :**
  - **Discuter de leurs propositions, prendre des décisions collectives** ;
  - **Acheter ou vendre des cartes** Activité.
  - **Acheter ou vendre de l'information.**

- 2 MINUTES vous sont à nouveau laissées pour terminer de remplir votre fiche de suivi (partie verte). Une fois les 2 minutes passées, le tour suivant commence.

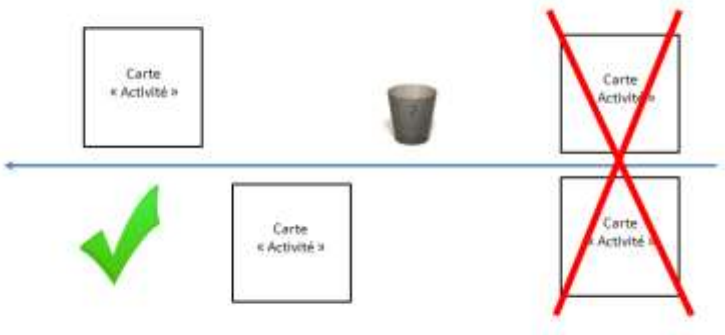
Rivière : déroulé d'un tour de jeu

Une partie se compose de plusieurs tours de jeu : leur nombre vous est inconnu.

Les ressources circulent dans des coupelles transparentes le long de la rivière en suivant le sens des flèches.



Les activités sont placées les unes après les autres le long de l'axe de la rivière, de façon à ce que l'ordre de jeu des activités soit bien visible.

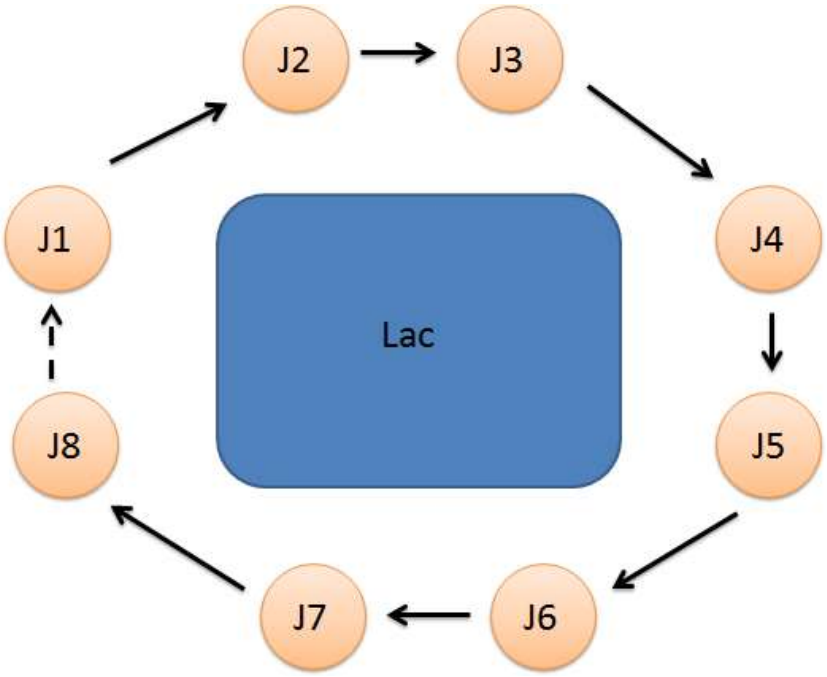


1e tour de jeu:

- Vous avez au départ 1 carte Activité et 4 WAGS.
- Au début du tour de jeu, l'animateur annonce la « météo » du tour. Selon la météo, le nombre de billes d'eau dans la rivière et de pollution dans l'écosystème est plus ou moins important !
- Pour gagner des WAGs : jouer des cartes activités !
- Pour gagner des smileys : faites des actions en groupe avec d'autres joueurs !

LAC : Comment jouer ? Déroulé d'un tour de jeu.

Une partie se compose de plusieurs tours de jeu : leur nombre vous est inconnu.



1e tour de jeu:

- Vous avez au départ 1 carte Activité et 4 WAGS chacun ;

- Au début du tour de jeu, l'animateur annonce le « climat » de l'année, c'est-à-dire du tour de jeu. Selon ce climat, le nombre de billes d'eau dans le lac et de pollution dans le milieu naturel est plus ou moins important ;

- Le facilitateur désigne au hasard le 1e joueur à jouer au début de chaque année. Les joueurs jouent ensuite les uns après les autres dans le sens des aiguilles d'une montre.

You play the role of a user of the river/lake. Your goal is to manage your activities during every round so that you maintain or improve your level of life, while respecting the collective environmental objectives.

In this game:

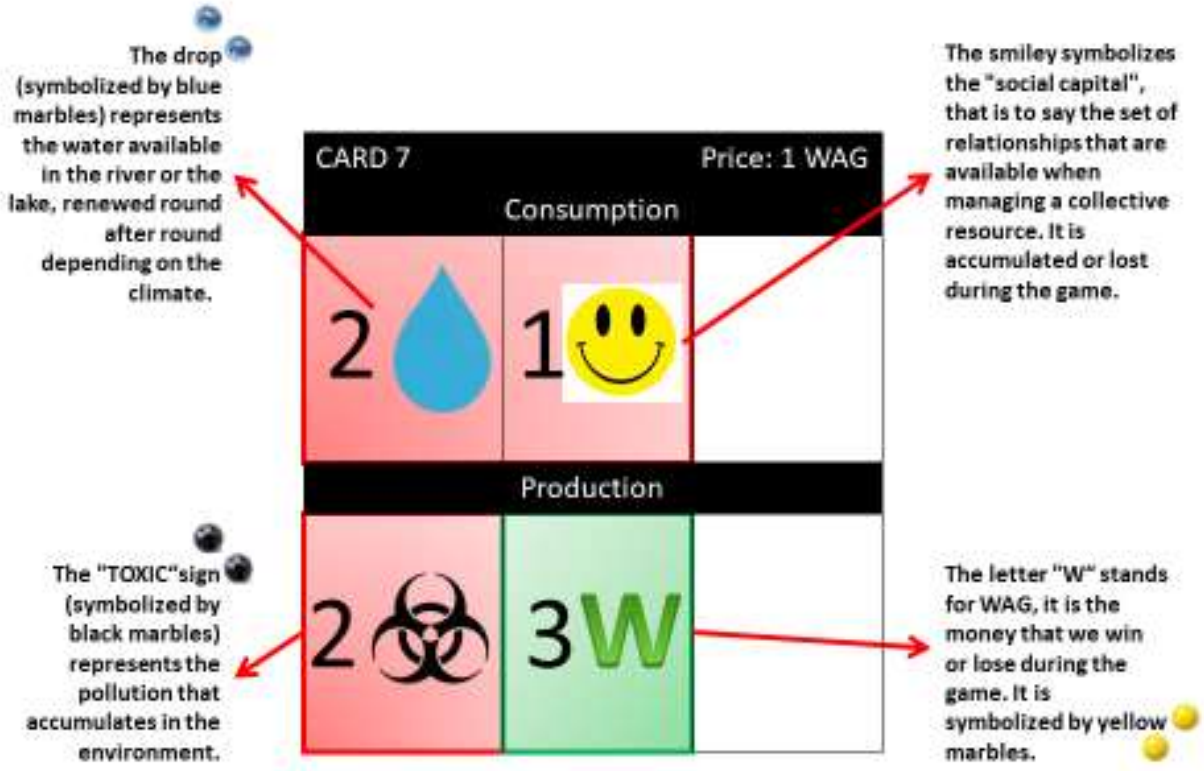
- the river is represented by a straight blue line at the center of the table. You represent a user located along the river.
- the lake is represented by a blue piece of paper at the center of the table. You each represent a type of user seated in a circle around the lake.

Your activities are not named.

The resources to manage

Four main "resources" are put in interaction: the water in the river, the pollution of the environment, money and the level of sociability of players. In the game, these resources take the form of marbles and smileys and are also represented by symbols on the Activity cards.

Activity cards stand for the consumption and/or the production of water, pollution, WAG and social capital of each activity along the river/lake.



On the cards, there are cells of two different colors:

• The RED cells indicate rather negative actions that we do, for oneself or for the environment: we lose social capital, we take water from **the river/the lake**, we pollute the environment, we lose money or social capital.

• The GREEN cells indicate rather positive actions that we do, for oneself or for the environment: we gain social capital, we reject water in **the river/lake**, we decontaminate the environment, we earn money.

• The price of each card appears at the top right. We pay only once to buy a card. On your first Activity card, no price is displayed because you do not pay to buy it.

- To win WAGs : play Activity cards ;

- To win smileys : make group actions with other players! Each action or decision made together gives you a smiley. They will then be used to access new Activity cards.

The Activity cards

When the game starts, you possess one Activity card. Your card faces the table and only you can see it (you can watch it right now). When you play your card and unless you wish otherwise, you play so that other players will not see its content and/or your earnings. You can use for this an opaque bag.

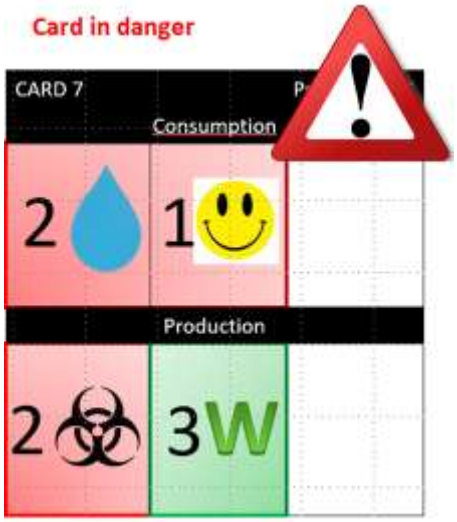
When the cups arrive at your level, you simultaneously:

- Take or reject in the river/lake the number of marbles indicated on your card;
- and/or produce or remove a number of pollution marbles from the pollution bag;
- and/or win or lose WAGS, which you accumulate during the game;
- and/or win or lose smileys, which you accumulate during the game.

When an Activity card is played, the cups then circulate to the next activity. A game round ends when all players have played.

When there is no more water in **the river or the lake**, the game round ends directly (even if you have not been able to play). If this is the case and you cannot play your Activity card, it is "in danger". You must then paste a danger symbol on your card.

If you cannot play your Activity card during two consecutive game rounds, it is lost and taken away from you. It is then replaced by a neutral card called "card 0".



Objectives to reach at the end of each game round

How to win the game ?

At the end of the game, the player with the highest number of wealth units wins the game.

/!\ An installed Activity card = 4 WAGS at the end of the game.

The environmental objective to respect at the end of each game round is:

- **At least three water marbles are in the river**
- **No more than ten pollution marbles are in the collective stock.**

If these conditions are not respected, you are all sanctioned and must pay a fine of 1WAG + 1 SMILEY.

/!\ This fine is growing! For each new fine, you will have to pay 1 WAG and 1 smiley compared to the previous fine.

Communication

DURING THE GAME ROUNDS: You are not allowed to communicate orally. You must wait for the discussion phases, which take place between each round!

AT THE END OF A GAME ROUND

- You have 2 MINUTES to fill the blue part of your monitoring file and think **silently** about what you want to say and/or do during the collective discussion time. *Ex: which proposals you want to make to the group, what activities you would like to buy, etc*.

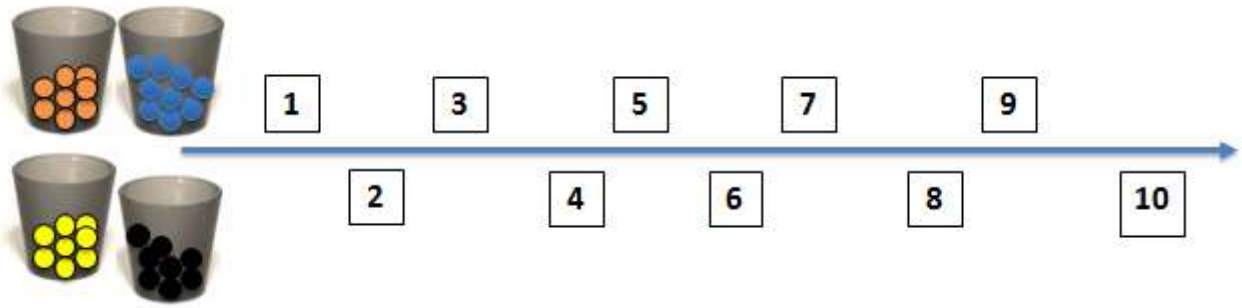
- **7 MINUTES (during the 3 first rounds) / 5 MINUTES (from the 4th round on) are then left for:**
  - **Discuss your proposals, make collective decisions;**
  - **Buy or sell Activity cards.**
  - **Buy or sell information.**

- You have once again 2 MINUTES to fill the green part of your monitoring file. Once the 2 minutes are over, the next round begins.

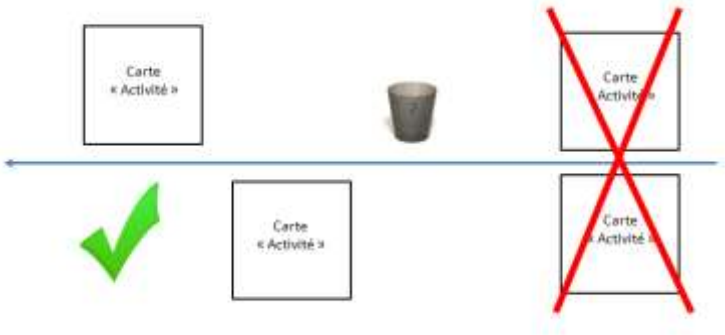
River: proceeding of a game round

A game is made of several game rounds: their number is unknown to you.

The resources circulate in the transparent cups along the river, following the direction of the arrows.



The activities are placed one after the other along the river, so that their playing order is visible.

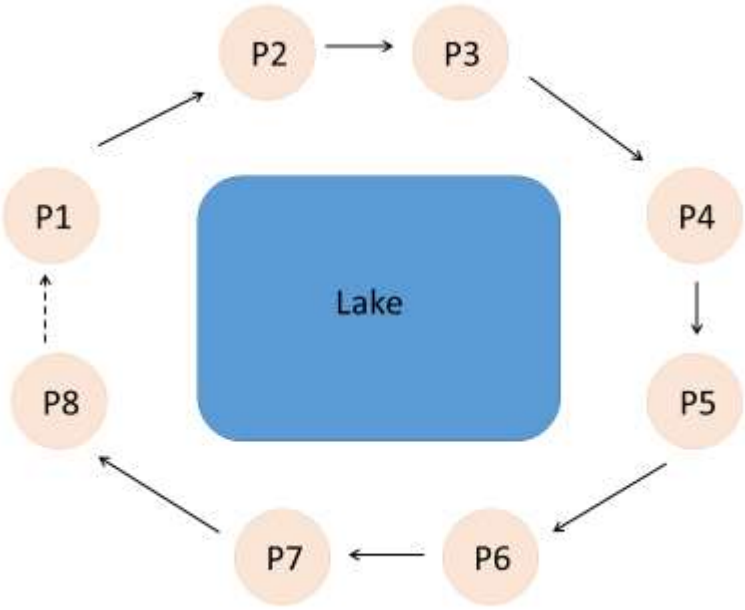


1st game round:

- At the beginning of the game, you have 1 Activity Card and 4 WAGS.
- At the beginning of the game round, the facilitator announces the "climate" of the tour. Depending on the climate, the number of water marbles in the river and pollution marbles in the ecosystem is more or less important!

Lake : proceeding of a game round.

A game is made of several game rounds: their number is unknown to you.



1st game round:

- At the beginning of the game, you possess 1 Activity Card and 4 WAGS.

- At the beginning of the game round, the facilitator announces the "climate" of the tour. Depending on the climate, the number of water marbles in the river and pollution marbles in the ecosystem is more or less important!

- The facilitator randomly designates the 1st player to play at the beginning of each round. The players then play one after the other in a clockwise direction.

ANNEX IV.1 : FICHE DE SUIVI

Fiche de jeu

Fiche de suivi individuelle à remplir entre chaque tour

Joueur n°……

Prénom & NOM : ……

Merci de bien vouloir remplir *de façon claire et soignée* les tableaux et répondre aux questions suivantes au fur et à mesure du jeu.

Fiche de jeu : ce que vous pouvez faire

DES LE 1E TOUR

- METTRE EN ŒUVRE une activité grâce à une carte Activité

APRES LE 1E TOUR

- DESINSTALLER une carte Activité

Coût : 1 WAG + 1 smiley

- ACHETER une nouvelle carte activité…

… à un autre joueur

Condition : que vous ou l'autre joueur possédiez au moins 1 smiley ;

Bénéfice automatique : lorsque vous concluez une transaction avec un ou plusieurs autres joueurs, vous recevez CHACUN 1 smiley ;

Coût : fixé par les joueurs.

… tirée dans la pioche

Comment faire ? Vous tirez au hasard dans la pioche autant de cartes que le nombre de smiley que vous possédez (ex : vous possédez 4 smiley : vous tirez 4 cartes). Vous pouvez garder celle qui vous convient, ou n'en garder aucune. Vous remettez ensuite les cartes que vous ne souhaitez pas conserver dans la pioche.

Coût : prix indiqué en haut à droite de chaque carte.

Acheter une carte Activité « Innovation »

Coût : prix indiqué en haut à droite de chaque carte.

DES LE 2E TOUR

- INSTALLER une carte Activité (la jouer pour la 1e fois)

Coût : 1 WAG + 1 smiley

APRES LE 2E TOUR

- Acheter de l'INFORMATION

Sur le contenu de la carte Activité d'un joueur : réunir 6 smiley, payer 6 WAGs.

Sur le fonctionnement du système naturel (niveau de pollution au début du tour, alerte à 50% du seuil de pollution à ne pas franchir, prévisions météorologiques pour le tour suivant, contenu des ajouts/retraits d'eau ou de pollution durant le tour) : réunir 8 smiley, payer 8 WAGS.

TOUR 1 1e phase ☐ 2ème phase ☐

1. Ressources

Indiquez le nombre de ressources en votre possession à la fin du jeu :

	WAGs	Smileys
Nombre de billes gagnées *durant ce tour*		
Amende payée suite à un non respect des objectifs environnementaux ?		
Nombre *total* de billes à la fin de l'entre deux tour		

2. Qu'en pensez-vous ?

- Comment décririez-vous ce tour de jeu? Cochez les qualificatifs qui vous semblent convenir (plusieurs réponses possibles).

□ équilibré □ égalitaire □ludique □ incertain □ déséquilibré □ non-égalitaire

□ ennuyeux □ prévisible □Autres : ……

- Quelles raisons vous amènent à penser cela ?

.....
.....

3. Propositions que vous souhaitez faire au groupe

Y a-t-il des propositions que vous souhaiteriez faire au groupe? Si oui, les lister et remplir le tableau ci-dessous (une proposition par ligne) :

Votre proposition (une par ligne)	Pour quelle raison faire cette proposition ?	L'avez-vous discuté avec le groupe ?	Si non, pourquoi ?

Si vous avez participé à la prise d'une décision collective (implique au moins deux personnes)

La décision collective (une par ligne)	Pour quelle raison avoir pris cette décision collective ?	A-t-elle été prise par l'ensemble du groupe ? (cocher la bonne réponse)	Si non, quels sont les joueurs impliqués ? Ecrire leur numéro :
		OUI / NON	
		OUI / NON	

ANNEX IV.2 : THE MONITORING FILE

Game sheet

Monitoring file to fill in between every round

Player n°……

Surname & NAME : ……

Thank you for filling in the tables *clearly and carefully* and answering the following questions as the game progresses.

Game sheet: what you can do

DURING PHASE 1

- IMPLEMENT an activity with an Activity card

DURING PHASE 2

- UNINSTALL an Activity card

Cost: 1 WAG + 1 smiley

BUY a new Activity card…

… to another player

Condition: that you or the player you want to to buy an activity card to possess at least 1 smiley

Automatic benefit: when you make a transaction with another player, EACH of the players involved receives 1 smiley

Cost: set by players.

… by drawing a new card from the deck of Activity cards

How to do it? Draw randomly from the deck as many Activity cards as the number of smileys you possess (e.g. you possess 4 smileys: you draw 4 cards). You can keep the one card that suits you, or keep none. You then put the cards you do not want to keep back in the deck.

Cost: the price indicated in the upper right corner of an Activity card.

Buy an "Innovation" Activity card

Cost: the price indicated in the upper right corner of an Activity card.

DURING PHASE 2 (STARTING ROUND 2)

- INSTALL an Activity card (play it for the 1st time)

Cost: 1 WAG + 1 smiley

DURING PHASE 2 (STARTING ROUND 3)

- Buy INFORMATION

About the content of the Activity card of a player: gather 6 smileys, pay 6 WAGs.

About the functioning of the natural system (the pollution level at the beginning of the tour, warning when 50% of the pollution threshold is crossed, weather forecast for the next round, additions / withdrawals of water or pollution during a round) : gather 8 smileys, pay 8 WAGS.

ROUND 1 1st phase ☐ 2nd phase ☐

1. Resources

Indicate the amount of resources in your possession at the end of the game:

	WAGs	Smileys
Number of marbles you won *during this round*		
Fine paid for failure to meet environmental objectives		
Total amount of marbles at the end of the discussion phase		

2. What do you think?

- How would you describe this game round? Check the words that you think fit best (several answers are possible).

□ balanced □ egalitarian □ playful □ uncertain □ unbalanced □ non-egalitarian

□ boring □ predictable □ others : ……

- Why do you think that ?

.....
.....

3. Proposals you wish to make to the group

Are there any proposals you would like to make to the group? If so, list them and fill in the table below (one proposal per line) :

Your proposal (one per line)	Why making this proposal?	Did you discuss it with the group?	If not, why?

If you participated to the process of making a collective decision (which involves at least two persons)

State the collective decision (one per line)	Why did you make this collective decision?	Was it made by the entire group? (check the right answer)	If not, who are the players involved? Write down their numbers:
		YES / NO	
		YES / NO	

ANNEX V: THE OBSERVATION FILE FOR THE FACILITATORS (V.1: FRENCH; V.2: ENGLISH).

ANNEX V.1 : CAPPWAG – FICHE-BILAN DU FACILITATEUR

Heures de début-fin et durée du jeu, du questionnaire, du débriefing :

……
……
……

Ambiance générale, dynamique générale du groupe :

……
……
……
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Déroulé du jeu (grandes décisions, actions, discussions, débats, etc.):

……
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Les joueurs ont-ils respecté les règles du jeu et les séquences silence/parole ? :

……
……
……
……

Le jeu a-t-il été interrompu avant la fin, ou pour une courte durée avant de reprendre ? Si oui, pourquoi ?

……
……

……
……

Autre :

……
……
……
……

Classement final et gagnant :

Classement WAG (nombre de points)	Classement CAPITAL SOCIAL (nombre de points)
Joueur 1 :	Joueur 1 :
Joueur 2 :	Joueur 2 :
Joueur 3 :	Joueur 3 :
Joueur 4 :	Joueur 4 :
Joueur 5 :	Joueur 5 :
Joueur 6 :	Joueur 6 :
Joueur 7 :	Joueur 7 :
Joueur 8 :	Joueur 8 :
Joueur 9 :	Joueur 9 :
Joueur 10 :	Joueur 10 :

ANNEX V.2: CAPPWAG – OBSERVATION FILE FOR THE FACILITATORS

Starting and ending time of the game, the survey and the focus group:

……
……
……

General atmosphere, general group dynamics:

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Proceedings of the game (important decisions, actions, discussions, debates, etc.):

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Did the players respect the rules of the game and the silence / speech sequences?

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……

Was the game interrupted before the end, or for a short amount of time before resuming? If yes, why?

……
……
……
……

Other:

……
……

……
……

Final ranking and winner :

WAG ranking (number of points)	SOCIAL CAPITAL ranking (number of points)
Player 1 :	Player 1 :
Player 2 :	Player 2 :
Player 3 :	Player 3 :
Player 4 :	Player 4 :
Player 5 :	Player 5 :
Player 6 :	Player 6 :
Player 7 :	Player 7 :
Player 8 :	Player 8 :
Player 9 :	Player 9 :
Player 10 :	Player 10 :

ANNEX VI: COMPLETE POST-CAPPWAG QUESTIONNAIRE (VI.1: FRENCH; VI.2: ENGLISH).

ANNEXE VI.1 : QUESTIONNAIRE

The following questions that are being highlighted in grey are the one that were deleted and in magenta that were being added in the « slightly simplified » questionnaire. The latter was filled in by the students of Groups 4 and 5 during the *ex ante* workshop and all of the five groups during the *ex post* workshop. The "river" mentioned during the questionnaire filled in after the *ex ante* workshop was replaced by a "lake" in the questionnaire filled in after the *ex post* workshop.

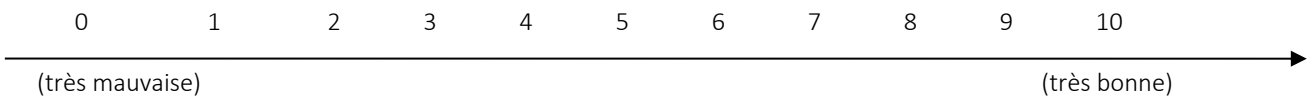
Questionnaire – A remplir après avoir joué au jeu CappWag

Votre numéro de joueur : **Vos prénom et nom et si vous le souhaitez, votre email :**

Nous vous demandons désormais de répondre à ce questionnaire avec la plus grande précision et le plus lisiblement possible. Vos réponses demeureront strictement confidentielles.

- ÊTRE CAPABLE DE S'EXPRIMER AU SEIN D'UN GROUPE

1. Sur une échelle de 0 (très mauvaise) à 10 (très bonne), comment noteriez-vous l'ambiance au sein de votre groupe ?



2. Comment qualifieriez-vous l'ambiance de votre groupe ? Donnez trois mots qui vous viennent spontanément à l'esprit.

……
……
…….

3. A quelle fréquence avez-vous participé aux discussions ayant lieu au sein du groupe (entourez une réponse) ?

Beaucoup / Assez souvent / Peu souvent / Pas du tout

- Si vous avez répondu « peu souvent » ou pas du tout », pourquoi ? Cochez une ou plusieurs réponses.

□ Les discussions ne m'intéressaient pas

□ Je n'ai pas eu assez de temps pour proposer mon ou mes idée(s) au groupe

□ Le groupe ne m'a pas écouté ou ne prenait pas en compte mes remarques

□ D'autres personnes ont eu les mêmes idées que moi et les ont mis en discussion avec le groupe avant que je le fasse

□ Je suis timide et je n'ai pas osé parler devant le groupe

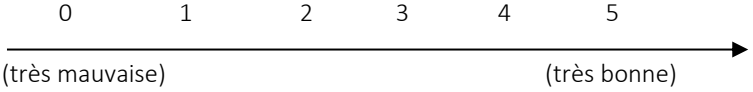
□ Je n'ai pas assez bien compris ce qui se passait dans le jeu

□ Je n'ai pas formulé de proposition suffisamment élaborée pour être discutée en groupe

□ Je ne me sentais pas en capacité de formuler correctement mes propositions et de me faire entendre.

□ Autre :
……
……
……..

4. Sur une échelle de 0 à 5, 0 signifiant « très mauvaise » et 5 signifiant « très bonne », comment noteriez-vous votre capacité à vous exprimer au sein de ce groupe pendant cet atelier ? Si vous ne savez pas, cochez la case « je ne sais pas ».



□ Je ne sais pas

- Expliquer brièvement votre réponse :……
  ……
  ……
  ……

- COMPRENDRE ENSEMBLE UNE SITUATION PROBLEMATIQUE

5. Pensez-vous que tout le groupe ait compris comment fonctionnait la rivière et ses différents usages dans le jeu de la même façon que vous ?

□ Oui □ Plutôt oui □ Plutôt non □ Non

6. Avez-vous parlé des causes des problèmes rencontrés avec d'autres personnes du groupe ?

□ Oui, très souvent □ Oui, parfois □ Très peu souvent □ Jamais

7. La discussion avec le groupe vous a-t-elle aidé à comprendre le fonctionnement de la rivière et les éventuels problèmes rencontrés durant le jeu ?

□ Oui □ Plutôt oui □ Plutôt non □ Non

8. Si « oui » ou « plutôt oui », pourriez-vous donner un ou plusieurs exemples ?

.....
.....
.....

9. Sur une échelle de 0 (très mauvaise) à 5 (très bonne), comment noteriez-vous votre capacité, en tant que joueur, à identifier quels sont les éventuels problèmes de gestion? Si vous ne savez pas, cochez la case « je ne sais pas ».

0 1 2 3 4 5 □ Je ne sais pas

(très mauvaise) → (très bonne)

- Expliquer brièvement votre réponse :

.....
.....
.....
.....

10. Sur une échelle de 0 (très mauvaise) à 5 (très bonne), comment noteriez-vous la capacité du groupe à identifier quels sont les éventuels problèmes de gestion? Si vous ne savez pas, cochez la case « je ne sais pas ».

0 1 2 3 4 5 □ Je ne sais pas

(très mauvaise) → (très bonne)

- Expliquer brièvement votre réponse :

.....
.....
.....
.....

11. Avez-vous identifié, seul(e), des actions à mener pour apporter des changements à la situation de jeu ?

□ Non □ Oui, mais peu d'actions □ Oui, beaucoup d'actions

12. Les interactions avec les autres joueurs vous ont-elles permis d'identifier des actions à mener pour apporter des changements à la situation de jeu ?

□ Oui □ Plutôt oui □ Plutôt non □ Non

- FORMULATION DE REGLES COLLECTIVES DE GESTION DE JEU

Durant le jeu, vous avez peut-être été amené à proposer des actions ou des changements au reste du groupe. Ces propositions pouvaient concerner :

- Des actions ou des décisions ponctuelles : par exemple, échanger une carte avec un joueur, prêter des ressources à un joueur lors d'un tour, etc.
- Des actions ou des décisions durables : par exemple, décider que les joueurs doivent partager de l'information sur leurs cartes, ou décider que les joueurs les plus riches payent des amendes plus élevées que les joueurs les plus pauvres, etc.

C'est sur ce 2e type de propositions que les questions suivantes portent !

13. Avez-vous pensé et formulé des propositions de nouvelles règles de gestion de la rivière durant la partie ?

□ Non, jamais □ Oui, une ou deux fois □ Oui, plusieurs fois □ Oui, à de nombreuses reprises

14. Si oui, avez-vous présenté au groupe ces propositions de règles de gestion durant la partie ?

□ Non, jamais □ Oui, une fois □ Oui, quelques fois □Oui, à de nombreuses reprises

- Si non, pourquoi (cochez une ou plusieurs réponses possibles) ?

□ Cela ne m'intéressait pas

□ Je n'en avais pas envie

□ Je n'avais pas d'idées

□ J'ai préféré laisser les autres joueurs intervenir

□ L'ambiance au sein du groupe n'était pas propice à la discussion

□ Autre : ……

- ACCEPTATION DES REGLES COLLECTIVES DE GESTION DE JEU

15. Lorsque des règles de gestion ont été formulées, les avez-vous validées ?

□ Jamais □ Rarement □ Parfois □ Souvent □ Toujours

16. Le reste du groupe les a-t-il validées ?

□ Jamais □ Rarement □ Parfois □ Souvent □ Toujours

17. Lorsqu'une ou des règles de gestion ont été validées, comment avez-vous participé et comment expliquez-vous ce choix (cochez une ou plusieurs réponses possibles) ?

□ En donnant spontanément et ouvertement mon accord au groupe

□ En donnant mon accord à la suite d'une demande d'un ou plusieurs membres du groupe

□ En votant

□ C'est moi qui ais demandé au groupe de valider la règle

□ Je n'ai pas voulu m'opposer à la volonté collective du groupe

□ Je ne souhaitais pas que des règles soient mises en place dans le jeu

□ Les règles proposées ne me semblaient pas toutes intéressantes.

□ Je n'étais pas d'accord avec le contenu des règles de gestion

□ Je n'avais pas l'intention de respecter ces règles

□ Je n'ai pas participé

□ Autre :
……

- MISE EN OEUVRE DES REGLES DE GESTION

18. Avez-vous appliqué de nouvelles règles de gestion pendant la partie (entourez la bonne réponse)? OUI/NON

19. Avez-vous respecté toutes les règles de gestion mises en place par le groupe durant le jeu ?

□ Oui, toujours □ Oui, souvent □ Non, pas souvent □ Non, jamais

- Si vous avez répondu « oui, toujours », veuillez expliquer ce choix (cochez une ou plusieurs réponses possibles) :

□ J'étais d'accord avec toutes les règles validées par le groupe

□ Je n'étais pas d'accord avec toutes les règles, mais puisqu'elles ont été collectivement choisies, je les ai suivies

□ Je n'étais pas d'accord avec toutes les règles, mais je n'ai pas osé m'opposer au groupe et risquer de provoquer un conflit ou d'être pointé du doigt

□ Je n'étais pas d'accord avec toutes les règles, mais je n'ai pas osé tricher

□ Je ne prêtais pas ou peu d'importance aux règles mises en place car il s'agit d'un jeu

□ Autres :
……..

- Si vous n'avez pas toujours respecté les règles choisies par le groupe, pourquoi (cochez une ou plusieurs réponses possibles) ?

□ J'aurais souhaité que cette ou ces règle(s) soit ou soient différente(s)

□ Je souhaitais gagner la partie et j'ai donc choisi de jouer à ma façon

□ Je ne prêtais pas d'importance aux règles mises en place car il s'agit d'un jeu

□ Autre :
……

- Si vous n'avez pas respecté des règles de gestion, l'avez-vous ouvertement dit ou montré aux autres joueurs?

□ Oui □ Plutôt oui □ Plutôt non □ Non

Expliquez brièvement ce choix :

……
……
……
……

20. Sur une échelle de 0 (très mauvaise) à 5 (très bonne), comment noteriez-vous la capacité collective du groupe à mettre en œuvre une ou des règle.s de gestion ? Si vous ne savez pas, cochez la case « je ne sais pas ».

0 (très mauvaise) 1 2 3 4 5 (très bonne) □ Je ne sais pas

Expliquer brièvement votre réponse :

……
……
……
……

- POUR ALLER PLUS LOIN

21. Durant le jeu, avez-vous principalement cherché à gagner ? Répondez en cochant une case par ligne dans le tableau ci-dessous.

	Oui	Plutôt	Plutôt	Non	Je ne sais pas	VRAI	FAUX
Oui, je souhaitais gagner le jeu.							
Oui, mais j'ai aussi participé à l'effort collectif pour atteindre les objectifs environnementaux							
Oui, mais j'ai aussi participé à l'effort collectif pour que tout le monde puisse gagner des unités de richesse et des point de capital social							
Oui, mais j'ai aussi participé à l'effort collectif pour que joueurs ne se retrouvent pas en difficulté dans le jeu							
Non, j'ai surtout participé à l'effort collectif pour atteind es objectifs environnementaux							
Non, j'ai surtout cherché à ce que tout le monde gagne façon équitable des unités de richesse et des points de capital social							
Non, j'ai été tellement pris par le jeu et les discussions q e n'ai finalement pas cherché à maximiser mes gains pour gagner							
Autre : ……							

22. Pensez-vous que si vous aviez eu plus de temps de discussion entre les tours de jeu, vous auriez agi différemment ?

□ Oui □ Surement □ Peut-être □ Peut-être pas □ Surement pas □ Non

23. Parmi les compétences et aptitudes listées ci-dessous, lesquelles ont influé sur votre façon de jouer, et comment ? Cochez une case à chaque ligne.

	Jamais	**Un peu**	**Souvent**	**Constamment**	**Je ne sais p**
Connaître la profession réelle des autres participants (en dehors du jeu)					
Connaître la personnalité des autres participants					
Connaître les valeurs et les intérêts des autres participants					
Être habitué(e) à participer à des ateliers ou travaux collectifs					
Votre empathie, votre capacité à vous mettre à la place des autres joueurs					
Votre capacité à anticiper les stratégies de chacun					
Votre capacité à vous exprimer avec aisance devant un groupe					
Votre *leadership*, votre capacité à mener un groupe					
Votre expérience liée à votre parcours de vie (si oui, précisez brièvement pourquoi : ……. ……..)					
Votre expérience liée à votre métier (préciser alors votre métier……)					
Votre capacité à faire office de médiateur, à concilier différents points de vue et/ou à gérer des conflits					
Votre esprit de « gagnant »					
Votre esprit collectif					
Autres : ……					

24. Reprenons les principales compétences et aptitudes listées dans le tableau ci-dessus et appliquons les cette fois-ci à l'échelle du groupe de joueurs. Selon-vous, lesquelles ont le plus influencé la façon de jouer des autres joueurs ?

	Jamais	**Un peu**	**Souvent**	**Constamment**	**Je ne sais p**
Connaissance mutuelle des professions des participants (en dehors du jeu)					
Connaissance mutuelle des personnalités des participants					
Connaissance mutuelle des valeurs et des intérêts des autres participants					
Habitude de participer à des ateliers ou travaux collectifs					
Empathie et capacité à se mettre à la place des autres joueurs					
Anticipation des stratégies de chacun					
Capacité à s'exprimer avec aisance au sein du groupe					
Leadership, émergence d'un ou de plusieurs meneurs					
Expérience liée à des parcours de vie (précisez brièvement pourquoi :…… ……..)					
Expérience liée à des métiers (préciser lesquels) …….. ……..					
Présence de médiateurs, capables de concilier différents points de vue, de gérer des conflit					
Esprit collectif					
Esprit de « gagnants »					
Autres : ……					

25. Êtes-vous d'accord avec les affirmations suivantes ? Cocher une réponse pour chaque affirmation.

	Pas du tout d'accord	Pas d'accord	Ni en désaccord ni d'accord	D'accord	Tout à fait d'accord
Une condition à la gestion collective efficace d'une rivière est que tous les membres du groupe puissent s'exprimer					
Une condition à la gestion collective efficace d'une rivière est que tous les membres partagent leur vision du problème et que le groupe réalise suite à cela un diagnostic commun					
Une condition à la gestion collective efficace d'une rivière est que le groupe puisse mettre en place ses propres règles de gestion					

26. Enfin, concernant le lien entre le cours que vous avez suivi sur la GIRE et ce jeu : êtes-vous d'accord avec les affirmations suivantes ? Cochez une réponse pour chaque affirmation.

	Pas du tout d'accord	Pas d'accord	Ni en désaccord ni d'accord	D'accord	Tout à fa d'accord
Les connaissances acquises sur la GIRE et la participation grâce au cours ont influencé la façon dont j'ai agit durant le jeu					
Les travaux en groupe menés dans le cadre du cours sur la GIRE ont influencé la façon dont j'ai agit durant le jeu					

27. Quelle est votre année de naissance ?.....

- Quelle est votre situation ?

□ Retraité.e □ Etudiant.e □ En activité professionnelle □ Père ou mère au foyer

□ Sans activité professionnelle (chômage, autre)

- Quelle est ou a été votre profession ?

□ Agriculteur.trice exploitant.e □ Artisan.te □ Commerçant.e ou chef.fe d'entreprise
□ Cadre ou profession intellectuelle supérieure □ Profession intermédiaire (ex : infirmier.e, instituteur.trice, etc.)
□ Employé.e □ Ouvrier.e □ Aucune

Vous avez atteint la fin du questionnaire.

Merci de votre contribution !

Si vous avez des questions sur l'atelier ou le questionnaire, merci d'écrire à l'adresse suivante :

sarah.loudin@irstea.fr

ANNEXE VI.2 : QUESTIONNAIRE

Questionnaire – To fill in after having played CappWag

Your player's number: **Your name, your last name and if you so wish, your email :**

We now ask you to fill in this questionnaire with the highest precision and as understandable as possible. Your answer will remain strictly confidential.

- BEING ABLE TO EXPRESS ONESELF IN FRONT OF A GROUP

1. **On a scale from 0 (very bad) to 10 (very good), how would you rate the atmosphere in your group ?**

0 1 2 3 4 5 6 7 8 9 10

(very bad) (very good)

2. **How would you qualify the atmosphere in your group ? Give three words that spontaneously come to your mind.**

……
……
…….

3. **How frequently did you participate to the discussions taking place among your group (circle an answer)??**

A lot/ Quite often / Not often / Never

- **If you answered "Not often" or "Never", why? Check one or several answers.**

□ Discussions dit not interest me

□ I did not have enough time to propose my idea(s) to the group

□ The group did not listen or did not take into account my remarks

□ Other persons had the same ideas and discussed them with the group before I did

□ I am shy and I did not dare talking in front of the group

□ I did not sufficiently understand what was happening in the game

□ I did not formulate a proposition elaborated enough to be discussed with the group

□ I did not feel able to correctly formulate my propositions and be heard

□ Other :
……
……
……

4. On a scale from 0 (very bad) to 5 (very good), how would you rate your capacity to express yourself in front of your group during this workshop? If you don't know, check the box "I don't know".

0 1 2 3 4 5 □ I don't know

(very bad) (very good)

- Briefly explain your answer :.....
  .....
  .....
  .....

- Understanding together a problematic situation

5. Do you think the group understood the same way that you did how the river and its various uses worked?

□ Yes □ Rather yes □ Rather no □ No

6. Did you discuss with other persons in the group the reasons behind problems you experienced during the game?

□ Yes, very often □ Yes, sometimes □ Very seldom □ Never

7.1. Have the discussion with the group helped you understand the functioning of the river and possible problems faced during the game?

□ Yes □ Rather yes □ Rather no □ No

7.2. If "yes" or "rather yes", could you give one or several examples?
.....
.....
.....

8. On a scale from 0 (very bad) to 5 (very good), how would you rate your capacity, as a player, to identify potential management problems? If you don't know, check the box "I don't know"

0 1 2 3 4 5 □ I don't know

(very bad) (very good)

- Briefly explain your answer : .....
  .....
  .....
  .....

7. On a scale from 0 (very bad) to 5 (very good), how would you rate the capacity of the group to identify potential management problems? If you don't know, check the box "I don't know".

0 1 2 3 4 5 □ I don't know

(very bad) (very good)

- Briefly explain your answer : ……
……
……
……

8. Did you individually identify actions to modify the game situation?

□ No □ Yes, but few actions □ Yes, a lot of actions

9. Have the interactions with other players allowed you to identify actions to modify the game situation?

□ Yes □ Rather yes □ Rather no □ No

- FORMULATING collective game management rules

During the game, you may have suggested actions or changes to the rest of the group. These proposals could relate to:
- One-time actions or decisions: for example, exchanging a card with a player, lending resources to a player during a turn, etc.
- Long-term actions or decisions: for example, deciding that players must share information on their cards, deciding that the richest players pay higher fines than the poorest players, etc. *The following questions tackle this second type of proposals!*

13.1. Have you thought about and formulated new river management rules during the game?

□ No, never □ Yes, once or twice □ Yes, several times □ Yes, many times

13.2. If so, did you present these management rules to the group during the game?

□ No, never □ Yes, once □ Yes, several times □ Yes, many times

13.3. If "no, never", why (check one or several boxes)?

□ It was not interesting me

□ I did not feel like it

□ I did not have any ideas

□ I preferred to let other players intervene

□ The atmosphere in the group was not propitious to discussion

□ Other : ……

- MANAGEMENT RULES ACCEPTANCE

15. When management rules were formulated, did you validate them?

□ Never □ Seldom □ Sometimes □ Often □ Always

16. Did the rest of the group validate them?

□ Never □ Seldom □ Sometimes □ Often □ Always

17. When one or several management rules were validated, how did you participate and how do you explain your choice (choose one or several answers)?

□ By spontaneously giving my agreement to the group.

□ By giving my agreement after one or several persons in the group asked for it.

□ By voting

□ I was the one who asked the group to validate the rule.

□ I did not want to confront the collective will of the group.

□ I did not wish for rules to be implemented in the game.

□ The rules did not all seem interesting to me.

□ I did not agree with the content of the management rules.

□ I had no intention to respect the rules.

□ I did not participate

□ Other :
……

- MANAGEMENT RULE IMPLEMENTATION

18. Did you apply new management rules during the game (circle the correct answer) ? YES/NO

19. Did you respect all the management rules implemented by the group during the game?

□ Yes, always □ Yes, often □ No, not often □ No, never

- If you answered (4) "Yes, always", explain your choice (one or several answers are possible) :

□ I agreed with all the management rules validated by the group.

□ I did not agree with every rule, but I followed them because they were collectively chosen.

□ I did not agree with every rule but I did not dare to contest the group and provoke a conflict or be stigmatized.

□ I did not agree with every rule but I did not dare cheating.

□ I did not care much or at all about the rules implemented during the game because it is only a game.

□ Other:
……..

- If you did not always respect the rules chosen by the group, why (choose one or several answers)?

□ I wish these rules would have been different.

□ I wanted to win the game and I chose to play in my own way.

□ I did not give importance to the rules implemented in the game because it is only a game.

□ Other :
……

- If you did not respect the management rules, did you openly say or show it to the other players?

□ Yes □ Rather yes □ Rather no □ No

Briefly explain this choice : ……
……
……

20. On a scale from 0 (very bad) to 5 (very good), how would you rate the collective capacity of the group to implement one or several management rules? If you do not know, check the box "I don't know".

0 (très mauvaise) 1 2 3 4 5 (très bonne) □ I don't know.

Briefly explain your answer : ……
……
……
……

- LET'S GO FURTHER

21. During the game, did you mainly try to win? Answer by ticking one box per line in the table below.

	Yes	Rather yes	Rather no	No	I don't kn	TRUE	FALSE
Yes, I wanted to win the game							
Yes, but I also participated in the collective efforts to reach the environmental objectives							
Yes, but I also participated in the collective effort so that everyone would earn wealth and social capital units							
Yes, but I also participated in the collective effort so that players would no find themselves in difficulty in the game							
No, I mainly participated in the collective efforts to reach the environmen goals							
No, I mainly sought for everyone to earn a fair share of wealth and social capital units							
No, I focused so much on the game and the discussions that I did not try t maximize my earnings to win							
Other : ……							

22. Do you think that if you had had more discussion time between every game turns, you would have acted differently?
□ Yes □ Surely □ Maybe □ Maybe not □ Surely not □ No

23. Which of the skills and capacities listed below influenced the most your way of playing and how? Check one box for each line.

	Never	Sometim	Often	Constantly	I don't know

Knowing the real job of the other participants (outside the game					
Knowing the personality of other participants					
Knowing the values and interests of other participants					
Being used to take part in collective work and workshops					
Your empathy, your capacity to put yourself in the shoes of othe players					
Your capacity to anticipate the strategies of other players					
Your capacity to express yourself easily in front of a group					
Your *leadership*					
Your life experience (if so, briefly explain why : ……. ……..)					
Your work experience (if so, state your profession :……)					
Your capacity to mediate and reconcile different points of view, manage conflicts					
Your "winning spirit"					
Your collective spirit					
Other : ……					

24. Let's take the same skills and capacities listed in the table above and apply them to the group of players. Which ones influenced the most the way of playing of other players and how?

	Never	**Sometim**	**Often**	**Constantly**	**I don't know**
Knowing the real job of the other participants (outside the gar					
Knowing the personality of other participants					
Knowing the values and interests of other participants					
Being used to take part in collective work and workshops					
Empathy and capacity to put oneself in the shoes of other play					
Capacity to anticipate the strategies of other players					
Capacity to express oneself easily in front of a group					
Leadership					
Life experiences (if so, briefly explain why : ……. ……..)					
Work experiences (if so, how :……)					
Capacity to mediate and reconcile different points of view, to manage conflicts					
"Winning spirits"					
Collective spirits					
Other : ……					

25. Do you agree with the following statements? Check one box for every statement.

	I do not agre at all	I do not agree	I do not agree n disagree	Agree	Fully agre
A condition for an effective collective management of a water river that every member of the group can express himself or herself.					
A condition for an effective collective management of a water riv is that all members share their vision of the problem and then ma					

a common diagnosis of the situation.					
Une condition à la gestion collective efficace d'une rivière est que le groupe puisse mettre en place ses propres règles de gestion					

28. Finally, concerning the link between the course on IWRM you followed and this game: do you agree with the following statements? Check one answer for each statement.

	I do not agree a all	I do not agree	I do not agree n disagree	Agree	Fully agr
The knowledge gained on IWRM and participation through the course influenced the way I acted during the game					
Group work done during the course influenced how I acted du the game					

26. In which year were you born ?.....

- What is your professional situation ?

□ Retired □ Student □ Professionally active □ Stay-at-home father or mother

□ Not professionally active (unemployed, other…)

- What is/were your profession ?

□ Farmer □ Artisan □ Trader, business manager □ Executive officer, intellectual profession
□ Intermediate profession (eg. Nurse, teacher, etc.) □ Employee □ Worker □ None

You have reached the end of the questionnaire.
Thank you for your contribution !

If you have any questions about the workshop, please write to the following address:

sarah.loudin@irstea.fr

ANNEX VII: STRUCTURE OF THE DEBRIEFING (VII.1: FRENCH; VII.2: ENGLISH).

ANNEX VII.1: STRUCTURE DU DEBRIEFING COLLECTIF

- CAPPWAG-RIVER

- Trame pour le débriefing collectif – version classique (groupes T1, T2, S1, S2, S4 et S5)

1. Récapitulatif : un volontaire pour chaque groupe effectue un récapitulatif du jeu et de la façon dont le groupe a interagi.

2. Identification des points positifs et négatifs de leur gestion par les joueurs eux-mêmes : Selon vous, avez-vous bien géré le bassin versant durant le jeu ?

3. Lien avec la réalité : selon vous, qu'est-ce que vos actions et votre comportement durant le jeu disent de vos actions et votre comportement dans la réalité ?

/!\ Pas d'auto-analyse plus poussée pour l'atelier *ex ante*. Il ne faut pas qu'une réflexion trop poussée sur les objectifs du jeu ait lieu et qu'elle influe ensuite directement le comportement des joueurs lors de l'atelier *ex post*.

- Trame pour le débriefing collectif – version développée (groupe S3)

- 1. Récapitulatif : un volontaire pour chaque groupe effectue un récapitulatif du jeu et de la façon dont le groupe a interagi.

- 2. Identification des points positifs et négatifs de leur gestion par les joueurs eux-mêmes : Selon vous, avez-vous bien géré le bassin versant durant le jeu ?

- 3. Selon vous, tout le monde a-t-il pu s'exprimer comme il le souhaitait durant le jeu ? Pourquoi ? Réponse des joueurs un par un.

- 4. Selon vous, vous êtes-vous entraidé pour identifier ensemble des problèmes et des solutions à mettre en place dans le jeu, ou était-ce plutôt un processus individuel ? Pourquoi ?

- 5. Avez-vous « régulé le système de jeu avec des accords ou des nouvelles règles mises en place ? Si oui, ou si non, pourquoi ?

- 6. Lien avec la réalité : selon vous, qu'est-ce que vos actions et votre comportement durant le jeu dit de vos actions et votre comportement dans la réalité ?

/!\ Pas d'auto-analyse plus poussée pour l'atelier *ex ante*. Il ne faut pas qu'une réflexion trop poussée sur les objectifs du jeu ait lieu et qu'elle influe ensuite directement le comportement des joueurs lors de l'atelier *ex post*.

- CAPPWAG-LAKE

- Structure du débriefing

1. Récapitulatif : un volontaire pour chaque groupe effectue un récapitulatif du jeu et de la façon dont le groupe a interagi.

Petite explication : en vous faisant jouer deux fois avant et après votre cours, on souhaitait voir si ce dernier influence votre façon de jouer et d'agir ensemble. C'est d'ailleurs un des objectifs des ateliers de participation mis en place « en vrai » pour faire participer les usagers et citoyens à la gestion des ressources en eau de leur territoire.

2. Lien avec la réalité : le cours sur la GIRE et les travaux de groupe que vous avez eu à faire ont-ils impacté d'une façon ou d'une autre votre comportement dans le jeu ? Ou pas du tout ?

/!\ Bien expliquer que faute de temps, on ne peut pas aller plus loin sur la question de l'utilité d'un tel jeu dans un cadre évaluatif... Un rapport sera envoyé à tous les étudiants, et ceux qui le souhaitent pourront contacter directement Sarah pour mieux comprendre comment on utilise ce type de jeu pour faire de l'évaluation !

ANNEX VII.2 : STRUCTURE OF THE DEBRIEFING

- CAPPWAG-RIVER

- Structure of the focus group – classical version (Groups T1, T2, S1, S2, S4 and S5)

1. Summary: One volunteer in each group summarizes the game and the way the group interacted.

2. Identification of the positive and negative points concerning their management of the socio-ecosystem by players themselves. Ask the following questions to the group: In your opinion, did you manage the watershed well during the game?

3. Link with reality. Ask the following questions to the group: according to you, what do your actions and behavior during the game tell about your actions and behavior in reality?

/!\ No further self-analysis for the ex ante workshop. It is important not to think too much about the objectives of the game, which could then directly influence the players' behavior during the ex post workshop.

- Structure of the focus group – developed version (Groups S3)

1. Summary: One volunteer in each group summarizes the game and the way the group interacted.

2. Identification of the positive and negative points concerning their management of the socio-ecosystem by players themselves. Ask the following question to the group: In your opinion, did you manage the watershed well during the game?

3. Ask the following question to the group: In your opinion, was everyone able to express himself or herself as he or she wished during the game? Why? Players answer one by one.

4. Ask the following question to the group: In your opinion, did you help each other to identify problems and solutions to implement in the game, or was it rather an individual process? Why?

5. Ask the following question to the group: Have you regulated the game with agreements or new rules that you designed yourselves? Why?

6. Link with reality. Ask the following question to the group: according to you, what do your actions and behaviors during the game tell about your actions and behavior in reality?

/!\ No further self-analysis for the ex ante workshop. It is important not to think too much about the objectives of the game, which could then directly influence the players' behavior during the ex post workshop.

- CAPPWAG-LAKE

- Structure of the focus group

1. Summary: One volunteer in each group summarizes the game and the way the group interacted.

An explanation of the game's objectives for players: we wanted to see how your class influenced the way you played and acted together by making you play twice. One of the objectives of participation workshops set up "in real life" is to involve users and citizens in the management of water resources in their territory.

2. Link with reality: did the IWRM course and the group work you participated in somehow impact your behavior in the game? Or not at all?

/!\ Explain that because of the lack of time, we cannot discuss further the usefulness of such a game in an evaluative framework ... A report will be sent to all students, and those who wish to know more can directly contact Sarah !

ANNEX VIII: INDIVIDUAL INTERVIEWS' GUIDE (VIII.1: FRENCH; VIII.2: ENGLISH).

ANNEXE VIII.1 : TRAME DES ENTRETIENS INDIVIDUELS

Rappel

Retour sur le contexte et le déroulé de l'atelier pour chaque groupe (but du jeu, grandes actions/décisions pendant le jeu, réponses au questionnaire, débriefing collectif)

Questions communes à tous les joueurs :

(1) Lorsque vous avez joué au jeu de rôle CappWag, avez-vous « pris au sérieux » le but du jeu et les problématiques environnementales et sociales (manque d'eau et pollution, partage de l'eau entre usagers-joueurs), ou bien au contraire, avez-vous plutôt gardé à l'esprit que ce n'était qu'un jeu ?

(2) Selon vous, à quel point la façon dont le groupe a travaillé ensemble dans le jeu est représentatif de la façon dont le groupe travaillerait ensemble « dans la vraie vie » ? Pourquoi ?

(3) Selon vous, le cours et le travail de groupe a-t-il eu un impact sur la façon dont les joueurs ont joué durant le jeu ? Pourquoi ?

(4) La façon dont vous avez joué en octobre lors du 1e atelier a-t-elle influencé la façon dont vous avez joué lors du 2e atelier en janvier ? Si oui, comment ?

Questions supplémentaires adaptées à chaque personne interrogée :

En fonction de la qualité des informations collectées sur certains joueurs, des questions spécifiques relatives à leur comportement pendant le jeu peuvent être ajoutées (par exemple, en cas de données contradictoires ou manquantes).

Question pour les participants tunisiens:

(5) Selon vous, est-il possible d'utiliser un jeu de rôle comme CappWag pour évaluer la façon dont des personnes peuvent gérer collectivement une vraie ressource comme l'eau ? Pourquoi ?

ANNEX VIII.2: STRUCTURE OF THE INDIVIDUAL INTERVIEWS

Reminder:

We remind players of the context and the workshop proceedings for each group (objectives of the game, main actions/decisions made during the game, answers to the questionnaire and focus group)

Questions:

(1) When you played the game, did you take seriously the goal of the game and the environmental and social issues at stake (lack of water and pollution, sharing water between users-players)? Or, on the contrary, did you keep in mind that it was only a game?

(2) In your opinion, how much is the way the group worked together in the game representative of how the group would work together in real life? Why ?

(3) In your opinion, did the class and group work have an impact on the way players played the game? Why ?

(4) Did the way you played during the first workshop influence the way you played during the second workshop? If yes, how ?

Additional questions adapted to each interviewee:

Depending on the quality of the information collected on certain players, specific questions adapted to their behavior during the game can be added (e.g. in case of contradictory or missing data)

Additional question for Tunisian participants:

(5) In your opinion, is it possible to use a role-playing game such as CappWag to evaluate how people can collectively manage a real resource such as water? Why ?

ANNEX IX: SUMMARY OF THE NEW MANAGEMENT RULES IMPLEMENTED BY THE SEVEN GROUPS OF PLAYERS DURING THEIR EX ANTE AND (IF EXISTING) EX POST WORKSHOPS.

Group	Workshop	NMR	Scale	Duration	Formalization (explicit/ implicit)	NMR made	NMR implemented
T1	**ex ante**	(1) Transparency	The whole group	Started during the 3rd round, lasted the rest of the game	explicit	yes	yes
		(2) « Associations » formed between two or three players	Three groups of 3, 2 and 2 players	From the 2nd and 3rd round till the last round	explicit	yes	yes
		(3) Merger of the associations into one "river management committee"	The whole group	Decided during the last round but could not materialized before the end of the game	explicit	yes	no
T2	**ex ante**	(1) Transparency	5 players out of 6	Started during the 2nd round, lasted the rest of the game	explicit	yes	yes
S1	**ex ante**	(1) Transparency	The whole group	Beginning unknown – lasted the rest of the game	explicit	yes	yes
	ex post	Ø	Ø	Ø	Ø	Ø	Ø
S2	**ex ante**	(1) Transparency	The whole group	Started during the 2nd round, lasted the rest of the game	explicit	yes	yes
		(2) Polluter pays principle and common funding pot	The whole group	From the 2nd round till 4th round	explicit	yes	yes

	ex post	(1) Transparency	The whole group	Beginning unknown – lasted the rest of the game	explicit	yes	yes
S3	**ex ante**	(1) Transparency	7 players out of 9	From the 2nd round, lasted the rest of the game	explicit	yes	yes
	ex post	(1) Transparency	8 players out of 9	Started during the 5th round, lasted the rest of the game	explicit	yes	yes
S4	**ex ante**	(1) Water quotas	The 4 upstream players	Started during the 2nd round and was abandoned before the end of the game.	explicit	yes	unknown
	ex post	(1) Transparency	5 players out of 6	Started during the 2nd round, lasted the rest of the game	explicit	yes	yes
S5	**ex ante**	Ø	Ø	Ø	Ø	Ø	Ø
	ex post	Ø	Ø	Ø	Ø	Ø	Ø

RESUME LONG (IN FRENCH)

INTRODUCTION

La participation du public à des projets de gestion de ressources naturelles, notamment de ressources en eau, est allée croissante depuis les années 80 ***(European Commission 2003)****. Cette participation peut avoir différents effets sur les participants, comme l'amélioration de la connaissance de leur territoire, des ressources naturelles et des acteurs sur ce territoire, du processus de prise de décisions et de leur contenu final, etc.* ***(Ridder, Mostert, et Wolters 2005)****. L'un de ces effets est le développement des capacités des participants à «*penser, valoriser et agir*»* (Sen 2004c, 11)*, c'est-à-dire le développement de leurs capabilités, tant au niveau individuel que collectif.*

Le développement de ces capabilités peut conduire à l'amélioration des capacités globales de gestion des ressources en eau des participants. En effet, des participants qui auraient accès à des capabilités liées à l'action collective pourraient être plus à même de tirer pleinement parti d'un processus participatif, en fonction de leurs intérêts et de leurs stratégies. De cela pourrait découler une gestion plus durable: avec ces participants exerçant leur pouvoir et décidant d'agir de leur plein gré, pour gérer l'eau ensemble, les décisions prises pourraient avoir plus de chances d'être acceptées et d'être durables dans le temps ***(Johnson 2002; Blomqvist 2004; Barbier et Larrue 2011)****.*

L'évaluation de ces processus participatifs est ainsi cruciale pour déterminer s'ils ont un impact sur ces capabilités, sur les décisions et pratiques des participants et à terme sur leur implication dans le processus de gestion. L'intérêt d'une telle évaluation est aussi d'améliorer les processus participatifs afin qu'ils ciblent spécifiquement les capabilités qui intéressent les participants.

Deux constats sont à la base des questions de recherche qui sont explorées par cette thèse. Le premier est que l'on comprend encore mal la façon dont la participation d'acteurs à un processus de gestion va influencer leur capacité à agir ou leurs intérêts, leurs valeurs en lien avec ces capacités. Le deuxième est qu'il n'y a pas de consensus sur la meilleure façon d'évaluer les processus participatifs de gestion de ressources en eau ou d'opérationnaliser l'approche par les capabilités.

En effet, dans la littérature sur la participation et sur les capabilités, la définition de ce qu'est un processus de participation efficace, des critères d'évaluation les plus appropriés, mais aussi la question de la mesure de capabilités et de leur évolution dans le temps, ne sont pas consensuels ***(International association for public participation - Canada 2016; Barbier et Larrue 2011)****. Ainsi, parmi les outils d'évaluation de processus participatifs existants, nombre se concentrent sur la qualité du processus ou sur ses effets concrets sur la gestion des ressources, plutôt que sur les changements qui vont avoir lieu chez les participants eux-mêmes, ces changements n'étant pas forcément visibles.*

Cela nous conduit à la question de recherche initiale de cette thèse : est-il possible d'utiliser une expérimentation sociale, basée sur un jeu de rôle, comme outil de mesure pour évaluer les impacts sur les participants d'un processus participatif pour la gestion de ressources en eau, cela en termes de capabilités ? Pour mener à bien ces travaux, nous avons identifié deux sous-questions de recherche : (1)

Peut-on mesurer des capabilités individuelles et collectives, liées à l'action collective, au sein d'un groupe de personnes prenant part à ces processus participatifs ?; et (2) peut-on évaluer l'évolution de ces mêmes capabilités au cours du temps, en suivant un protocole d'évaluation ex ante ex post*? Et peut-on évaluer le lien de ces évolutions avec le processus participatif ?*

L'APPROCHE PAR LES CAPABILITES

L'approche par les capabilités a été développée par Sen dès les années 80, comme une alternative au fait d'évaluer le bien-être de personnes uniquement à partir de la mesure de leur revenu ou du niveau d'accumulation de biens matériels. Cette approche se base sur plusieurs concepts (Figure A).

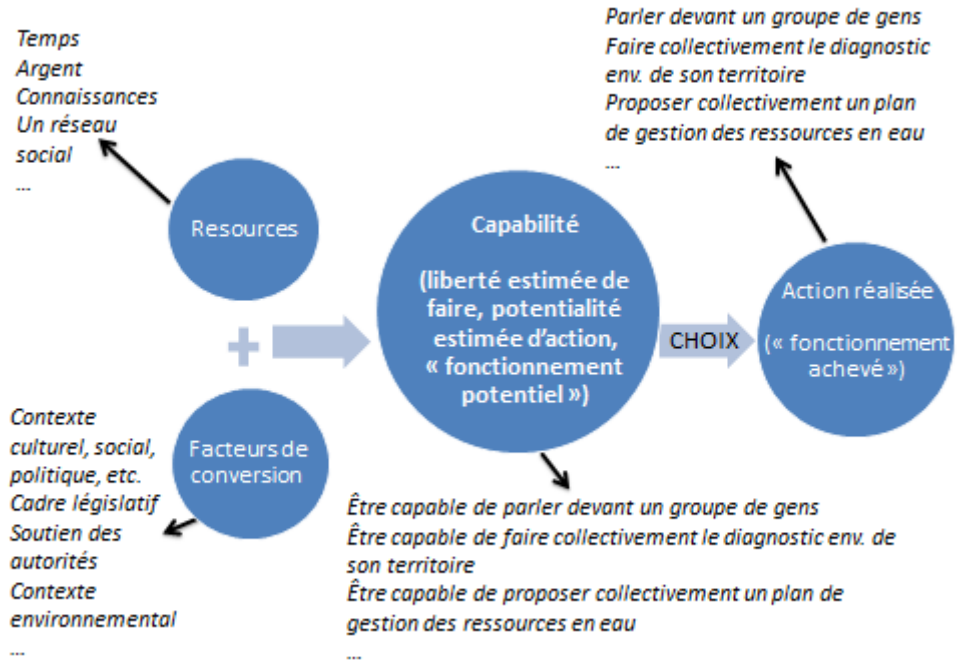


Figure A : Schématisation des principales composantes de l'approche par les capabilités.

Un fonctionnement correspond à une réalisation. Lorsqu'il est achevé, il s'agit d'un "être" ou d'un "faire" auquel une personne accorde de la valeur. Une capabilité est un fonctionnement potentiel, non achevé, c'est-à-dire une liberté de faire ou d'être à laquelle une personne accorde de la valeur. L'agencéité d'une personne va alors correspondre à sa capacité à agir pour réaliser les objectifs qu'elle s'est fixés, selon ses valeurs. Cela pourrait par exemple correspondre à des traits de personnalité, ou à des convictions politiques. Enfin, les capabilités d'une personne vont dépendre de son accès à des ressources et des facteurs de conversion. Ces derniers vont influencer la transformation de ces ressources en capabilités. Les facteurs de conversion peuvent être, par exemple, « personnels" (comme le genre, l'âge, la position sociale de la personne), « sociaux" (comme les normes sociales, les relations de pouvoir dans lesquelles évolue la personne, etc.), ou encore « organisationnels » (comme la présence d'un espace où s'exprimer, d'un

facilitateur qui donnerait lors d'une réunion la parole à ces personnes) ***(Bakhshi et Dubois 2008; Deneulin et Shahani 2009)***.

Si Sen reconnaît l'importance des interactions sociales dans le processus d'acquisition de capabilités, il les envisage à l'échelle individuelle. Pour cela, il a été critiqué dès le début des années 2000 ***(Evans 2002)*** *par des auteurs qui ont développé le concept de capabilités collectives. Une capabilité collective est une capabilité qui est valorisée, développée et atteinte à l'échelle d'un groupe d'individus. A travers l'action collective, un groupe peut réaliser des « être » ou des « faire » qui ne sont pas accessibles à des individus isolés. Les capabilités collectives sont ainsi inhérentes à chaque groupe et émergent des interactions sociales entre les individus, ainsi qu'entre le groupe et son environnement politique, social, économique, etc. Une capabilité collective correspond donc à une opportunité d'action collective à disposition du groupe* ***(Pelenc, Bazile, et Ceruti 2015)***. *Un fonctionnement collectif correspond ainsi à une action collective achevée. Le passage d'une capabilité collective à un fonctionnement collectif dépend là encore de l'agencéité collective du groupe. Cette agencéité collective correspond à la capacité du groupe à définir des objectifs communs et à agir ensemble pour atteindre les objectifs choisis. Elle peut par exemple correspondre à l'accord de tous les individus du groupe sur des valeurs partagées (politiques, religieuses, culturelles, etc.). Ces valeurs, intérêts et objectifs communs vont orienter leurs choix en tant que groupe. Enfin, tout comme à l'échelle individuelle, les capabilités collectives d'un groupe dépendent des ressources et facteurs de conversion que les individus choisissent de partager et de mettre à disposition du groupe.*

Pour opérationnaliser ces concepts, nous avons proposé dans cette thèse de travailler avec six positionnements possibles pour une personne ou un groupe (Figure B). Ces positionnements se basent sur trois dimensions issues de l'approche par les capabilités : le fonctionnement, la capacité à faire ou à être (que nous simplifierons par « capacité à faire » dans les prochaines lignes), en lien avec les ressources et les facteurs de conversion des personnes, et la valeur accordée à cette capacité (qui renvoie à l'agencéité des personnes).

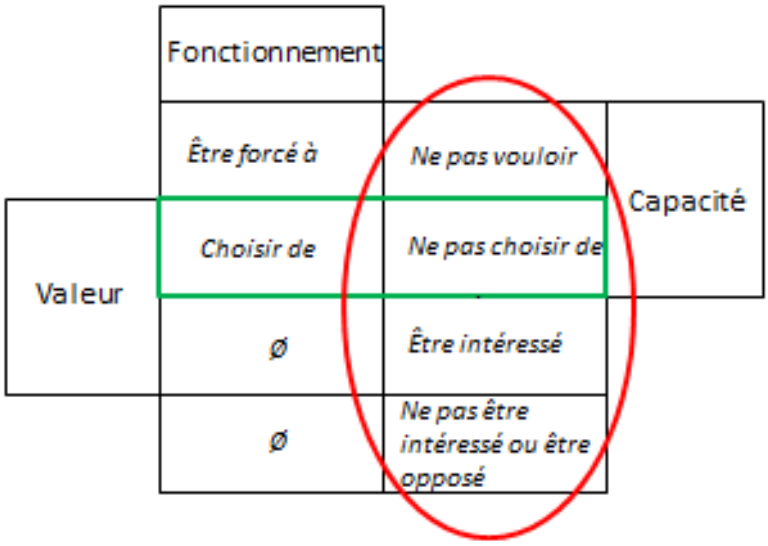


Figure B : Les trois dimensions d'une capabilité et ses six positionnements possibles. Les quatre positionnements qui ne peuvent être observées qu'en utilisant d'autres outils d'évaluation en complément du jeu sont entourées en rouge. En vert sont entourées les deux positionnements qui correspondent à une capabilité.

Du croisement de ces trois dimensions découlent six positionnements : (1) « Être forcé à faire quelque chose » : lorsqu'une réalisation existe mais n'est pas valorisée ; (2) « Choisir de faire quelque chose » : lorsqu'une capacité à faire est valorisée et transformée en fonctionnement ; (3) « Choisir de ne pas faire quelque chose » : lorsqu'une capacité à faire est valorisée mais pas transformée en fonctionnement ; (4) « Ne pas vouloir faire quelque chose » : lorsque la capacité à faire existe bien, mais n'est ni achevée, ni intéressante pour les personnes ; (5) « Être intéressé par "faire quelque chose » : lorsqu'une personne ou un groupe n'a pas de capacité à faire, mais qu'il y accorde de la valeur, nous pouvons supposer un intérêt pour acquérir la capabilité; et peut-être une volonté d'apprendre à posséder la capacité ; (6) « Ne pas être intéressé ou même opposé » à faire quelque chose: dans ce cas-là, une personne ou un groupe de personnes n'accorderait aucune valeur à une capacité à faire qu'elle ne possède de toute façon pas. Cela pourrait être lié à un manque d'intérêt, voire à une opposition envers la capabilité associée. Deux entrées vides complètent le tableau : nous considérons en effet que sans capacité à faire, il ne peut y avoir de faire. Ainsi, ce qui influence le changement de comportement de personnes en termes de fonctionnement sera des changements en termes de capacité ou de valeur.

Si Sen a longtemps affirmé qu'il n'existait pas de capabilités prédéfinies à évaluer et à développer en priorité, d'autres auteurs ont établi des listes de capabilités considérées comme essentielles au bien-être des individus ***(Nussbaum 2003; Sen 2004a)****. Pour notre part, dans cet esprit et dans un souci de comparabilité des résultats inter-individus et inter-groupes, mais aussi pour faciliter la mise en place de l'outil d'évaluation sur le terrain en temps limité, nous avons sélectionné trois capabilités choisies en nous basant sur la littérature des sciences de la participation et des capabilités : (1) une capabilité individuelle: être capable de s'exprimer au sein d'un groupe ; (2) une première capabilité collective : être capable de faire le diagnostic d'une situation de gestion d'un socio-écosystème ; (3) une deuxième capabilité collective : être capable de concevoir et de mettre en place des règles de gestion pour ce même socio-écosystème.*

UNE EXPERIMENTATION SOCIALE BASEE SUR UN JEU DE ROLE POUR EVALUER DES CAPABILITES

Les capabilités sont notoirement difficile à évaluer. Comme principales difficultés, nous citons notamment la mesure de contrefactuels et la dépendance vis-à-vis de préférences exprimées par les personnes dont les capabilités sont évaluées. Alors que ces évaluations se font le plus souvent à partir d'outils quantitatifs ou qualitatifs classiques (comme des enquêtes ou des entretiens individuels), nous explorons l'utilisation d'une expérimentation sociale basée sur un jeu de rôle pour tenter de dépasser ces difficultés.

Une expérimentation sociale consiste traditionnellement à assigner au hasard des personnes à deux types de groupe : des groupes de traitement et des groupes témoin, pour examiner les effets d'une politique sociale. Dans ce cas-là, seuls les groupes de traitement participent au programme évalué. Les deux groupes sont surveillés au fil du temps pour mesurer les différences de comportement. Une expérimentation sociale est contrôlée et suit un protocole précis ***(Anderies et al. 2011)****. L'utilisation d'un jeu de rôle comme outil au centre d'une expérimentation sociale s'appuie elle sur divers corpus littéraires dans lesquels des jeux sérieux ont été développés à des fins expérimentales ou éducatives. C'est*

notamment le cas en économie expérimentale ou dans le domaine des sciences politiques et des sciences de la participation **(Ostrom 2005; Carpenter, List, et Harrison 2005; Morardet, Milhau, et Murgue 2012)**.

L'utilisation d'une expérimentation sociale basée sur un jeu de rôle comme outil d'évaluation est pertinente pour plusieurs raisons. Elle permet la mise en place d'un environnement contrôlé, avec un protocole précis à suivre pour les joueurs et les facilitateurs, ainsi qu'une durée d'évaluation maîtrisée, ce qui simplifie la mise en place sur le terrain. Par ailleurs, un tel format permet le transfert de l'outil d'évaluation d'un groupe de joueur à un autre, d'un cas d'étude à un autre, ainsi que la comparaison des résultats. Enfin, l'utilisation d'un jeu de rôle permet de débattre de la complexité de véritables problèmes socio-environnementaux et, pour l'évaluation, d'agir comme une simulation de gestion de ressources naturelles en plaçant les joueurs dans une situation de gestion réaliste.

Nous considérons que si le jeu reflète un processus participatif réaliste pour la gestion de ressources naturelles, les joueurs vont pouvoir interagir les uns avec les autres comme ils le feraient dans la vraie vie s'ils étaient confrontés à des problèmes similaires **(Daré et Barreteau 2003; Daré 2005)**. *De là découle l'hypothèse de départ de nos recherches selon laquelle il existe un lien étroit entre le comportement des participants dans le contexte du jeu et dans un contexte réel.*

Enfin, il est possible d'associer le jeu à des outils complémentaires pour trianguler les résultats et affiner la mesure. C'est ce qui a notamment été discuté et proposé par deux auteurs italiens (Biggeri et Ferrannini 2014) les seuls à notre connaissance à avoir travaillé avec un jeu pour mesurer des capabilités.

Pour construire notre jeu de rôle, nous nous sommes appuyés sur la plateforme méthodologique Wat-A-Game (WAG) qui regroupe plusieurs outils de participation basés sur des jeux (G. Abrami et al. 2012). *Pour créer notre jeu CAPPWAG, nous nous sommes notamment inspirés d'INI-WAG, un jeu abstrait et simplifié qui n'utilise pas d'éléments spécifiques de langage. A partir d'une situation-type de gestion participative d'une ressource en eau, nous avons ainsi conçu l'expérimentation CappWag. Elle regroupe donc un jeu (à deux versions) et des outils d'évaluation complémentaires. Le processus de conception s'est déroulé sur plusieurs mois, en testant avec de nombreux volontaires, diverses options de jeu et types d'outils de suivi, conservés ou abandonnés selon les résultats des tests.*

Durant un atelier d'évaluation CappWag, les joueurs jouent d'abord au jeu puis ils remplissent un questionnaire, après quoi ils participent à un débriefing collectif. Le facilitateur et les éventuels observateurs assurent le bon remplissage des outils de suivi par les joueurs et font des observations sur leurs comportements durant l'atelier. Le chercheur-évaluateur analyse ensuite les données collectées pour les transformer en une mesure de l'espace de capabilités réelles des joueurs-participants. Pour cela, des éléments externes au processus participatif évalué sont également pris en compte. En effet, ces éléments (par exemple des spécificités contextuelles telles que le contexte culturel, social et politique dans lequel se déroule le processus participatif évalué) peuvent fortement influencer les comportements des joueurs pendant le jeu et sur leurs réponses au questionnaire et discussion pendant le débriefing.

Enfin, notre stratégie d'évaluation est double. L'outil d'évaluation sert à mesurer les capabilités des participants à un moment donné d'un processus participatif. Il doit aussi permettre une évaluation ex ante ex post *et l'identification de l'évolution des trois capabilités des participants au fil du temps. Il doit permettre de tracer leur émergence, leur renforcement ou au contraire leur disparition en cas de tensions ou de conflits. Dans ce cas, l'évaluation est idéalement mise en œuvre deux fois, une fois au début et une fois à la fin d'une période de participation donnée. A la suite de l'évaluation devrait être organisée une*

restitution des résultats aux participants. Nous avons pour cette thèse aussi mené des entretiens individuels avec des participants pour avoir plus d'informations sur certains comportements observés à la suite des ateliers.

Parmi les caractéristiques principales liées à son objectif évaluatif, nous citons le fait que le jeu CAPPWAG permet aux joueurs de discuter ensemble, de délibérer, de réfléchir au fonctionnement complexe du socio-écosystème… s'ils le souhaitent. Il donne la liberté aux joueurs de décider quels sont les meilleurs choix de jeu à faire pour eux individuellement ou pour le collectif. Enfin, l'utilisation de deux versions différentes pour les évaluations ex ante et ex post *doit permettre d'éviter les problèmes de fatigue face au deuxième jeu, mais aussi des apprentissages des règles du jeu qui influenceraient fortement le comportement des joueurs la deuxième fois qu'ils jouent.*

LA MISE EN PLACE DE L'OUTIL CAPPWAG SUR DEUX CAS D'ETUDE

L'atelier d'évaluation CappWag a été mis en place sur deux cas d'étude, qui correspondent à des formations à la participation. Le premier cas d'étude est situé en Tunisie et s'est déroulé dans le cadre du projet PR-OSCAR ***("PR-OSCAR" 2018)****. Pour le projet, un atelier de formation aux méthodes participatives d'une semaine a été organisé dans la ville de Bizerte, fin août 2017. Il consistait à former des fonctionnaires, membres de l'administration tunisienne locale ou nationale, travaillant sur les questions de gestion des ressources en eau, à des méthodes de planification participative. Ces fonctionnaires ont participé à un atelier d'évaluation avec d'autres confrères (ingénieurs ou techniciens) ne suivant pas la formation. Le deuxième cas d'étude se situe en France et a eu lieu avec une cinquantaine d'étudiants de la promotion 2017-2018 du Master 1 Eau, co-habilité par l'Université de Montpellier. Ces étudiants, aux expériences académiques variées, ont suivi un cours sur la gestion intégrée des ressources en eau s'étalant sur trois mois. Durant ce cours, les étudiants ont suivi des cours théoriques en ligne sur des méthodes et outils participatifs et ont travaillé sur des cas pratiques de gestion de bassins versants. L'atelier d'évaluation* ex ante *a eu lieu lors du premier cours de la promotion et l'atelier d'évaluation* ex post *a eu lieu trois mois plus tard et correspondait au dernier cours des étudiants.*

Les fonctionnements achevés (Figure B) sont les seuls aspects d'une capabilité que l'on peut observer, grâce aux observations externes et aux fiches de suivi. Parce que nous nous intéressons aux capabilités, nous nous concentrons aussi sur les fonctionnements potentiels, soit le domaine des libertés non nécessairement réalisées. Ces positionnements sont évaluables grâce aux observations mais aussi aux fiches de suivi, au questionnaire et au débriefing. Grâce au questionnaire, nous évaluons aussi les ressources et facteurs de conversion de chaque joueur, cela indistinctement pour les trois capabilités évaluées.

Au sein du cas d'étude basé en Tunisie, les résultats de l'évaluation ont notamment montré que dans le Groupe T1, trois «associations » de joueurs se sont créées pendant le jeu, puis un « comité de gestion » de la rivière en fin de partie. D'après leurs évaluations, croisées avec les observations des facilitateurs, quatre joueurs possédaient la capabilité à s'exprimer au sein du groupe et deux non ; la capabilité collective « faire et mettre en place des règles de gestion » n'était pas valorisée par tous les joueurs et donc n'existait pas (malgré une capacité effective du groupe bien présente : la règle de transparence des activités a été mise en place pas tout le groupe), tout comme la capabilité collective « diagnostiquer une situation problématique de gestion ». Les principaux ressources et facteurs de conversion mobilisés par les participants étaient : leurs connaissances

de la gestion de l'environnement et de la participation, leurs expériences de travail et leur esprit collectif. Dans le Groupe T2, une dynamique collective a été observée pendant le jeu, malgré des tensions entre joueurs souhaitant gagner la partie et joueurs souhaitant protéger l'environnement. D'après leurs évaluations, croisées avec les observations des facilitateurs, quatre joueurs possédaient la capabilité à s'exprimer au sein du groupe et un non ; la capabilité collective « faire et mettre en place des règles de gestion » existait (la règle de transparence des activités a été mise en place pas cinq joueurs sur six), tout comme la capabilité collective « diagnostiquer une situation problématique de gestion ». Les principaux ressources et facteurs de conversion mobilisés par les participants étaient : leurs connaissances de la gestion de l'environnement, leur empathie et leur esprit collectif.

Des résultats similaires sont disponibles pour les groupes du deuxième cas d'étude, comparables dans le temps grâce à l'évaluation ex ante ex post *menée. En plus de l'évaluation de leurs capabilités, les questionnaires* ex post*, les débriefings et les entretiens individuels ont permis d'interroger auprès des étudiants le lien entre les éventuels changements dans leur comportement et leurs valeurs durant l'atelier* ex post *et leurs liens avec la formation à la participation qu'ils ont suivie. Ces résultats étaient très partagés. Le cours sur la gestion intégrée des ressources en eau autant que la socialisation des étudiants pendant les trois mois de cours (dans d'autres cours et en dehors) ont été cités comme ayant influencé leur comportement lors du deuxième atelier.*

DISCUSSIONS ET CONCLUSION

Ainsi, pour répondre à notre première question de recherche (peut-on mesurer des capabilités individuelles et collectives au sein d'un groupe de personnes prenant part à un processus participatif pour la gestion de ressources en eau ?), nous répondons que cela est possible. En effet, grâce aux informations récoltées via les multiples outils d'évaluation et à la triangulation des données qu'ils permettent, nous pouvons évaluer des capabilités, individuelles et collectives, au sein d'un groupe à un instant donné. Par ailleurs, la méthode d'analyse et de présentation des résultats via des graphiques a été particulièrement appréciée par les participants à qui nous avons pu présenter leurs résultats. Cela constituait pour eux un support de discussion utile. Cependant, cette mesure de capabilités est possible mais un certain nombre de points restent à éclaircir et limitent encore l'interprétation des résultats. Trois ont particulièrement retenus notre attention : (1) Le jeu est finalement un espace contraint pour mesurer trois capabilités. Avec des temps de discussion limités, la plupart des groupes ont mis de côté la réalisation d'un diagnostic du socio-écosystème simulée pour jouer (acheter des cartes, faire des alliances) ou réguler le système. Il est possible que pour cette capabilité, le jeu n'ait pas suffisamment bien servi de support d'évaluation pour confirmer ou contrebalancer les affirmations des joueurs dans leurs fiches d'évaluation. (2) L'utilisation d'un outil participatif comme outil évaluatif peut conduire à impacter, positivement ou négativement, les capabilités que l'on mesure durant l'évaluation Cela n'est pas pris en compte dans l'évaluation, qui est statique (nous posons des questions aux joueurs à la fin du jeu et ne prenons pas en compte les évolutions liées à l'outil pendant l'heure et demie de jeu). En même temps, cette double facette du jeu a aussi été plébiscitée sur le terrain par les joueurs, qui n'ont pas l'impression d'être seulement évalués, mais aussi d'apprendre des choses. (3) Enfin, nous avons évoqué plus tôt la difficulté, malgré nos nombreux efforts, de mettre en place l'outil sur de vrais processus participatifs, avec des participants "non-captifs", c'est-à-dire qui n'ont pas d'incitation externe forte (professionnelle ou académique) à participer.

Pour répondre à notre deuxième question de recherche : "peut-on évaluer l'évolution de ces mêmes capabilités au cours du temps, en suivant un protocole d'évaluation ex ante ex post? Et peut-on évaluer le lien de ces évolutions avec le processus participatif », nous répondrons que cela n'est que partiellement faisable. L'utilisation d'un deuxième jeu de rôle pour l'évaluation ex post *devait permettre de comparer les résultats de deux situations d'action similaires et d'observer les changements potentiels dans les comportements des participants liés au processus participatif intervenu entre les deux ateliers. Ce choix représentait un défi pour la conception car il fallait que CAPPWAG-rivière et CAPPWAG-lac soient suffisamment différents pour éviter un trop fort apprentissage des règles du jeu à cause de la répétition de deux jeux, mais suffisamment proches pour permettre la comparaison des comportements.*

Hors les résultats de l'évaluation ex post *ont montré qu'il n'était pas tout à fait possible de séparer l'influence de la formation à la participation suivie par les étudiants de l'influence de l'outil. Des joueurs ont notamment évoqué un design à la fois encore trop similaire entre les jeux (avec donc un fort effet d'apprentissage des règles entre les deux jeux), ou sinon au contraire, trop différents. Enfin, nous a été rapportée une certaine fatigue face à un deuxième jeu à jouer.*

Pour conclure, les expérimentations CappWag « rivière » et CappWag « lac », si pris séparément, peuvent servir de support pour la mesure de capabilités à un moment donné. C'est là où se trouve l'apport de ce travail de recherche au domaine de l'évaluation de capabilités. C'est un avantage pour l'évaluateur de pouvoir comparer l'auto-évaluation des personnes évaluées avec leurs véritables actions en situation de simulation. Cependant, lorsque ces deux ateliers sont mis en œuvre l'un après l'autre selon notre protocole ex ante ex post*, les résultats doivent être interprétés avec beaucoup plus de prudence. Ainsi, ce travail de recherche constitue à la fois un premier pas vers le développement d'outils d'évaluation qui mesurent des libertés de faire non réalisées ; plutôt que des réalisations ; mais aussi vers le développement d'outils d'évaluation basés sur la comparaison entre auto-évaluation et test de groupe « en présentiel ».*

ABSTRACT

Title: Can we use social experiment to assess the impact of participatory processes for water management? Studying a generic method tackling the evaluation of capabilities.

Keywords: capability approach, collective capabilities, monitoring and evaluation, social experiment, participatory water management.

Abstract: *The involvement of people in decision-making processes concerning the management of their natural resources has been largely promoted by institutional actors, from national to international scale. Its evaluation is important to determine its effectiveness and support governance. That is why we proposed in this thesis to develop an evaluation tool of the impacts of public participation through time on people and groups of people. To do this, we explore the use of a social experiment to perform this task, and focus on the capabilities of people, that is to say their valued freedoms of being and doing. Hence, the main research question of this thesis is the following: is it possible to use a social experiment based on a role-playing game to evaluate the impact of participatory processes for water management on its participants?*

We focused on three capabilities related to important states of being and action in the field of participatory decision-making for water resource management: being able as an individual to express oneself in a determined social context; being able to collectively make the diagnosis of a problematic situation; and being able to collectively make rules to manage a socio-ecosystem and implement them.

We designed the CappWag experiment, a mixed-method evaluation tool based on an ad hoc role-playing game called CAPPWAG (divided in an ex ante version, CAPPWAG-RIVER, and an ex post version, CAPPWAG-LAKE), a questionnaire and a collective debriefing. We implemented the CappWag experiment on two case studies: a one-time evaluation of capabilities in Tunisia through the PR-OSCAR project, and an ex ante ex post evaluation in France with first-year Water Master's students taking part in a course on Integrated water resource management. The results showed that the capabilities evaluated in the twelve groups of players varied greatly in terms of existence and strength. In the Master's case study, the evolution of the three capabilities in the three-month span of the IWRM course was just as diverse and despite our expectations, they did not always increase, and sometimes even decreased. The methodology we used to analyze the data proved to be an interesting compromise between the collection and treatment of the data and the precision of the final results delivered to researchers, but also practitioners and participants. The evaluation of a collective capability was the most difficult part of the analyses, because of the multiple group configuration that can take place during a workshop. Despite the efforts undertaken to make the evaluation tool as appealing as possible to participants and practitioners, its inclusion within participatory processes could still be improved, in order to ensure its double implementation (ex ante and ex post). The capability approach that serves as a conceptual framework in this research does presents strong assets to capture the motivations, interests and capacities of participants in terms of water resource management and collective action. In order to be even more useful to practitioners and participants, our evaluation tool would benefit from the collection and treatment of additional information concerning people's involvement in the real-life evaluated participatory process or training and to the events and social dynamics taking place outside of the evaluation tool.

RESUME (IN FRENCH)

Titre : Peut-on évaluer expérimentalement l'impact des processus participatifs en gestion de l'eau ? Etude d'une méthode générique ciblant l'évaluation de capabilités.

Mots-clés : approche par les capabilités, capabilités collectives, suivi-évaluation, expérimentation sociale, gestion participative de l'eau.

Résumé : *L'implication des populations dans les processus de décision concernant la gestion de leurs ressources naturelles a été encouragée par les acteurs institutionnels, de l'échelle nationale à l'échelle internationale. L'évaluation de ces processus est importante pour déterminer leur efficacité et renforcer leur gouvernance. C'est pourquoi nous avons proposé avec cette thèse de développer un outil d'évaluation des impacts des processus participatifs dans le temps sur les personnes y prenant part. Pour ce faire, nous explorons l'utilisation d'une expérimentation sociale et nous nous concentrons sur les capabilités des participant·e·s, c'est-à-dire leurs libertés d'être et de faire auxquelles ils accordent de la valeur. Ainsi, la principale question de recherche de cette thèse est la suivante : est-il possible d'utiliser une expérimentation sociale basée sur un jeu de rôle pour évaluer l'impact des processus participatifs pour la gestion de l'eau sur leurs participant·e·s ?*

Nous nous sommes concentrés sur trois capabilités liées à la prise de décisions participative dans le domaine de la gestion des ressources en eau : être capable de s'exprimer dans un contexte social déterminé ; être capable de faire collectivement le diagnostic d'une situation problématique ; et être capable de collectivement établir des règles pour gérer un socio-écosystème et de les mettre en œuvre.

Nous avons conçu l'expérimentation CappWag, un outil d'évaluation mixte reposant sur un jeu de rôle ad hoc appelé CAPPWAG (divisé en une version ex ante, CAPPWAG-RIVIERE, et une version ex post, CAPPWAG-LAC), un questionnaire et un débriefing collectif. Nous avons mis en œuvre l'expérience CappWag sur deux études de cas : une unique évaluation de capabilités en Tunisie dans le cadre du projet PR-OSCAR ; et une évaluation ex ante ex post en France avec des étudiant·e·s de première année de Master participant à un cours de trois mois sur la gestion intégrée des ressources en eau. Les résultats ont montré que les capabilités évaluées dans les douze groupes de participant·e·s variaient considérablement en termes d'existence et de développement. Dans le cas du Master Eau, l'évolution des trois capabilités au cours des trois mois de cours était tout aussi diverse. Elles n'ont en effet pas toujours augmenté et parfois même diminué. La méthodologie que nous avons utilisée pour analyser les données s'est avérée être un compromis intéressant entre la collecte et le traitement des données et la précision des résultats finaux fournis aux chercheurs, mais également aux praticiens et aux participants. L'évaluation des capabilités collectives a été la partie la plus difficile des analyses, en raison des multiples configurations possibles de groupes qui peuvent avoir lieu pendant un atelier. Malgré les efforts entrepris pour rendre l'outil d'évaluation aussi attrayant que possible pour les participant·e·s et les praticien·ne·s, son inclusion dans de vraies processus participatifs pourrait encore être améliorée, afin de garantir sa double mise en œuvre (ex ante et ex post). L'approche par les capabilités qui sert de cadre conceptuel à cette thèse présente de solides atouts pour saisir les motivations, les intérêts et les capacités des participant·e·s en termes de gestion des ressources en eau et d'action collective. Afin d'être encore plus utile aux praticien·ne·s et aux participant·e·s, notre outil d'évaluation tirerait profit de la collecte et du traitement d'informations supplémentaires concernant la participation des personnes au processus participatif ou à la formation évalués dans la vie réelle, ainsi qu'aux événements et aux dynamiques sociales s'y déroulant.