

# Artifacts to support knowledge legitimation in multi-stakeholders initiatives

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## 1 Multi-Stakeholders Initiatives for Natural Resources Management

Multi-Stakeholders Initiatives (MSI) for Natural Resources Management (NRM), between several challenges, need to deal with uncertainty and biological and social dynamics. One way to engage participants of MSI in joint decision and collective action to improve NRM is to accompany them to build trust between themselves, to exchange their specific knowledge. To reach this aim we consider that each participant needs to consider the others as legitimate to discuss with and to produce joint decision and collective action. But how is legitimation process built in a group of multiple actors? In this paper we suggest that artifacts used or produced within a participatory process or a MSI, are convenient tools to reveal legitimation processes in action.

Natural resource management situations, such as fisheries, biodiversity management and water management have been studied for decades. One way to address these questions is to consider them as complex socioecosystems. A solution to deal with this complexity is the involvement of multiple actors in the management of the common good (Dietz, Ostrom, & Stern, 2003) in question. Multi-stakeholder initiatives and participatory processes may be seen as operational attempts to face these challenges. They are expected to contribute to building a common understanding of the issues participants share and a better dissemination of this understanding. Once a shared understanding of the issue has been reached, MSI may lead, through negotiation (Leeuwis, 2000) to more robust management systems. In some cases, MSI promoters may hold enough power to enforce the rules and action plans negotiated together. But situations arise when no such central power exist. Most MSI are created in such cases where co-management and collective actions are recommended in theory but do not happen in practice as centrally-discussed rules are not followed. Many reasons may lead actors not to follow a rule. And many reasons may also lead them to follow it, to internalize it until it becomes an implicit norm. In this paper, we suggest that legitimacy may be used as a symbolic asset to draw the basis of adaptive co-management of natural resources.

Weber remains the main author to address legitimacy and relations between legitimacy and power.. . His first definition of legitimacy he suggests is of a socially constructed “horizon of meaning” that allows actors to frame their decisions and actions and make sense out of it (Corcuff & Lafaye, 1996). Building on this definition, we used (Thevenot & Boltanski, 1991) work on economies of worth to suggest that legitimacy may be socially granted to an object, an information, a proposal or a person depending on the outcome of a “test of worth”. During such a test, people evaluating the object make use of their knowledge, ways of knowing and cognitive frameworks to study the properties of the object and assess what it is worth to them. The outcome of such a test of worth is that the object is granted a value relative to a socially accepted order of worth. Once it has been “tested”, it may be stored among other similar objects and re-used to evaluate other

objects. This test of worth both contributes to the legitimation of the object and of the different material and cognitive tools used to evaluate it.

There is however no universal order to evaluate whether an action, decision or situation is better or worse than another. Thevenot and Boltanski initial work covered 6 different and independent orders of worthiness in France. (Lafaye & Thevenot, 2006) □ then considered a 7th order based on ecological properties. Within a MSI, representatives of different stakeholders groups are likely not to share the same evaluation schemes and sets of preferred worth. Some will attach a great importance on equity and fairness. Other will promote efficiency or protection of cultural heritage and traditions. To jointly evaluate an object, a proposal, a situation requires that participants explicit their preferences, values and evaluation schemes, then negotiate to forge a common evaluation scheme, based on unstable, vague yet consensual compromise. Building such compromises between systems of values held by the different groups is one of the expected outcomes of MSI. Jointly challenging objects may contribute to such learning process.

Assuming legitimacy is a relevant asset to support joint decision and collective action in MSI, it is of high interest to better understand the different legitimation processes in action. To do so, we focus in this paper on “tests of worth” faced by artifacts built to support MSI we studied. We suggest artifacts are convenient tools to reveal legitimation processes in action. (Bessy & Chateauraynaud, 1995) □ have studied such situations when individuals meet things and have to qualify the thing's properties to assess its identity and value. Their observations range from the war between luxury firms and pirates, auctioneers and suspicious objects, rubbish recycling and art expertise. They suggest that when evaluating an unknown thing, people tend to gather different cognitive and sensual skills to tie the new thing to known objects, practices, concepts and experiences. Such skills cannot be easily explained but can resurface when qualification is not obvious and minor details raise controversies. Following Bessy and Chateauraynaud, we are going to focus on the incidents, debates and controversies that may occur during artifacts tests to grasp insights of the legitimation processes. We will then try to conclude on some recommendations on how artifacts construction and handling may improve MSI legitimation.

## **2 MSI in practice: Materiality, places, artifacts**

When observed in practice, MSI, as most participatory processes are grounded in a very material world. The two case studies discussed here were initiated to solve very material problems. In the first case, a conflict opposing two villages focused on a bag of sand obstructing an irrigation channel. In the second case, piles of green waste that take fire spontaneously, poultry liver and pig shit vanishing and expensive bags of chemical fertilizer led some people who did not interact together previously start considering joint decisions and collective action.

Resources managed are not isolated from the world but are located in sociotechnical contexts. In both cases, high mountains, steep slopes create specific constraints to be taken into account. Practical management of these resources involves the use of agricultural tools, irrigation channels made of mud or concrete in the first case, trucks, shovels, storing locations and biochemical analysis labs in the second.

MSI considered as participatory processes take the form of a series of meetings, workshops or

conferences, supported by venues, participants lists, program, transportation, conference rooms, carts loaded with coffee, tea and orange juice. Pictures are taken and uploaded to websites. Badges with names, companies and qualities on it identify participants. Most of these objects are revealed when problems arise: a microphone without battery, a mistyped name on a guest list, a cable missing to connect a laptop to the projector.

The objects we are discussing here are conceived to bring the materiality of the natural resource management issue into the conference room. They are the “content” of workshop. They are meant to convey explicit knowledge of the situation to the negotiation arenas. The list of usual material used includes paper and digital files. If the use of text remains significant, other graphical grammars such as diagrams, maps and charts are often used to provide a “more” understandable information.

Usual criticism of these artifacts conveying “content” is that they require specific skills to be understood, and even more specific skills to be produced. A first syntactic boundary to cross is the ability to read, to be comfortable with the language used and the vocabulary used. A second semantic boundary to access these artifacts is the capacity to decipher the diagrams, schemes, maps and other graphical representations. Using vertical bars to represent a flow of water is not obvious. Linking a box with written “villagers” on it to a group of folks neither. A third boundary to the use of these artifacts is that they embody implicit representations of the individuals that produced them and limit the different forms of knowledge to be discussed only to what can be transformed into an explicit form (Carlile, 2002)□. Implicit knowledge that cannot be measured, such as feelings and expectations, things that cannot be described with words such as experience and know-how may require other way to be shared (Nonaka, 1994)□. There is a risk that the use of those artifacts to support MSI workshops may reinforce scientific symbolic domination, creating an invisible but significant bias in the dialogue MSI try to achieve.

Other artifacts attempt to display a representation of reality that relies on other senses. Samples, models and prototypes, but also pictures and videos provide other ways to express someone's understanding of the situation, of the problem, of options. MSI Experiments have been conducted based on photographs taken by local stakeholders. In Latin America, following the basis of P. Freire or A. Boal, the use of small plays by actors are used to provide alternative communication media. Finally, the role playing games (RPG) we are about to introduce were conceived as an experimental attempt provide participants of MSI workshops with dynamic representations of the issue. Preliminary surveys and participatory modeling provided a broad understanding of the issue to be discussed. Scientific knowledge such on biophysical and socio-economic dynamics, where used to create a simplified multi-agent model. The modelers involved used a very simplified subset of this knowledge to produce games made of items, board games, player roles, rules, scores and debriefing guidelines. The games produced have no ambition to provide players with a comprehensive “virtual world” but to set in motion an “experience” through which they may learn more about their real world seen through the magnifying lenses of the modelers.

Building on observation of the gaming sessions organized during two participatory processes in Bhutan and La Réunion, we will now attempt to better understand how such artifacts contribute to legitimation processes in the process. How does the handling of such artifacts allow players to evaluate their value? What are the skills mobilized to do so and how can we render such process?

### **3 Cases studies: role-playing games co-construction in Bhutan and La Réunion**

#### **Mediating an irrigation water conflict in Lingmuteychu watershed in Bhutan**

Bhutan, a small kingdom in the Himalaya, remains a predominately agrarian nation with over 80 % of the population (about 750,000) relying on small-farm agriculture for household. The main crop is rice, cultivated on terraces. Control of irrigation water is of paramount importance for this activity, as terraces must be drawn for transplantation of the plants early enough to harvest before winter comes.

Lingmuteychu watershed is a small valley located in the vicinity of the local research center of the city of Bajo. Age-old local arrangements on water control have notoriously resulted in recurring conflicts between villages. According to an age-old rule, the Tchokpa of the highest village, Limbukha should release half of the flow of the Lingmuteychu stream on the 10th day of the 5th month to allow the next village, Dompola, to start transplantation. Within each village, water is shared according to the social rank of farmers.

From 2003 to 2005, an ambitious research program was conducted in collaboration with a European research institute to facilitate this conflict resolution and attempt to set up a watershed management institution. After a preliminary survey of the agricultural activity in the watershed, 3 workshops were organized in May 2003, December 2003 and April 2005. These workshops were organized by the Bhutanese researchers and role-playing games were used as mediating objects to facilitate the dialogue among villagers and between villagers, scientists and officials. (Gurung, Bousquet, & Trébuil, 2006).

Legitimation of the participatory process did combine several orders of legitimacy". Bhutanese researchers had been asked to work on this topic by the Ministry of Agriculture and the research project was funded by the European Union. A Water Management Law was being drafted in Timphu. Water sharing conflict resolution methodologies was therefore an important and legitimate concern for the Bajo research center which was expected to use the Lingmuteychu experiment as a pilot site to draft recommended water-sharing policies. The water-sharing conflict was defined by the Bhutanese administration as conflict between age-old traditions and modernity. Maintaining cultural heritage and traditions was an important concern as existing arrangements could not be condemned. As a result, the research project received institutional, scientific and operational legitimacy. Such assets were carefully maintained by the project manager who kept inviting officials to workshops, respected traditional ceremonies to open and close meetings and maintained a good quality of scientific production.

Three successive versions of the same role-playing games were used. The core idea of these games was to represent on a board a grid composed of farm plots. Irrigation water was represented by tokens. To cultivate a plot, a farmer had to place a water-token on a plot. A plot cultivated generated a revenue. The number of water-tokens available depended on the rainfall, a random variable, and on existing water-sharing rules. Building on this simple mechanism, several sets of rules were played successively to discuss under which conditions irrigation water could be exchanged : Without communication among villages, with communication and finally with farmers from each village swapping their places. A monitoring protocol was set to record players actions

and two debriefings were performed, individuals then collective to evaluate the distance between real activities and simulated ones. Comments, critics and suggestions were re-used to the next versions of the game.

The first RPG had been designed by Bhutanese and French scientists to facilitate discussions on water sharing among members of a same village. It was played by two groups of representatives of the two villages involved in the conflict. The game board was a paperboard nailed on a wall and both water and crops were represented as colored cards. The number of “water cards” depended on the social rank of the farmer. During this first gaming session, players suggested water could be traded for labor or cash. This suggestion was included in the second version of the RPG, played 6 months later. The workshop ended with two collective decisions. One was that the higher village should release water 5 days earlier (decision that will not be respected as no paper was signed), the other to extend the process to the entire watershed composed of 7 villages.

The third RPG was played 18 months later. The workshop has been carefully prepared to facilitate the creation of a Watershed Management Comitee. 3 representatives of each of the 7 villages of the watershed played the game. Government representatives and development workers were invited as observers. This third game had been adapted to take into account players remarks. It did not implement social ranking and intermediary crops anymore. The physical tools used were not made of paper anymore but re-used a traditional wooden board game. Playing space was used to represent the watershed with 7 boards aligned from the upstream village to the downstream one. The number of water card given to each village depended on the simulated rainfall and on the position of the village in the watershed in order to reproduce the inequitable sharing of water. A reward was granted to the entire watershed depending on the number of plots receiving too much water. See (Gurung et al., 2006) for a detailed description of this process.

The reason why it is used in this paper is because the whole participatory process timeline is covered, from the initial demand to the final institutional arrangement.

### **Framing a collective reflexion on large scale organic fertilizer production in La Réunion**

La Réunion is a small high tropical island of the Indian Ocean.. Steep slopes and logistical difficulties are significant constraints to human activities in highlands. The island is quite heavily populated and most of its population concentrates by the coast. One of the problems caused by this pressure is waste management. Over the past few years, several types of wastes have seen their elimination process challenged:

- An intensive livestock industry has been developed in the 80s to provide economic development in the highlands. Elimination of pig and poultry manure is a raising concern, due both to an increase of the amount produced and to tighter European regulations;
- Rapid urbanization and a firm gardening tradition in tropical climate generates significant amounts of green waste whose treatment is not effective;
- A recent upgrade of the island water treatment facilities results in the need to eliminate growing amounts of sewage sludge;

In 2010, the Girovar project (Integrated agricultural recycling of organic matters in the West of La Réunion) was initiated to promote a joint exploration of integrated management scenarios. Partners to this project are the main producers of organic matters (urban and livestock), agriculture research and development institutions, local fertilizers distributors and farmers cooperatives. The main ideas of the project were to favor a participatory process involving stakeholders in order to promote mutual understanding, to address the issue starting with the agricultural “demand” of soil amendment instead of focusing on the “offer” of organic matters and finally to use the co-construction and evaluation of scenarios as the backbone of the process.

Legitimation of the participatory process is conceived to combine several orders of legitimacy. Institutional legitimacy of the participatory process is based on the partnership that includes institutions which have been working on this issue for a long time. A steering committee is led by a highly ranked civil servant and elected politicians. A website, a logo and communication leaflets contribute to establish this project as something that matters. Technical legitimacy of the participatory process is sought through high quality scientific data and the association of acknowledged technical experts during scenario design phases. An empirical legitimacy stage of the participatory process is coming from participatory workshops during which representatives of 12 stakeholder groups are invited to contribute to the initial diagnosis and action plan and to the validation of technical intermediary results. Finally, social legitimacy is also taken into account through providing workshop participants opportunities to meet, discuss freely and exchange information.

The “Fetaferi” game also uses the gaming space to represent the geographic distribution of farms, vegetable growers and sugar-cane planters. Organic matters and fertilizers are represented by colored cards. Farming plots are represented by boxes drawn on cardboard paper boxes, each box representing a farm. Each turn, organic matters producers have to get rid of their colored cards. Farmers get cards and use them as fertilizers on their plots. Fertilizing spending and regulation infringements are monitored. The underlying model is based on the outcome of a first participatory workshop held in 2011 during which companion modeling techniques were used to frame a shared representation of the situation and to try to frame a common problem.

A first gaming session was organized in June 2012. Two scenarios were played, the second introducing a recycling station that produces an organic fertilizer out of organic wastes in order to explore social acceptability and to discuss management rules of such a station. Players' comments insisted on logistical costs being supported by the station customers. During individual monitoring, farmers complained that the game did not allow the use of fertilizer 6 months after planting and that the return on investment of fertilization spending was not provided.

In this second case study, one of the authors is directly involved in the design process of the RPGA. A total of 4 observers were involved in the first gaming session observation, then in both collective and individual debriefings. This second case study is still in process. The monitoring system set on this participatory process draws on a first assessment of the boundary work in action in Bhutan (Queste, Bousquet, Gurung, & Trebil, 2010). We expect to improve our understanding of legitimation processes in action using this case study.

## 4 RPGs and legitimation processes

Building on these two case studies, we have been trying to understand how these RPGs and gaming sessions could contribute to legitimation processes during the participatory workshops and between two such events?

### Gaming sessions to test the worthiness of the model

In both case studies, the use of RPG aimed two objectives, (i) to express the scientists representation of the issue discussed in a more understandable way and (ii) to provide an opportunity to explicit the players own representation of the issue. The models used to construct RPGs already merge both theoretical scientific knowledge and “empiric” knowledge such as farm types, average revenues and practices. Scientific knowledge relies on peer-reviewed publications, books and scientific community consensus to assess their reliability. But even when considered very reliable, this type of knowledge may end-up not being considered relevant and useful for decision making and action by stakeholders. Field data are collected through on-field investigation, preliminary investigations and surveys. They rely on methodologies, personal investigation skills and expertise for reliability. Because of operational constraints, this knowledge may be less reliable but more relevant. These two forms of knowledge are combined in RPGs and tested by players.

Players were representatives of stakeholders groups asked to play their own role in the RPG in the two case studies. The RPG proposed were based on a simplified model of the issue discussed, perceived and designed by a team of scientists and modelers. At this point, it shall be made clear that no player confuses the “real” world with the “virtual” one. (Daré, 2005) has investigated the difference between practices, decisions and actions during a game and in real life to conclude that if playing strategies are built using empirical knowledge of the “real world”, they also take into account the very specific context of both the workshop, the negotiation arena and the participatory process. This said, playing the game led to individual and collective manipulation of the simulated environment. Players were set in a situation where they were asked to perform actions, take decisions and develop strategies. Doing so, they did mobilize different forms of enacted knowledge. At the beginning of the game, most players just followed instructions and copied other players’ actions. But in both cases, at some points, discussions have arisen about details of the model, inappropriate rules or surprising results of simulated dynamics. Following Bessy and Chateauraynaud recommendations, we are going to focus not on similarities between the model and the real world but on differences, controversies and discussions noticed and discussed during the gaming session.

- In Bhutan, despite recommendations, a farmer kept on over-flooding its virtual plots with 2 “water-cards”. Asked why, he explained that his casual practice was to over-flood his plots. “More water is better”. Scientific theory is that there is an optimal amount of water to flood a plot of rice. Spending more water than necessary is wasting water. But in practice, farmers use more water to reduce risks of incidents such as leaks, miscalculation or fraud. As in well documented bureaucratic situations, not using their water share during wet years could also lead to a reduction of their share, endangering their crops during dry years. In this

example, the farmer did mobilize empirical knowledge on the real water sharing issue to take decisions during the gaming session. During the discussion, he did legitimate the concept proposed by the scientists that there exist an optimal volume of water to be used to flood a plot of rice. He did also legitimate the fact that other concerns such as water irrigation system reliability and long-term water rights are issues to be considered.

- In La Réunion, the RPG included a model of sugar-cane fertilization schemes. Sugar cane plots are supposed to be planted every 10 years to maintain a high productivity. Fertilizer is then used before plantation. When re-plantation is done too late, a rotation is lost and the first harvest takes place only 18 months later. During the game, farmers complained that in such case, the rules proposed did not allow them to fertilize twice in such situations. Here again, asked to simulate existing practices, the farmers were able to compare the agronomic rules they use and the model proposed by the scientists. In real life, they tend to fertilize all plots at the same time, whether it has been replanted or not. Pointing out this mistake did improve the legitimation of the agronomic model used, once corrected by local experts.
- A last example of test of worth also originates from La Réunion. Colored cards were used to represent the optimal amount of organic fertilizing matter to be used on a plot. When later referring to these cards, farmers named them “coupons” and were comfortable trading cards for money, storing them and spreading them on plots. In La Réunion, a system of coupons is used to trade sugar refineries residues. When delivering his crop to the refinery, sugarcane farmers are granted a coupon to be traded for as much as 6% of the total mass of cane delivered. An informal market allows vegetable farmers to buy such coupons and access to this valued fertilizer. In this example, the game cards were associated to the material supports of an existing informal market. Doing so, the scientific concept that such matters can be traded is legitimized by the existing informal market.

These “incidents” provided glimpses of the activities done by workshops participants to try to make sense out of colored cards, wooden cubes and simulated crops. When placed in acting situations, participants use enacted empirical knowledge to assess the different parts of the RPG. This empirical knowledge may rely on practical rules in use, decision scheme or comparison to existing similar artifacts. Referring to Bessy and Chateauraynaud's framework, the gaming session is an opportunity to explore the folds and details of the proposed representation, to evaluate the artifact and to provide a detailed expertise of the different forms of knowledge it embodies. The cognitive resources used include a sensual experience of the gaming session and a qualification activity to link each part of the RPG to the knowledge of the players. This knowledge includes explicit information, but also empirical practices, past experiences, anticipation of possible futures and a catalog of similar artifacts to compare to.

The outcome of the gaming session is a precise evaluation of the model by the participants using their own ways of knowing. Several forms of knowledge are being combined to improve the quality of the test of worth performed. In both cases, the evaluation contributed to legitimate the models as worthy representations of the issue according to the players. Scientific explicit information used to build it was acknowledged as both accurate enough, compatible with past experiences and current practices and useful in order to solve the issue discussed: The existence of an optimal amount of water to flood a plot of rice in Bhutan, the predicted fertilizing power of organic matters once transformed through compost in La Réunion were acknowledged by stakeholders representatives.

Empiric knowledge used to design the model was also acknowledged as scientifically acceptable and relevant to solve the issue: The unequal distribution of water among Bhutanese villages, the existing transactions of organic matters in La Réunion.

During this test, a third form of knowledge is used and legitimized: Players skills and enacted knowledge come into play, as players are placed in a situation where they are required to use their knowledge to act, decide and develop strategies: In Bhutan, the flooding strategy meant to secure both this year harvest and future rights to water; in La Réunion, the existing fertilizing practices are both made explicit during the game.

### **Joint expertise and material compromise**

We consider the gaming sessions as tests that allow workshops participants to invest implicit knowledge, experience and other forms of expertise to assess the worthiness of the underlying model. The outcome of this exercise includes a review of the model, impressions, comments and suggestions of improvements by the players. This information is both collected during the gaming session and after through individual and collective debriefing. But there is more.

Discussions on controversial rules during the game and ex-post debriefing are opportunities for participants to explicit and share their preferences, the way they evaluate both the reliability and the relevance of some elements of the RPG considering the issue being discussed.

In Bhutan, (Queste et al., 2010) underlined the translation across semantic boundaries operated by the RPGs: At the end of the gaming session, a set of indicators is calculated to illustrate players performance: Revenue, amount of water used, shared and wasted, number of unused plots. During the debriefing, scientists insisted on the global revenue to insist on the benefits of collective actions. Representatives from the lower-stream village used the difference of revenue among villages to insist on equitable rules of water sharing. Representatives of the upper-stream village noted the difference of revenue between years of high and low rainfall to suggest that the central issue to be addressed is not to share water but to increase the amount of available water by renovating the irrigation system and performing collective prayers. The latter proposal was accepted as a compromise by the different stakeholders, scientists and institutional included.

In La Réunion, a first participatory workshop done in 2011 had been organized to co-construct a shared understanding of the common problem to be solved. The central issue was the sub-optimal recycling of organic matter. During the gaming session, sugar cane planters were given the number of tons of sugar cane produced on each plot as an output of the fertilization they had performed. During individual debriefing, a majority of the farmers asked to be provided with the annual net margin at farm level, as they develop strategies to maximize their revenue, not their production. Breeders revenue was not displayed. Blue cards were distributed each time a control revealed an infraction to the regulation but no monetary value was associated. Breeders confirmed that if money was a serious issue, their main motivation was to avoid embarrassing situations and to anticipate tightening regulations to come in the future.

RPG debriefing offers an opportunity to instantiate a reflexive analysis of the stakeholders systems of value. Negotiation may then lead the assembly of participants to adopt a compromise between these systems. Maximizing the amount of water at watershed level in Bhutan is a sound example.

In La Réunion, finding a compromise between maximizing farmers' revenues, minimizing breeders' infringements and exploring scenarios that are innovative and exciting enough to get published is still a task to be done. In both cases, RPGs did contribute to explicit and provide material support to the collective exploration of systems of value. This information may be used to legitimate the participatory process toward each group of stakeholder by adapting its objectives to address precisely the problems expressed by the stakeholders representatives and by endorsing their systems of values. Such adaptation requires however that the institutional frame of the participatory process and its governance allows an iterative evolution of its objectives.

## **5 Artifacts to build-up legitimation**

The two cases studies used in this paper addressed multi-stakeholders initiatives through participatory processes aiming at improving the co-management of natural resources. In both cases, RPGs and MAS were used to explicit, combine and evaluate different forms of knowledge on a shared issue. RPGs, MAS and companion modeling are convenient tools but are definitely not the only solutions to reach these objectives. In this last section, we attempt to identify the properties of the artifacts we did employ that may be of use to improve legitimation processes in multi-stakeholders initiatives.

### **Considering different forms of expertise and legitimation processes**

Our theoretical framework is based on the hypothesis that within the group of participants of the participatory process exist different systems of values. These systems of value may be shared within each group of stakeholders but differ from a group to another. Therefore, joint and symmetric legitimation must be compatible with each of these systems of value.

An example of such multiple legitimation is provided by the last RPG designed in Bhutan: A reward in revenue was granted collectively to the 7 villages if the number of plots receiving too much water in the entire watershed was not too high. The reason of this collective bonus is ambiguous: It was explained to the villagers as a reward paid by the electricity company operating a dam further downstream. It was explained to the scientists as an implementation of the economic model of the positive side effects of a proper management. It was explained to institutional as NGO funds collected through a well-publicized water management committee. Taking into account these different forms of legitimation requires that activities allow participants to explicit their systems of value. This was partially done through individual surveys in La Réunion.

What was observed during the gaming sessions was the use of different forms of knowledge by players when placed in situations of action. Explicit knowledge of rules and regulations were displayed in La Réunion, among with experience of the way controls are performed and of how to by-pass them. Explicit understanding of cropping cycles was used in Bhutan, among with experience of long-term perspective calculations. When facing new artifacts that are somehow linked to familiar situations, players mobilized different evaluation schemes: Mathematical calculation to maximize their revenue, comparison with existing artifacts when dealing with coupons, experimentation of new fertilization practices to "test" new fertilizers efficiency. Providing

stakeholders with opportunities to use their own ways of evaluating an artifact seems to improve the quality of the test of worth the artifact is submitted to. Making stakeholders representatives react and interact in small plays is a promising technique we consider investing.

### **Knowledge legitimation and de-legitimation**

In both cases, preliminary investigation led to the collection of very interesting sets of data. Several points of view seemed very promising to scientists and modelers. In Bhutan, deep investigation on customary rules of sharing water inside each village was conducted with the expectation that unveiling the inefficiency of such rules at village level could lead communities to reconsider such rules. More equitable rules may theoretically provide a more efficient use of water, improve the community global revenue. In La Réunion, a revue of literature provided the scientists with a large array of technical solutions, from compost to pyrolysis and biomass production. On field inquiries suggested that strong ties existed between breeders and farmers. Such networks could be used to promote collective management of a shared space and the search of “win-win” solutions.

These assertions were used to develop the models the RPGs were based on. In Bhutan, the first versions of the RPG included unfair water card distributions. In La Réunion, negotiations on logistical costs and the simulation of a very volatile price of chemical fertilizers were expected to bring the discussion on the relations between farmers and breeders. These are two examples of assertions that did not pass the test of worth of the gaming session. When discussed collectively, the explicit and reliable knowledge provided by the scientists was not evaluated as relevant by the stakeholders, relatively to their own systems of value. Equity and solidarity are important, but not paramount enough when it comes to negotiation.

These two examples illustrate situations where knowledge legitimation by stakeholders does not rely on scientific reliability but on social validation relative to the issues at stake that legitimate the multi-stakeholders initiative. It is important to remember that scientific legitimation is not a sufficient condition for legitimation during a MSI. Scientists should be prepared to accept the result of the tests that will take place and the governance of the participatory process should allow that some scientific knowledge – and the scientist that represent them – may sometimes be driven out of the negotiation arena.

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