Natural resources governance scales and social learning approaches in peri-urban areas: contribution experience in Bolivia and Brazil

Raphaèle Ducrot

CIRAD, UMR G-Eau / Universidade de São Paulo, Instituto de Estudos Avançados, Brasil, São Paulo, Brasil - raphaele.ducrot@cirad.fr

Abstract: *Competition for water, often associated with a struggle for land, tends to be exacerbated in periurban areas because of the conflicting interests of the users, a dynamic land use pattern and specific hydrological functions provided to the city. The variety of stakeholder processes dealing with water often puts local nested approaches fully taking into account local strategies into opposition with basin-scale approaches able to engage in broader issues such as sustainability or global pressure. Assistance to multi-stakeholders' processes using simulation tools such as role playing games were tested in the metropolitan areas of two South American cities: 1) in the periphery of Cochabamba, to facilitate conflict resolution stemming from the impact of urbanisation on the irrigation infrastructure, and 2) in the peri-urban areas of São Paulo to assist in negotiations on land and water management in a protected catchment. Both interventions were designed to broaden the stakeholders' perspectives and facilitate the exchange of the different actors' views of water and land management through participation in role-playing activities. Both acknowledged the need to bridge the gap between local-level and regional-level management. This paper discusses the problems encountered in these two interventions to bridge local-level and regional-level land and water management needs. Both experiences underlined how different the issues at stake for the same problem were between local and regional management, thus limiting direct appropriation and integration at regional-level social learning processes initiated at the local level (or vice-versa). Bridging the gap between these management levels was more complex than simply integrating stakeholders in the discussion process and developing better communication. The need for the development of a specific approach to facilitate interaction mechanisms between the two management levels or to creatively use the tensions between the different levels of management is highlighted.*

Keywords*: peri-urban, role playing game, multi-level governance, multi-stakeholders platform, land and water management*

Introduction

In our rapidly urbanising world, providing safe water for cities is a challenge, especially in the south. Competition for water, often associated with a struggle for land, tends to be exacerbated in periurban areas because of the wide variety of users with conflicting interests, a dynamic land use pattern and specific hydrological functions provided to the city. As a consequence, the water systems supporting traditional and new livelihoods in these areas are increasingly under pressure. In these areas, resolving future conflicts that involve very heterogeneous types of stakeholders calls for carefully crafted multi-stakeholder resource management processes. These processes frequently contrast with local nested approaches that fully take into account local strategies and basin-scale approaches able to engage in broader issues such as sustainability or global pressure. To what extent is it possible to bridge the two approaches and the different levels of organisation and management in a peri-urban context characterised by rapid changes and dual institutions (bringing rural and urban institutions into conflict)?

This paper analyses the problems encountered in bridging the gap between the different organisational levels during two interventions developed in the periphery of South American cities using role-playing games as part of the Negowat project "Facilitating negotiation over land and water conflicts in periurban areas" in the periphery of Cochabamba (Bolivia) and São Paulo (Brazil). Both interventions were designed to broaden the stakeholders' perspectives and facilitate the exchange of the different actors' views of water and land management issues by developing multi-step processes using different participative tools and methodologies. Both acknowledged the need to associate local

level water management and regional management, for example, bring together the municipal planning processes and the catchment discussion bodies. This paper aims to present the different experiences, how this encounter was attempted and the output impact at local and regional levels.

The challenge of integrated environmental governance in peri-urban areas

Integrated water resources management (IWRM) frequently highlights the opposition between local nested approaches that fully take into account local strategies and basin-scale approaches able to handle broader issues such as sustainability or global pressure. Thus IWRM implementation studies reveal various tensions between the chosen methodologies: between top-down and bottom-up approaches, between a holistic and an integrated approach and the democratic ideal of decentralised decision making (Meadowcroft, 2002), or between science-based decisions and local knowledge (Hirsch Philip, 2005) (Lovell et al., 2002). Each of these approaches has its own justification: accountability and appropriation by local communities for the nested local approach and anticipation from external drivers such as climate change or facilitating connections between uses and problems for the basin-scale approach. What is at stake is a balance between the effectiveness of the intervention, participation and the legitimacy of the intervention.

When dealing with the integration of different organisational or management levels in water governance, three different hypotheses are put forward in the literature. Some authors claim that they are clearly distinct levels of management and that the emergence of a watershed or supra-level adds specific problems and tensions for local people who have long developed a local form of collective action that is well adapted to the local situation (Ruf, 2001). Others maintain that individual and more regional strategies can be integrated at the basin level provided they are well understood and clearly communicated. Typically, this approach requires the development of integrated multi-scale spatialised models. A third approach distinguishes different management strategies at the different levels: the different levels of collective or individual action are assumed to be more or less related by mechanisms such as a flow of information and knowledge, an actors' network or institutions and norms.

Participation is one of these mechanisms. One of the basic principles of IRWM, is that it sustains the development of some type of Multi-Stakeholder Platform (MSP) as inadequate participation of local actors in a watershed discussion sphere is frequently stated as the main reason for a lack of integration between these levels of water resource management. This may be due to different phenomena such as a misunderstanding of each other's representations, selection of participants, legitimacy or even capacity to meaningfully participate (Faysse, 2006; Lemos and Dilling, 2007). A MSP can be defined as a 'decision-making body (voluntary or statutory) comprising different stakeholders who perceive the same resource management problem, realise their interdependence for solving it, and come together to agree on action strategies for solving the problem' (Steins and Edwards, 1999). The implementation of these platforms is often driven and analysed as an ideal or perfect communication and social learning approach (Faysse, 2006), without fully accounting for the history behind the relationships between stakeholders and power asymmetry between participants, which can also affect communication mechanisms. Participation also covers a wide spectrum of communication with and between stakeholders: from a one-shot stakeholder survey to an interactive (multi-session) dialogue, from information sharing to negotiation (Warner, 2006). It may be used to sell government policy and fulfil procedural requirements, or as an effective mode of governance (Mostert, 2003). Consequently, using participation as a bridging mechanism between governance levels also raises the question of the coordination mechanisms between the participative forum and other decision-making spheres, as well as the circulation of information between representatives and grassroots stakeholders.

Periurban areas are characterised by the high population density, the development of migration and urbanisation processes, which tend to loosen social ties and community memory and transform social organisations (with weakened agricultural or rural organisation and incipient urban-oriented organisation). This generally results in leadership and representativeness issues (rapid leadership rotation or weak representativeness) and a weak commitment to collective activities. Moreover, the frequent dual orientation (rural/urban) of the institutions often causes them to avoid or ignore these areas or their specificities. It includes dynamics or strategies that are difficult to account for and consequently difficult to integrate into decision-making processes, for example their very rapid

geographical, population, economic and landscape changes, the development of adaptive strategies to compensate for insufficient availability of urban infrastructure (transportation, water, sanitation, electricity) and complex biophysical processes caused by urbanisation. Integrated environmental governance in these areas raises specific challenges in terms of participation, mobilisation of stakeholders (public authorities or grassroots actors) and persistence of collective action, integration processes and communication between decision spheres. Water governance in these areas combines the local level (local practices), municipal levels (generally in charge of land management) and supra-levels such as catchment levels (for water) or the metropolitan level (for land and urbanisation processes). To what extent can social learning approaches help to develop sustainable water management mechanisms taking into account the different organisational and governance levels?

Presentation of the two interventions studied

Building the local communities' ability to negotiate land and water issues in peri-urban São Paulo (Brazil)

The Guarapiranga reservoir in the south of the municipality of São Paulo (Brazil) provides the water supply for nearly one-third of the 18 million inhabitants of the Metropolitan Region of São Paulo (MRSP). The Guarapiranga catchment, 905 km² covering five of the 39 municipalities of the MRSP, has undergone extensive urbanisation since the 1950s. Because of a lack of housing policies, poor workers have no other option than to settle in the periurban areas of the city, whose vast areas are a headwater catchment. The development of illegal settlements with no urban infrastructures such as a sanitation network has led to rapid deterioration of the reservoir's and catchment's water quality. The implementation of legislation (*Lei dos Mananciais or Headwater catchment law*) in the 1970s failed to contain the urbanisation and settlements continue to spread in the area. Domestic effluent discharge accounts for 60% of the pollution charge on an annual basis.

In the 1990s, public authorities developed new land and water policies promoting stronger participation. A catchment committee bringing together representatives of the state, the municipalities and the civil society is the consultative-deliberative body that manages water. Because of its complexity, the Alto Tietê catchment, covering 74% of the MRSP, has been divided into five sub-catchments, each with is own sub-committee. This is the case of the Guarapiranga catchment. Land management is the responsibility of the municipalities and participation is encouraged in the elaboration of land planning and the local participative budget since the promulgation of the 2001 City Statute. The headwater catchment legislation was adapted to better articulate land and water planning at the different planning levels. After years of discussion, the specific legislation of Guarapiranga summarising this integrated planning was finally approved by the State Assembly at the beginning of 2006.

Local communities of the peri-urban areas are not well represented in the catchment and sub-catchment committees. Local organisations – when they exist – are fragile and run into problems in working effectively with institutional actors (the municipalities, representatives of the state and the water company) as they compete among themselves to gain access to authorities (and their resources) and both passivity and strong paternalistic attitudes are encountered. The competition is even more acute in that local municipalities often lack the financial and human resources to deal with the area's many problems. Various tensions are emerging because of the conflicting interests of these very heterogeneous actors: authorities are willing to control urbanisation and pollution, while the water company (SABESP) economic focus limits the extension of the sanitation network to low-income or illegally settled populations. On the other hand, local communities focus mainly on attaining a better quality of life, i.e. access to better urban infrastructures such as transportation, electricity, potable water, security as well as legalising their situation.

In this context, the Negowat multidisciplinary team suggested developing an intervention so that the local community could better participate in the negotiations concerning land and water use with other institutionalised actors following a companion modelling approach, an approach based on social simulation in various forms to understand and strengthen the collective decision-making process of the stakeholders sharing a common resource. Simulation models have been developed to integrate the various stakeholders' points of view and are used as platforms for collective learning. For the simulations, preference was given to the model that explicitly represents social processes and decision making, such as multi-agent modelling and role playing games (RPG) (Antona, 2003). The

methodology elaborated was used to develop various discussion tools which put into a debatable form the hydro-social functioning of the area, allowed local communities to understand them and to discuss their interaction modes (box 1). One of the tools is a computerised role-playing game called Ter'Aguas (Box 2). The last step of the approach was devoted to developing a negotiation plan for real issues as a way to help participants make sense of the learning processes in the different steps. However, this plan was not implemented during the intervention, which remained a skill-building approach.

Box 1. the Teraguas approach

A series of seven activities were held during four or five workshops:

- Map the relationships between resources (land, water, housing, urban infrastructures) in each settlement and compare settlements to identify similarities and differences.
- Reconstruct the development of settlements and the history of the present situation in order to introduce the dynamics of resource relationships.
- Reconstruct a simplified version of the mechanisms of dynamics (for example land market or land use) (this activity was only implemented once).
- Map the actors, responsibilities and activities (legal or illegal) relating to resources.
- Rapidly stage a situation close to the issue, adapting the game situation (role description) from a pre-existing game, Desafios das Aguas, in order to introduce multi-party negotiations.
- Play the Ter'Aguas games followed by a debriefing. This helped to connect all previous elements, provide a dynamic view of the situation at the regional level, and experiment with new attitudes and solutions.
- Carry out action planning or negotiation planning related to the selected issues. This helped stakeholders to prepare specific actions or negotiations and to identify further information needs, mobilisation needs, actors, etc.

Box 2 . The Ter'Agua computerised role playing game.

Ter'Aguas is a computerised role-playing game used to simulate negotiations related to land use planning in a peri-urban municipality. Six types of actors are represented (mayor, water company, four district representatives, two small farmers, two big landowners with speculative strategies, one business representative, and one weekend house owner with environmental sensitivity).

The players take decisions concerning investment strategies (urban infrastructure, property development and land use activity), economic activities (buying and selling plots, subvention and taxes on land), licensing land uses and activities, and allocating land to migrating families in the area. The computer simulation assesses the impact of land-use changes on reservoir water quality on the cash assets of players, social indicators of the municipality. After a round of decision making, all players gather to try to find a more collective planning strategy and try to implement it in the following round. The interactions can focus on strategies for urbanisation, investment in urban infrastructure (sanitation, piping, wells, roads etc.), land-use planning and land market dynamics.

The approach was tested in two areas. In each case, it gathered between 12 and 20 community leaders. The game was also used twice with the community focus group that helped develop the tools as a way to validate its contents and performance. It was also played separately once with representatives of the Guarapiranga catchment committee and twice within training courses for water specialists. The structure of the participation in the game is presented in Table 1.

Table 1. Participants and role structure in the Ter'Aguas games.

		Participants	Role	Nb turn in the game
Community games	Focal group Game 1	Local community leaders Local business representative Municipality: head of planning SABESP: water resources department member	Each in their own role	2
	Focal group Game 2	Local community leaders Municipality: head of agricultural department SABESP: water resources	Municipality/SABESP inverted	4
	Embu Game	Health agents and executives Local NGO Municipality: head of planning SABESP: no one represented	Two most active leaders doubling municipality and SABESP role – no	4
	Paralheilos Game	Local community leaders Local business representative Municipality: head of planning SABESp: water resources department member	Two most active leaders doubling municipality and SABESP role – no change for other roles	4
Institutional actors	Sub-committee Game	Representative of an urban municipality Department of environment Environmental NGO Two members of local NGO	Role inversion. Two noninstitutional players (representative of local NGO) doubling	4
	Training sessions	Engineers and water specialists	Role inversion (by definition)	4

Tab 2. The different game sessions

		Game only	Teraguas approach
With representatives of local communities, municipality and SABESP	Focal group	2 (game elaboration and validation)	
	Embu-Guaçu northern districts		1
	Paralheilos southern districts		1
Representatives of "institutional actors" only	Sub-committee	1	
	SABESP training	2	
	Technician training	1	

Aid to negotiating the impact of urbanisation on irrigation infrastructure in peri-urban Cochabamba (Bolivia)

The intervention studied in the Tiquipaya municipality in the periphery of Cochabamba (Bolivia) was explicitly oriented towards an aid to negotiating and developing agreements to minimise the impact of urbanisation on irrigation infrastructures.

The valley area of this municipality has experienced a rapid demographic growth over the last 15 years, with the population increasing from 3000 inhabitants in 1993 to 30,000 in 2003 (Faysse et al., 2007). This once completely rural centre is now a peri-urban municipality. Urbanisation is particularly dense in its eastern part adjoining the city of Cochabamba. Irrigated small-scale farming (maize and alfalfa for dairy production, cash crops and flowers) used to be the inhabitants' main activities. Agricultural production is only possible through irrigation: five collective irrigation systems, managed by irrigators' associations following irrigation rules defined in the 19th century and inherited from centuries of irrigation history, criss-cross the valley. These associations are grouped into a municipal federation, called ASIRITIC (Association of Irrigation Schemes of Tiquipaya and Colcapirhua).

Urbanisation results from the division of former agricultural land into small parcels sold by farmers and their families to newcomers (migrants) for construction. This results in a mosaic pattern of land use, with built plots adjoining irrigated farmed plots. The newcomers who are not aware of the traditional rules that regulate the irrigation system tend to build houses or walls that block canals and their flow and restrain access to canals (necessary for inspection and maintenance). They may even discharge sewage water or trash into the canals and sometimes even move them or fill them to increase space or prevent humidity problems. At the same time, farmers are no longer motivated to clean the canals and canal maintenance has deteriorated, leading to increasing irrigation and drainage problems, because in some areas, where urbanisation has developed without an adequate drainage evacuation system, irrigation canals are useful to evacuate rainwater and avoid local flooding.

The project team proposed to develop an approach at the local level aiming at facilitating the development of win-win agreements between farmers and urban dwellers around canal maintenance. The approach was based on the acknowledgement that irrigation canals have a dual function of irrigation and drainage. To moblise the inhabitants, it was decided to combine the development of a management agreement with more concrete goals such as the design of a canal recuperation project to protect and improve the irrigation infrastructure at the local level. A multi-step participatory approach was developed and tested to meet this objective; it included a preparation phase to mobilise the actors and a negotiation phase (Figure 1). The intervention was carried out in two communities (Linde and Kanarancho), without the support of ASIRITIC, which had a conflictual relationship with the research centre hosting the project at the time.

The preparation phase included a detailed community diagnosis and a collective restitution meeting and was followed by a role-playing game session. The game sessions were implemented to (i) facilitate exchanges between urban residents and farmers in a tension-free environment, (ii) raise awareness on the canals' dual function (irrigation and drainage) and the impact of mismanagement on this function, and (iii) discuss potential solutions. All in all, eight games (four in each community) were implemented bringing together an average of nine participants per game (70% farmers and 30% urban residents) (Vega et al., 2006). The game sessions were followed by a collective canal inspection to identify the concrete problems and discuss and assess on-the-spot solutions. These solutions were then prioritised. The outcomes were used as a base to develop a community agreement, to elaborate the technical and economic specifications of a canal project and to develop an agreement between the municipality and the community for canal maintenance. The methodology chosen included various discussion times when community members could express their preferences and points of view, but municipal authorities and ASIRITIC were not seriously involved in the discussions.

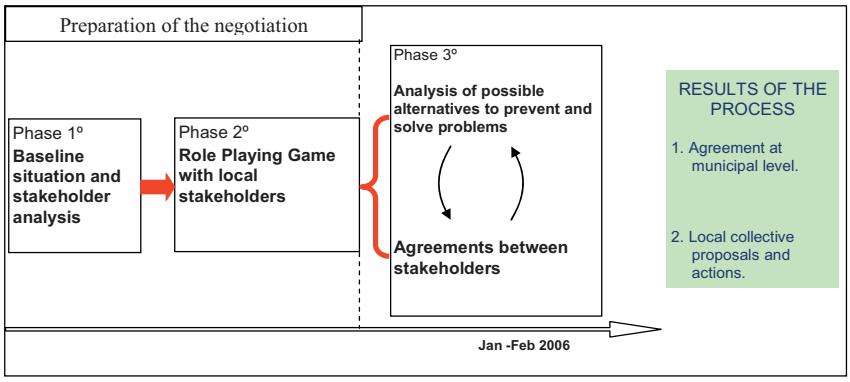

Figure 1. General structures of the approach on the impact of urbanisation on irrigation canals (from Faysse and al, 2007)

Box 3. The Larq'asninchej role-playing game (Bolivia)

Larq'asninchej ('our canals' in Quechua) represents a peri-urban community. The roles played in the game are irrigation farmers, urban dwellers and the local OTB representative. At the beginning of every turn, the farmers decide which fields they want to cultivate and possibly irrigate; meanwhile urban dwellers decide where to build houses. Both groups may decide to set up walls to protect their house or crops from thieves. For both groups, it is cheapest to build walls that infringe on the nearby canals. Farmers situated downstream of blocked canal sections face difficulties to obtain irrigation water. At the end of each turn, the OTB representative leads a meeting in which the "local community" analyse the problems arising from walls built too close to canals and possible solutions. If no agreement is reached locally, the Municipality, represented in the game by a set of cards, eventually takes a decision.
By making the players put themselves in each other's shoes, the game aimed at improving inhabitants' understanding of other points of view held by different residents. Therefore, in the game, irrigation farmers were invited to play the role of a new urban dweller and vice versa..

Mobilising tools and approach but problems bridging the gap between the different management levels in both cases

Assessment methodology

Between 10 and 18 months after the end of the intervention, both experiments were assessed using qualitative interviews with the designers of the approach and a number of participants. The objectives were to assess (i) the outcomes of the intervention as perceived by the different participants over the long term and (ii) the contribution of the different steps of the approach to the outcomes. This analysis was completed by the assessment of the game sessions developed during the intervention: this assessment was based on video monitoring of the sessions in both countries. In Brazil, monitoring was completed by comparing the contents of short questionnaires on learning contents carried out immediately before and after the game session. In Bolivia, the assessment was based on participant interviews carried out 2–3 days after the game session, focusing on the acceptance of the game as a discussion space to deal with local issues.

Mismatch between organisational levels revealed by game sessions in São Paulo

Huge discrepancies were found on the content and focus of the main negotiations in the games played with and without community representatives in São Paulo, revealing substantial mismatches of actors' perceptions of the issues studied.

Apart from the first session (which aimed to validate the contents of the game), all games proved entertaining and succeeded in bringing the different participants together. In the first session, the players had not been sufficiently prepared and a spatial virtual map that was too close to reality led to a standstill situation. The game was then adapted and it developed adequately in further sessions. Players had no particular problems playing after the first round for most people and the second round for a couple of them (Jacobi and Granja, 2006). To avoid problems with partial or complete illiteracy, assistance was provided to community players to fill in the interface sheet. Institutional actors were assumed to be able to manage written information and were not offered this assistance.

The assessment showed that the game appeared more complex for the institutional players than for the community leaders, probably resulting from the assistance provided in completing the written interface, the fact that the water company and municipality roles they were assigned to were indeed more complex, the fact that the institutional players did not participate in previous preparatory workshops and the perception that role and game were too far removed from reality. Community players or local representatives perceived the game and the roles as close to their own reality. They easily connected it to the real situation and all stated that it represented their situation accurately. On the contrary, institutional players were much more critical, assessing the game as virtual or theoretical, with little connection with reality, or at least their reality. This was surprisingly expressed by the sub-committee members who had been involved in the development of the specific Law of Guarapiranga focusing on planning management in the catchment over the previous 6 months.

Game session contents with and without community representatives were very different. In the three games where community leaders were involved, the negotiations were basically sustained by the interactions between the big landowner, district representatives and the mayor and focused on the

possibilities of land use legalisation given the legal constraints of the virtual situation and possible trades between legalising illegal settlements and development of sanitation infrastructures. In these games, the institutional players were particularly attentive to orienting community leaders to respecting the legal aspects of the situation (zoning) but offered many alternatives such as public housing settlements or legalisation options providing certain conditions. Other preoccupations emerged such as minimising unemployment or coalition attempts between business players and district representatives. Attempts to use the land market mechanisms to organise land use and occupation also appeared, although this remained unsuccessful. On the contrary, games with institutional actors and water technicians were oriented by the Municipality-Environmental NGO-Business player trio. The discussions focused on the role of business actors and economic incentives or tools to orient land use and activity development. Surprisingly, zoning was very infrequently used as a tool to orient or manage the urbanisation process. The district representatives in this "institutional" game mostly demanded access to potable water and sanitation while in the other game, their demands extended to other aspects such as schools, transportation, security or legalizing current land use. Institutional players assuming a district representative role protested less actively than real community leaders. The big land owners did not demonstrate this speculative orientation as in community games and were overall more cooperative. During the debriefing phase of these institutional games, the players imputed the weak collective performance to the lack of environmental police and control in the game, a role which was purposely not included because in the real world it is slow and not very efficient.

Community leaders reported skills had been developed during the simulations. Institutional actors who had played with community leaders also mentioned learning and changes in practices: while at the time they had explained their participation as a mere act of communication (to tell community leaders what should be done), they mentioned they were less likely to adopt a top-down approach, more attentive to the community's position and points of view, and more likely to develop collective solutions several months after the intervention. On the contrary, institutional players who had not encountered community players did not mention learning or changes in practices. On the other hand, the two community members who participated in the institutional games mentioned that they had learnt a great deal, although the situation represented was quite different from their urbanised area. Because of this difference, they were asked to play the municipality and water company with another institutional player since these two roles interacted with their association in real life. Surprisingly, they connected the virtual situation to their own situation, correctly interpreting the virtual situation presented as an historical reconstitution of the development of their zone. They mentioned that the game provided a broader and more detailed vision of urbanisation and environmental issues as well as changes in their work and interactions with others.

In both types of game, the players mentioned that such easy and cooperative meeting between institutional actors and community leaders as that provided by the game were unlikely to occur otherwise. They also thought that it would be useful to develop this approach not only with community leaders but also with grassroots community members.

Raising awareness on canal management but problems implementing agreements in Cochabamba

The intervention contributed effectively to changing ideas on canals in this urbanising area. Their dual functions as irrigation and drainage infrastructure are now being acknowledged by the different actors. Even actors who were only slightly involved in the process or even critical, such as ASIRITIC, now recognise the need to protect the canals: the municipality of Tiquipaya even allocated a small part of its budget (approximately 9000 euros) for their maintenance. ASIRITIC members' interviews indicate that this association is even debating this dual function to request an extension of the irrigation network. The intervention also contributed to developing local actions such as a canal cleaning operation, gathering farmers and urban dwellers into a single community, although it does not seem to have been repeated a second time. Participants also mentioned an improved ability to constructively interact with their neighbours.

Two key steps of the intervention were identified by the interviews: the role-playing game sessions and the canal inspections. The canal inspections helped bring out the amplitude and diversity of the problems in each community; it was perceived as an efficient exchange and discussion platform gathering not only local actors, but also public authorities and technicians. As an outdoor activity that involved the entire community, it was highly visible and helped raise awareness on the issue. The role-playing game sessions were declared to be particularly helpful in bringing participants to a better

understanding of each other's points of view, to debate complex issues in a tension-free environment, and to understand how discussion and negotiation could help identify possible solutions.

However, the intervention's mobilisation and dissemination strategy was only partially successful: new migrants appear to have little awareness of the issue and mobilising participants to attend the game sessions proved difficult. This was attributed to the lack of interest given to collective activities because of weaker social ties, the insufficient availability of people engaged in various income-raising activities (farming, small businesses) and institutional weaknesses such as local organisation as well as distrust of meetings called by local organisations (Faysse, 2006). Though the game sessions themselves were said to be very interesting and enjoyable, most players did not participate in further steps, except for those directly affected by canal mismanagement, contrary to the continuation expected: it was as if once participants had proposed and discussed their solution in the games, they believed it was the project or community representatives' responsibility to transform them into concrete proposals (Vega, 2006; Faysse and al, 2007).

Even if people could not be mobilised as expected given the well-acknowledged team commitment and participative effort, the dissemination activities did succeed in raising the attention of the authorities, an important development considering the initial tensions with certain actors. However, it was insufficient to lead to clear concrete results in the second phase of the process. Apart from small construction works in Linde that were finalised during the project's life with the assistance of the municipality, none of the canal projects have been implemented. Different responsibilities and reasons have been suggested for this failure. The agreements are only recognised as a basis for discussion for the development of future arrangements, notably between ASIRITIC and the municipality, and the team mentioned the strong opposition of some actors during the elaboration of the agreements in spite of the previous discussions and participative actions already developed.

The first part of the approach (inclusively the game) was based on the hypothesis that the dual function of canals was hindered by the lack of (local) maintenance, but this hypothesis was only valid at a local level. Thus as the first phase (and the consequent proposal) focused on this aspect, it did not really prepare participants for the complexity of larger-scale negotiation that had to take into account other considerations on the canals that were only relevant at a higher level or for actors who did not participate in the local level discussions and issues. This occurred most notably with this issue of how to connect the drainage system and the irrigation canals, public health issues related to sewage dumping in the canals relevant for the municipality, and issues of infrastructure ownership that were particularly important for ASIRITIC.

The second phase of the process was not merely a methodological development (the negotiation phase after the mobilisation process), but it actually was a change of scale. The first phase was necessary to raise awareness on the importance of the issue at the local level and to mobilise local actors to support an intervention that was difficult to implement in the local context. Because flooding was not only a local problem, but also related to the situation upstream, it was necessary to move up to the regional management level. The designers of the intervention tried to involve other types of actors and propose integrated solutions in the municipal agreement. However, the change to the regional scale also meant a change in the main issues and representations and this was insufficiently taken into account when developing concrete outputs. Nevertheless, the intervention has clearly raised awareness about this issue not only in the municipality of Tiquipaya, but also in surrounding municipalities, and municipal actors, notably the farmers' association, are trying to develop their own solutions using the work developed during the intervention as a basis for discussion.

Discussion: A proper modelling scale for social learning approaches?

Role-playing games were key tools in both approaches and permitted players to experience and simulate the management of different elements that were subjected to different representations. These games made it possible to discuss the different needs and perspectives in a tension-free arena and proved to be interesting tools to bring players closer together. Though both interventions used the same type of tool, they differed widely on their objectives and methodological development. One focused on skill building and empowerment of certain actors while the other aimed at developing concrete agreements. However, in general terms they actually contributed to social learning processes between participants characterised by changes in their representation, transformation of the

interactions between actors with less hierarchical relations, and increased trust between actors at least at the local level.

However, the better understanding of the situation and the integration of this learning into practices depended on the how close the players perceived the game to be to their actual situations. Too close, for example based on real maps of the situation, and discussion froze because of real conflicts. Too far from reality and the game was only perceived as an enjoyable moment and did not contribute to real-life practices.

Distance should not only be assessed in terms of modelling and schematisation: it was also related to the appropriate representation scale. In São Paulo, the game was not recognised as sufficiently close to reality by regional-level actors to provide significant learning on how the system functions, when not directly exposed to local representatives. On the other hand, community representatives from a different area (an urbanised district of the periphery as opposed to a peri-urban area) easily connected the virtual situation as the close past of their own situation.

In Cochabamba, the initial steps of the process were very locally oriented and not very relevant at the municipality level. The game has never been played with representatives of the public authorities (except once in a validation session) and was considered somewhat too simple or basic for authorities. However, it was not clear whether this resulted from an oversimplification of the issue, the game elements or the contents of the game which did not completely coincide with the authorities' preoccupations. Similarly, in São Paulo, a non-computerised version of the Ter'Aguas game (called JogoPol) was also assessed by community players as fastidious, too simple to involve the authorities and institutional actors and better suited to educational purposes than as a discussion platform.

Thus both interventions underline the problems inherent to moving from one management level to another in participative approaches. The representation scale affects its legitimacy depending on the participants. This tends to indicate that a game (as a model of a complex environmental issue) in itself is not sufficient to make sense to the public if they cannot connect it to their preoccupations. On the other hand, the same tool proved to be a true exchange platform between local institutional actors and community representatives when both types of actor were present, but active participation in the local steps was not sufficient to mobilise and discuss these issues at a regional level: negotiations there stumbled over elements that were not included in the previous discussions because they were only relevant at a regional level.

Although both approaches succeeded in integrating the different strategies, including illegal strategies, in the discussion, they mobilised a relatively small number of people in the population concerned, raising the question of the future of its results in a rapidly evolving community. Local workshops at the community level were not really successful. Would dissemination using local media, as suggested by some participants, have permitted to reach more actors? In São Paulo, participants regretted that the whole process did not mobilise grassroots residents along with community leaders. However, this would probably mean developing a specific step in the process addressing the preoccupations of grassroots actors at the right scale for them: household access to land and water within the district rather than the articulation between district and municipality. Another problem lies in the expectations raised by an intervention where participants really felt taken into account but which did not really give way to substantial change (in terms of infrastructures, for example).

In both interventions, the rapid changes typical of peri-urban areas was difficult to integrate. The changes are so rapid that 12 months after the intervention some participants considered the canal projects obsolete. As recorded in the session monitoring, these changes and their speed had never been integrated into the discussions themselves and were not included in the game. In São Paulo, the Ter'Aguas game permitted developing evolution scenarios but the sessions underlined the problems players had thinking the future when confronted with acute and very diverse problems. Because they are facing very diverse and urgent needs that are already difficult to respond to, it is difficult for decision makers to take into account possible future changes in their decision processes. Actually, very few participants mentioned they had learned something on these dynamic and development trajectories. All were participants who already had a global vision of the territory and its problems and issues, which may suggest that acquiring this vision is a necessary step before integrating processes of rapid change.

Both experiences underlined how different the issues at stake were for the same problem between local and regional management levels: it limits direct appropriation and integration at a regional level of the social learning processes initiated at the local level (or vice-versa). Bridging the gap between these levels was more complex than integrating stakeholders in the discussion process and enhancing

communication mechanisms between actors as permitted by the approach developed, although this type of approach was very interesting in terms of skill building and representation changes for participants. They underlined the need for the development of a specific approach to facilitate interaction mechanisms between both levels or to creatively use the tensions between the different levels of management, as well as the need to find the right balance between consultation and participation in environmental governance processes.

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