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## Normative structures, collaboration and conflict in irrigation; a case study of the Pillaro North Canal Irrigation System, Ecuadorian Highlands

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### Abstract

This paper analyzes conflict and collaboration and their relation to normative structures based on a case study of the history and external interventions of the Pillaro North Canal Irrigation System in the Ecuadorian Highlands. It does so by using Ostrom's framework for analyzing the sustainability of socio-ecological systems together with an analysis of the normative structures that define the governance systems through which the interactions in irrigation systems are mediated. I argue that the external interventions by the state and NGOs imposed a new governance system that undermined the existing normative structures and related organizations, leading to internal conflicts. The case study suggests that a reformulation of irrigation policies and state intervention methodologies in user managed supra-community irrigation systems in the Andes could lead to higher levels of cooperation.

### Keywords

*Collective action; Ecuador; irrigation; normative structures; water governance*

### 1. Introduction

Collective action has for long been identified as an important pillar for sustainable irrigation system management (Ostrom 1990). In the Andes small semi-autonomous community managed irrigation systems have been constructed, operated and maintained for centuries through collective action and collaboration (Bolin 1990; Trawick 2001a; Boelens 2009). Their systems of water rights which define the 'authorized demands to use (part of) a flow of water, including certain privileges, restrictions, obligations and sanctions accompanying this authorization' (Beccar et al. 2002) are deeply rooted in the often implicit normative frameworks that mediate community coexistence. These have ensured sustainable and often equitable irrigation management for extended periods of time (Trawick 2001b) and have shown to be dynamic systems that evolve with changing social and natural conditions (Boelens and Hoogendam 2002). Collective action in these small community systems has received much scholarly attention. In contrast, collective action in the large state built irrigation systems that cross and unite several communities along different agro-ecological zones -and that have had repeated rounds of external state and/or non-governmental organizations' (NGO) support- have received less scholarly attention. This is remarkable in view of the fact that since at least the late 1990s most of these systems have been handed over to self-governing Water Users Associations (WUAs) through nationwide Irrigation Management Transfer programs in Ecuador (Cremers et al. 2005; Hoogesteger 2014), Peru (Vos 2002) and Colombia (Vermillion and Garcés-Restrepo 1994).

In this contribution I aim to address this gap and explore the role of the normative structures that underlie social capital as the basis for the engagement of water users in collectively managed systems that unite several communities and that have been built with -and intervened by- external support agents. I do so based on a detailed case study of the Pillaro North Canal Irrigation System in the Ecuadorian Highlands. I draw on the work of Putnam (1993, 171) who defines social capital as the stock of norms of reciprocity and networks of civic engagement; and incorporate its analysis to the framework for analyzing the sustainability of socio-ecological systems (SES) presented by Ostrom (2007, 2009). In doing so I explore how existing social capital is transformed in and through WUAs and point at some of its implications for interventions in irrigation systems (also see Hoogesteger 2013c).

Meinzen-Dick et al. (2002), amongst others, have identified several factors that influence the levels and probability of collective action for irrigation system operation and maintenance (see also Bardhan 2000; Araral 2009). These authors show that amongst others a relatively secure water supply, a high dependence of users' livelihoods on irrigated agriculture, no individual groundwater use in the command area, close access to agricultural markets, a predominance of peasant smallholders as users, and the presence of other local organizations positively impact the levels of collective action in irrigation systems. Taking these issues into account, the Pillaro North Canal Irrigation System in the province of Tungurahua, central Ecuadorian Highlands was chosen as case study because it complies with most of these characteristics identified to positively affect collective action. The data of the case study were gathered between 2008 and 2010 through fieldwork in the irrigation system. Data gathering consisted of eighteen in depth semi-structured interviews, two focused group discussions, and various informal interviews and observations in the field. This primary material was supplemented by reviewing secondary material of the non-governmental organization the Ecuadorian Central for Agricultural Services (CESA) and other researchers who have worked in the area. Through the research design data were gathered from amongst the included actors only (water users and CESA's personnel). Interviewees were selected through a snowball sampling methodology (Heckathorn 1997). This started with personnel from CESA who work with the communities belonging to the abovementioned irrigation system. From there, people that had been actively involved in the irrigation system at different moments in time were selected and interviewed.

In this article I first analyze the concept of social capital relating it to the different relations normative structures can establish and place it within the framework for analyzing the sustainability of socio-ecological systems (SES) presented by Ostrom (2007, 2009). Secondly, I present how the communities of the parish of

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San Andres, in the province of Tungurahua, Ecuador worked on the construction of the Pillaro North Canal through forms of community based and associational collective action. Then, I present how the external intervention of NGO and state agencies imposed new normative structures and a related governance system in the process of supporting the consolidation of the irrigation system and show some of the internal conflicts this created. Then I show how after the above analyzed interventions the users of the irrigation system have continued to seek external support as a means to ensure the sustainability of their irrigation system. The discussion focuses on the implications this analytical approach and specific case study has for understanding the relations between external interventions and imposed normative structures vis-a-vis conflict and cooperation in irrigation systems. In the conclusions I retake some of the elements presented in the discussion and present its implications for policy making and interventions in irrigation systems (and SES more broadly).



## 2. SES, irrigation systems and normative frameworks

The general framework for analyzing the sustainability of socio-ecological systems (SES) presented by Ostrom (2007, 2009) is a valuable lens to analyze irrigation systems. This framework basically proposes to disaggregate the analysis of a SES into eight core subsystems that are 'relatively separable but that interact to produce outcomes at the SES level, which in turn feed back to affect these subsystems and their components' (Ostrom 2009, 419). Irrigation systems are relatively well defined SES systems that are embedded in a broader SES system such as a watershed or river basin (Pérez et al. 2011). Irrigation systems are composed of multiple subsystems that have internal variables at multiple levels that interact with each other (secondary canals, tertiary units, etc.) (Özerol 2013). From this departing point the irrigation infrastructure can be conceived as the resource system (RS) that is used to convey the resource units water (RU) to a specific place and time for the users (U) (irrigators) to be able to achieve specific desired outcome (O) (crop production). The interactions (I) that enable the users to achieve the desired outcomes through the RS and RU are mediated by a specific governance system (GS) that defines, through a shared normative framework, the rules, rights, sanctions and authorities responsible for their implementation. This whole is embedded in a broader socio-economic and political setting (S) and in a related broader ecosystem (ECO) which in most cases is a watershed or broader river basin.

In this contribution I specifically focus on four elements of this SES which are the governance system (GS), the users (U) and the broader political settings (S) which I analyze through their interactions (I). In doing so I conceptualize the normative structures that manifest as social capital as a central component that determines the form of the interactions between the users and: a) the internal governance system; b) the broader political settings and actors in which they are embedded (S); and, although not explicitly analyzed in this article, c) their interactions with the irrigation infrastructure (RS) and water (RU) (see Janssen and Anderies 2013; Bueno 2014).

Social capital operates through relationships of trust and reciprocity and is rooted in social relations. Once social capital is established it can, according to Portes (1998) have three different yet complementary functions which are: a) a source of social control and enforcement of the shared normative framework, b) a source of support from other members of a defined and bounded group, and c) a source of benefits through broader extra-group networks.

Reimer et al. (2008) build on Putnam's (1993) idea that social capital can be defined as a stock of 'norms of reciprocity and networks'; and argue that reciprocity (and related trust) are a consequential component of the normative structures that define social relations. Normative structures maintain and organize the connections in these networks by establishing 'reasonable' expectations concerning what others will do through 'systems of sanctions and incentives that ensure consistency in those actions' (Reimer et al. 2008, 259). These same authors categorize four different kinds of normative structures that organize and guide social interactions through which people accomplish tasks, legitimize their actions, structure their institutions and distribute resources. These are (261–263):

1. Market relations: Through these relations between relatively free actors people exchange goods and services and in doing so build, create and maintain relations of trust.
2. Bureaucratic relations: These are often impersonal and formal legal relationships based on generally applied principles, hierarchies and status positions through which rights and entitlements are regulated between social actors. The legitimacy and implementation of these rules form an important element of trust building amongst social actors.
3. Associative relations: These are based on shared interests and the common contribution to shared goals through different forms of collective action.
4. Communal relations: These are based on a strong sense of shared identity based on, for instance, location, birth, ethnicity, intensely shared socialization. The rights and obligations are closely linked to this identity. Generalized reciprocity and collective action are important in these relations which is mostly maintained through the exchange of favours and the reinforcement of identity.

In SES, the relations between the different subsystems are often mediated by a mix of these different kinds of normative structures which are or become embedded in the governance system. Which normative structures dominate is a direct result of the accumulated histories of the SES, their embedding in broader networks, administrative systems and the power relations that operate both within and on the system. In Andean irrigation systems therefore the normative frameworks are dynamic and incorporate elements from different forms of normative structures which result from processes of 'hybridization' and conflicts over authority and legitimacy in the governance system and its broader embedding (Boelens 2009; Hoogesteger 2013b; Boelens and Seemann 2014). These changes have direct bearings on the levels and forms of collective action for irrigation system management and operation as is explored for the case of the Pillaro North Canal Irrigation System analyzed below.

## 3. The Pillaro North Canal Irrigation System, [1] Central Ecuadorian Highlands

### 3.1. Building on communal and associative relations

In Ecuadorian Andean communities, social capital that is based on communal relations is expressed in their diverse efforts to collectively maintain and transform local places and ways of life (Bebbington and Perreault 1999). These efforts are generally coordinated through community-wide collective action (*mingas*). Before the fall of the hacienda hegemony in rural areas *mingas* were generally practiced for the benefit of local hacienda owners and urban elites (Korovkin 1997). Nowadays *mingas* are organized for community based resource use and broader activities that benefit and are part of community life (including celebrations) [2].

*Mingas* are often compulsory for community members. [3] They are a fundamental cornerstone of community life and are closely linked to community identity, territorial belonging and play a key role in the definition of community resources use and the distribution of its benefits (Boelens et al. 2014). *Mingas* are usually prepared and coordinated by community leaders and discussed with all community members in community assemblies.

Even though ever-more Andean families are scattering territorially through migration to work and trade in urban centers (Bebbington 1993; Jokisch 2002), *mingas* still exist in almost all communities (Korovkin 1998). One of the results of temporal labor migration, that is predominantly done by men, is that women have come to play a crucial role in rural community life and in *mingas* (Boelens and Zwartveen 2002). Specific rules for participation and collaboration in *mingas* have changed to adapt to new local realities. For instance communities increasingly organize *mingas* and meetings in weekends or holiday periods to facilitate the participation of migrant and wage-labor dependent community members. Another common rule is that the responsibilities of absentees can be shifted within households (delegated to husband/wife, parents or children); or in time; or be met financially.

After acquiring land during the agrarian reforms of the 1960s and 1970s (see de Janvry and Sadoulet 1989), many communities engaged in struggles for obtaining irrigation water through either the rehabilitation of old formerly *hacienda* (landlords) owned irrigation systems or the construction of new ones (often financed by external agents and the state) (Hoogesteger 2013a,b). This was also the case for several communities of the Parishes of San Andres in the province of Tungurahua, in the central Andes of Ecuador.

In the late 1960s the state built the Pisayambo dam and the Pucará hydro-electric power station. The plans envisaged the construction of the Pillaro irrigation system to productively use the water that had passed through the hydro-electric power station. A tunnel of three kilometers and a distributor, which divides the flow into two main sections, the Pillaro North Canal and the Pillaro South Canal were built, but because of a lack of funds further construction of the irrigation system, that would benefit amongst others the communities of the parish of San Andres, was suspended in 1971.

In the early 1990s many of the communities of the parish of San Andres joined their efforts with the aim of making the long promised irrigation system a reality. To coordinate the efforts of the individual communities the Federation of Farming Organizations of San Andres (FOCCAP) was established. As a community leader explains:

*In every community we had organized a committee of development ... later we organized in the FOCCAP to bundle our efforts to find external sources of support to develop the region.*

This new federation established as a new source of associative relations which were deeply embedded in the normative structures of the part-taking communities and their members. In 1995, based on the coordination of FOCCAP, the communities began the work to, by hand, dig the 17.6 kilometers of the main canal of the Pillaro North Canal Irrigation System (Récalit 2009). As one of the former community leaders explains:

*... every Saturday and Sunday we were working on the main canal. We had a president of all the communities and he used to call us out to work through mingas.*

According to the data of FOCCAP, the communities dug the canal through 90,000 labor days and other material and financial contributions from the communities (Dries van den and Jaramillo 2000). In 1997, the communities at the head-end of the main canal began using water based on the rules established by the associative and communal relations that had made access to water possible. These established amongst others three important principles: first that only work in collective *mingas* generated the right to use water, second that all recognized water users had a right to the same share of water, and third that water issues would be resolved within the community organizations.

In recognition that for the construction of the whole irrigation system external support was needed, FOCCAP sought external support. As part of these efforts, between 1996 and 1997 they approached several NGOs including CESA, that had a long trajectory and vast experience in irrigation projects aimed benefitting the smallholders and in attracting funding to execute these projects.

### 3.2. Dealing with the imposition of market and bureaucratic relations

At the end of 1998, with foreign development funds, CESA began a participative diagnosis and planning process that resulted in a Local Development Plan and funding proposals to start an intervention process in the area (Dries van den and Jaramillo 2000). In May 2000, CESA -that had been able to access development funds from German and Spanish donors- began to work with the communities on a) the construction and installation of the secondary and tertiary canals of the irrigation system in the San Andrés parish [4], and b) the organization of water management organizations. Between 2001 and 2003, after a prolonged lobbying process by part of FOCCAP, the state agency formally responsible for the irrigation system (CORCICEN) lined the main canal of the irrigation system. At present the irrigation system irrigates 3270 hectares with a water allocation of 1270 litres/second and benefits some 3100 families (CESA 2007, 2008).

Although the external support for the construction of the irrigation infrastructure (RS) and the technical and organizational capacity building interventions were needed for water (RU) to be used (U), these interventions did bring about important changes to the governance system that FOCCAP and the communities had established for the management of the irrigation system (SES) based on their community and associational relations.

In the area strong bonds of social capital existed at community level and at supra-community level FOCCAP coordinated the associational relations for managing the water affairs related to the Pillaro canal (Récalit 2009). Nevertheless, with the external intervention process CESA and the state agencies took a central and powerful position in determining the different subsystems of the SES.

The infrastructure was designed by engineers based on state guidelines that prescribe that in principle all land in the command area had to be irrigated based on a water allocation per area unit (litres/second/hectare) and that the infrastructural design had to be made 'as efficient as possible' in hydraulic terms (see also Boelens 2008). This expanded the irrigation system to many communities that had never participated in the collective efforts to construct the irrigation system through FOCCAP (CESA 2008). The governance system was likewise constituted on the basis of state guidelines that did not recognize the communities and their normative frameworks as legitimate. Rather, the state guidelines stipulated, based on the infrastructural design, the formation of 25 Water Assemblies responsible for the operation, management and administration of the secondary and tertiary canals through Modular Committees (Den Ouden 2011).

To coordinate the operation, maintenance and administration of the main canal and the collaboration between the Water Assemblies, the Central Water User Organization for the Pillaro North Canal was consolidated. The Central Water User Organization for the Pillaro North Canal in turn was made a part of the Water Users Association Pillaro. This association congregates the water user organizations of the North Canal and that of the South main canal of the Pillaro irrigation system (a pre-assembly had been in existence since 2005). After its consolidation, the Water Users Association Pillaro has become the organization that represents the interests of the water users of Pillaro towards external organizations (see also Table 1). Despite the fact that these different levels of organizations for system management are in principle user based, they were given little room to maneuver within the guidelines established by the state. This is in part because in these guidelines they are conceived primarily as administrative units that are to work based on the bureaucratic relations established.

**Table 1**

Organizational structures of the Pillaro irrigation system (own elaboration based on field data, CESA, 2008 and Den Ouden, 2011).

Level	Functions
Water Users Association Pillaro	Coordinates the administration, operation and maintenance of the main canal and tunnel up to the Santa Rita distributor. As legal representative organization of the water users of Pillaro it represents water users interests at local, regional and national levels through NGOs and state agencies.
Central Water Users Association (WUA) Pillaro North canal	Administration, operation and maintenance of the main canal and water distribution to the Water Assemblies in cooperation with public and private institutions, by means of contracts and agreements. Representation of the users of the North Canal of the Pillaro Irrigation system in the Water Users Association Pillaro and with external agents. Establish mechanisms for the recovery of the water tariffs as set by the General Assembly, corresponding to the contributions of users for the administration, operation and maintenance of the irrigation system.
Water Assemblies	Administration, operation and maintenance of the secondary reservoirs and canals for each sector. Distribution of water to the Modular Committees by means of a ditch tender. Fee recovery of the quotas and tariffs as set by the Directive of the Central WUA and as approved by the General Assembly.
Modular Committee	Administration, operation and maintenance of the tertiary canals and distribution to plots amongst users (with or without a ditch tender).

This imposition from the state has not been uncontested as it effectively displaced both the communities and the FOCCAP from the irrigation system and its management; despite their explicit desire to become the central organizations for irrigation management. As a community leader explains:

*I think it would be better if the community organization and the water organizations would be together. Now each one calls separately for assemblies. One for issues concerning water; the other for other issues. I think these should work together. We used to do all in the community organization... and that kept us united. Now divisions have been created because of two different assemblies... now there are people that do not want to know anything about the community.*

In a similar strand the water rights that stand central to the governance system are based on state guidelines that mix bureaucratic relations with some elements of market relations. This normative framework that was imposed establishes amongst other the following:

1. All landholders within the potentially irrigable area of the system are eligible to acquire a water entitlement through: *acquired rights* which were granted to all the community members who participated in the *mingas* for the construction of irrigation system; and *bought rights* which enabled non-participant landowners within the command area to 'buy' their water rights.
2. Water allocations are proportional to land tenure.
3. Infrastructure and water flows of the primary and secondary canals are operated in principle by a ditch tender.
4. At tertiary level and at plot level either water users or ditch tenders can operate the infrastructure and water flows.
5. All water users have to pay the WUA and the Water Assemblies to cover the administration, operation and maintenance costs of the system.

Many of the users that initially worked through their communities and the FOCCAP have called this new system 'egalitarian yet not equitable' and complain about the fact that the system does not take into account the previous investments of people through *mingas* and community participation. Many individuals and some communities have not recognized this new normative framework as legitimate. As a staff of CESA explains:

*There are people that do not respect the normative framework... they refuse to pay the water tariff... we have had a lot of problems especially with community [...] where people do not want to pay... saying that if they pay it will only be to their sector and community. (CESA staff-1)*

Cases of individuals that fail to recognize the normative frameworks of the water user organizations also exist in the irrigation system causing several problems and delays with the construction of the infrastructure and its operation and maintenance (see also Den Ouden 2011):

*There are a lot of problems regarding the right to let water pass through private plots by means of the construction of the needed canals. It seems that sometimes once people have their access to water secured, people forget about the collective interest of the water user organization. (CESA staff-2)*

One of the main problems identified by many community members is that the external intervention and its new imposed governance system has replaced both the communities and their forms of collective action (community relations) with market based relations in which paying the irrigation fee stands central rather

than the participation in community affairs. This creates conflicts with the community norms that have their roots in the community traditions of reciprocity in which collective action stands central and monetary contributions are not fixed nor periodic, but are established by the General Assembly for covering very specific and well identified costs. Therefore tensions arise as worded by a community leader:

*In the last years we have had some conflicts... the Water Assemblies have separated themselves from the community structures... and the new directives have applied a lot of monetary sanctions and that creates conflicts.*

But not all communities have staunchly resisted the introduction of the new governance systems. For instance the collective of water users of the parish of Urbina, which joined the irrigation system later, hybridized the newly imposed structures with their own community structures into a very well working organization in which high levels of trust persist. These are based on the already existing forms of social capital in the community. They have formed the Cooperative of Water Users of Urbina through which the water fees are collected from the different families and then are paid to the Water Users Association collectively. This cooperative has built its own office which is used to discuss water issues in the Parish as well as other issues of collective interest, while also forming a venue for the resolution of local conflicts over water.

Despite the internal conflicts amongst users and the different groups that form the governance system through which the irrigation system is operated and maintained, up to the present the SES has managed to maintain the infrastructure and deliver water to the final users. This can be attributed to the fact that despite the internal conflicts about how the governance system should be structured and function, cooperation for achieving the desired collective and individual outcomes prevails. The main sting in the conflict being fundamental disagreements over the boundaries of the organizational structures; and the content and structure of the normative relations that mediate the interactions for the internal management of the irrigation system (communal and associative versus market and bureaucratic).

As in many other supra-communal highland irrigation systems in Ecuador, despite these internal conflicts over the abovementioned issues, enough base-line cooperation prevails to sustain the system and guarantee water delivery to the users (see also Hoogesteger 2013a). As one user said: '... despite the conflicts we now have our water' and another asserts 'these soils were only good for barley and maize... now we can sow potatoes, vegetables... we have a small pasture for the animals'. Another important source of cooperation that often bridges across the prevailing internal conflicts is the collaboration needed for the establishment of relations with external actors as is explained in the section below.

### 3.3. Interacting with external actors to guarantee irrigation system sustainability

Interactions with external actors have played a central and determining role in the development of the irrigation system. FOCCAP has linked with CESA and the state agency to finance the construction of the irrigation system. Once the irrigation system and its 'new' governance structures were in place, the new WUA became the central point of interaction with external actors. The WUA has been able to obtain the financial and technical support of the town council of Pillaro for the construction of 23 night storage water reservoirs. Moreover, the town council has supported some of the production and commercialisation initiatives that have been carried out in the irrigation system. In 2007, the water users were able to obtain resources from the Ecuadorian Ministry of Agriculture for the modernization of the irrigation system through funding for new reservoirs and sprinkler irrigation. Initially these resources would be channelled to the state agency that was formally responsible for the irrigation system. Yet, based on the bad experience the water users had with it, they managed to negotiate that the funds (4 million dollars) be channelled and managed by the Provincial Council of Tungurahua (which has a good reputation with regards to the management and execution of projects in the province).

Moreover, the Water Users Association Pillaro was able to amend the terms of the system's formal water allocation in 2008. With support of CESA specialists the WUA managed to change the legal status and terms of use of their water allocation in relation to that of the Pucará power station. These modifications managed to change the power station allocation into a multi-purpose water allocation, which made irrigation the priority use. This modification has improved the water supply of the irrigation system by changing the functioning regime of the power station through which water is supplied to the Pillaro Irrigation System (Den Ouden 2011; Récallt 2011). [5]

## 4. Discussion: normative structures, conflict and collaboration in irrigation systems

In many rural areas of the world where access to and use of renewable resources are fundamental for livelihoods, improving cooperation for their management is an important step for ensuring long-term socio-ecological sustainability and resilience. This is also true for the administration, operation and maintenance of irrigation systems which, if managed based on user based arrangements, is dependent on cooperation and collective action (Ostrom 1990). Yet, as collective action is heavily dependent on social capital, it cannot be taken for granted and has to be fostered and recreated through the functioning and implementation of normative structures that mediate the interactions between the users through a governance system (Ostrom 1990; Araral 2013). These normative structures that are basically put in place to establish systems of cooperation through trust and reciprocity establish relationships that are mediated by bureaucratic, market, associational or communal relations. These different forms of normative relations are often mixed and hybridized to shape the water rights frameworks that structure irrigation management (Boelens et al. 2009) through the interactions of the different subsystems that form the SES which irrigation systems conform.

The analysis of the case of the Pillaro North Canal irrigation system shows that interventions from outside actors in the construction of the different elements that conform and irrigation system (RS, RU, GS, U) are powerful forces that define the contours of how irrigation systems will work. In doing so, they become determining factors for the long term sustainability and resilience of these systems (Ratner et al. 2013). Although for rural communities of smallholders, external support is often needed and/or wanted for making investments in infrastructure (RS) for the use of water (U), the infrastructure does not stand on itself. It is often implemented along with the imposition of new normative structures and related governance systems. These are nevertheless not implemented on an empty socio-natural environment; but are often forcefully overlain on already existing local normative structures and governance systems. This creates tensions and conflicts amongst users and can on the long run imperil the sustainability of the SES; importantly because many of the external interventions especially those of the state introduce normative structures that foresee the mediation of the interactions amongst users based on bureaucratic and market relations rather than on the existing local associative and communal relations. In doing so they weaken and transform the basis of existing forms of local community based social capital. As shown for the case of Pillaro, the community

structures were undermined and replaced with WUAs that operate based on a normative framework that greatly relies on bureaucratic relations (see [Den Ouden 2011](#)). This has clearly debilitated the willingness of many water users to engage in collective action and participate in community affairs; while on the other hand some of the stronger communities have resisted to make the irrigation system work according to the new imposed normative frameworks and governance structures. This reminds us that closed bonding networks of people who share a common normative framework (religious, political, ethnic, class) sometimes impede the formation of social cohesion beyond the group boundaries ([Ryan 2011](#)) and that the existence of social capital is only selectively mobilized for achieving group and/or individual advantages ([Anthias 2007](#)).

Yet, as other cases of external interventions show, external interventions can also strengthen community collaboration and collective action based on communal and associative relations ([Hoogesteger 2013b](#)). The key to this is a participative intervention methodology in which the water users and the existing communities become the decision makers on how the irrigation systems (SES) and their different subsystems get shaped ([Hendriks 2002](#); [Gutierrez 2005](#)). This requires of the intervening parties a different approach in which their role becomes one of facilitators rather than 'experts' ([Ubels and Horst 1993](#)); but if and whether this is possible greatly depends on the room to manoeuvre there is within the broader legal and institutional context.

On the other hand, the case of Pillaro also shows that despite these internal conflicts, collaboration does exist and persist within the system to ensure water delivery to the users and when it concerns the establishment of relations with external actors that can support the enhancement and sustainability of the resource system (infrastructure) of the SES. In this manner cooperation and conflict live alongside each other in and amongst the same population of users. In this sense, for the sake of analysis, it is useful to distinguish between two forms of social capital which are: *internal looking social capital* which basically determines how the interactions are shaped within a SES and which greatly rely on the internal governance system; and *outward looking social capital* that shapes the interactions between the SES and the broader actors and networks in which that SES is embedded ([Hoogesteger 2013a](#)). Through the latter, the leaders and directives that represent the collective interests of the users can sometimes spark internal collaboration and ensure, through external support that the resource system and resource units and with it the outcomes of the SES are maintained and improved.

## 5. Conclusions

The analysis of the case study of the Pillaro North Canal Irrigation System through the SES framework, brings to the fore three important issues that are at play when analyzing collective action in the large Andean state built irrigation systems that cross and unite several communities along different agro-ecological zones -and that have had external state and/or NGO support in contexts that have been identified as enabling for the development of collective action (see introduction section).

First, it pulls renewed attention to the study of the contents, origins, conflicts and local/cultural embedding of normative structures and the related governance systems that shape the internal functioning of supra-community irrigation systems and more broadly of SES. In this analysis the different relational forms that normative frameworks establish (market, bureaucratic, associational or communal) can form a valuable analytical tool.

Second, based on this renewed attention for normative frameworks in SES, it brings the focus to the powerful role that external agents (NGOs and state agencies) that intervene in irrigation systems have. It shows how these external interventions can shape the contours of the different subsystems of the irrigation systems with important consequences on how it functions through the interactions between the users and the other subsystems. A focus on the contents of the normative frameworks that shape these interactions through a governance system sheds important light on what kind of relations (market, bureaucratic, associational or community) are fostered and/or hindered through these systems. At the same time this analysis sheds important light on some of the underlying norms around which conflicts arise when these systems are imposed on existing communities and their normative structures. The presented case shows that despite the capacity of some communities to cleverly hybridize new and existing normative structures (as is the case for the water users of the Urbina Parish) (see also [Boelens 2002](#)) the imposition of state defined bureaucratic and market relations that are to structure the functioning of the WUAs has weakened and undermined the existing forms and organizations (communities and FOCCAP) of collective action and supra-community collaboration.

Third it focuses the attention to the importance of the relations between these supra-community irrigation systems and external agencies/actors. In many Andean supra-community irrigation systems external interventions are a necessary must to construct infrastructure (RS) (and related operational skills) that because of its size, monetary costs and technical complexity are impossible for local rural communities to materialize without external support. This in spite of the fact that these often impose governance systems that are at odds with the existing local organizational structures and normative frameworks (see also [Boelens and Doornbos 2001](#)).

This necessary, yet sometimes uneasy relation between local rural communities and external support agents calls for a reconsideration of the intervention methodologies of the latter and a revision of the legal guidelines within which WUAs in the Ecuadorian Highlands (and more broadly speaking the Andes region, see [Hendriks 2006](#); [Boelens et al. 2013](#); [Harris and Roa-García 2013](#)) are expected to manage and sustain their irrigation systems. The present case study suggests that at least three important first steps are desired for enhancing cooperation and collective action in supra-community irrigation systems: 1) the legal (and de facto) recognition of customary rights and local semi-autonomous governance systems, 2) the development of interactive and participatory intervention methodologies, that can lead to 3) the establishment of local governance systems that, as analyzed in [Hoogesteger \(2013b\)](#), build on existing organizations and normative structures that enhance collective action and collaboration amongst and within communities that share an irrigation system.

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#### Notes

- 1 The Píllaro irrigation system is composed of the Píllaro North Canal and Píllaro South Canal. At the time of study the technical and organizational interventions in the Píllaro South Canal had only started and were based on the intervention methodology that had been used in the Píllaro North Canal. Therefore I focused my case study only on understanding the Píllaro North Canal SES. Data of this case study have been published earlier in [Hoogesteger 2013a,c](#).
- 2 In externally funded projects, communities usually agree to provide the required (un)skilled labor through *mingas*.
- 3 Participation and work tasks are assigned according to the capacity of the individual. Elderly and pregnant women are usually exempted from work.
- 4 The second phase of the project, (beginning in 2005) included the communities of Urbina parish in the project.
- 5 Although legally and on paper these changes have taken place, their implementation is still not always followed because for power generation purposes the new operation guidelines are not ideal. Therefore it has kept on being an issue of struggle.



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