

Irrigation Management from a Qualitative Approach: How Key Stakeholders are Involved in Decision-Making Processes. Learning from Irrigated Agricultural Systems in Spain, France and Italy

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Abstract

Concerns about water scarcity and management have focused attention on agricultural use of water and irrigation. As the largest water-using sector worldwide, irrigation have to adapt to new demands of non-consumptive water uses. This research applies the Stakeholder analysis approach and the Governance model approach to evaluate perceptions of and preferences for irrigation use and its management in three multi-functional irrigated agricultural systems from Southern Europe. The obtained results from their application in three large irrigation areas in Spain, France, and Italy highlight the conflicting attitudes on irrigation development from confronted points of view (public and private services, rural community, and civil society), the key stakeholders' profiles and their interactions in decision-making processes, and the ability to improve agreements by promoting social learning methods and participative tools. These results can be used by the relevant authorities to customize their interventions, knowing which are the different stakeholders' priorities and establishing also more effective avenues of communication.

Keywords: Irrigation, stakeholders, qualitative analysis, Territorial Irrigation Management Model, Southern Europe

1. Introduction

In contemporary society, water is a major theme of scientific, economic, political and social debate (El Chami *et al.* 2011). Aspects like water scarcity and efficiency (Yang *et al.* 2013), population and economic growth (Alcamo *et al.* 2007), food production and trade patterns (Kasaai 2014), environmental services and impacts (Cook and Spray 2012), or competing water demands (Strzepek and Boehlert 2010), have exposed the weakness of many current water governance and management systems (Sarker and Itoh 2003; De Fraiture and Wichelns 2010).

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In addition, rapid and pervasive changes in land and water use amplified by climate change impacts have increased the pressure on water resources (Allan *et al.* 2013; Brownlee *et al.* 2014). Water management issues, often embedded in seemingly endless ecological, social and political interactions across temporal and spatial scale, are context-dependent, socially constructed and technically uncertain (Grigg 2008; Hamdy 2008). They are shaped, among other things, by the interplay of multiple legitimate perspectives and problem definitions, and grounded in the wide range of stakeholder values, worldviews interests found in increasingly pluralistic societies (Jonsson 2005; Pahl-Wostl *et al.* 2011). Foresters, fishermen, recreational users, municipal and rural water utilities, industries, farmers and environmentalists have legitimate interests in how water is allocated and used in their own as well as in competing sectors (Heydari 2014). Legal, moral, political and other systems of beliefs and decision inputs compete with economic return of water use making water resource problems not only a demand–supply topic but also complex social and environmental challenges (Mollinga 2008; Dessu *et al.* 2014).

The main EU policies that affect the practice of irrigation have tended to progressively adapt and integrate the historical conception of irrigation with the new demands of multi-functionality, common goods and legitimacy (Reyes-García *et al.* 2011; Gómez-Limón and Picazo-Tardeo 2012). Given the complexity, uncertainty, increasing vulnerability of both natural and human systems, and the competing water uses, water managers around the world agree that the only way forward is through an inclusive and integrated approach to water resources management (Pereira 2005; Buyukcangaz and Korukcu 2007; Faysse *et al.* 2014). In parallel, it will lead to an emphasis on social participation as an integral part of the management of water resources (Reed 2008), which is justified by the climatic and environmental complexity, the competition among users for water resources, and the loss of social legitimacy in decision-making (Blackstock *et al.* 2007). This loss of legitimacy from society is influenced prominently by the emergence of new social actors (environmental groups, professional associations and civil organizations, among others), who advocate defending the public interest. Ultimately, the challenges faced by the management of water resources tend to favor the implementation of governance as a mechanism to mutual understanding and potential agreement between the confronted points of view. In this context, Stakeholder participation is a key principle of the integrated water resources management (McDonnell 2008; Carr *et al.* 2012).

It is a central issue in planning and decision making processes for the development of suitable water resources management strategies at the river basin level (Rault and Jeffrey 2008). The main ideas and arguments behind the need to involve stakeholders are: a) ownership of proposed policies, b) increased acceptance of the decisions made, and c) information sharing and improved transparency in decision making process. It is for these reasons that stakeholders' participation is advocated in decision-making process and development of policy documents and regulations in several fields of natural resources management (Gunasekara 2014). Concerns about water scarcity and management have focused attention on agricultural use of water and irrigation, the largest water-using sector worldwide, which is widely seen as a low-value, wasteful and "inefficient" use for water, especially in arid regions with competing water uses. Irrigation is a vital component of agricultural production in many developed and developing countries. Water management in agriculture is evolving toward a more holistic and integrated approach by considering water availability, stakeholder's demands, social decision-making processes and legitimacy (Giannoccaro *et al.* 2013). Consequently, there is an increasing integration of land use with water use management decisions to both help conserve water and enhance water quality, but also to promote the potential of agriculture to provide multiple environmental benefits and food production to society (Parris 2011).

This paper will analyse the stakeholders' attitudes on three irrigated agricultural systems and it will compare and discuss their priorities and discourses around irrigation its management and governance. In particular, understanding how public and private services interact for managing competing water uses. Further, analysing how rural community and irrigators' attitudes affect rural development in a context of an increasingly post-productivist farming regime. Finally, evaluating how civil society assesses the irrigation sector and how is perceived a more participated and holistic management of interconnected activities like irrigation and natural resources management. We hope that this paper will form the basis for a discussion of possible implications of the inclusion of the qualitative approach and 'attitude change' on the monitoring of water and agricultural integrated policies and practices (for example, understanding the relation between stakeholder interests, local practices, impact on rural landscape, and potential climate change mitigation actions).

2. Data Sources and Methods

One of the pillars of the geographic discipline is to understand the interaction dynamics between natural and social phenomena in a given space and time (Garmendia and Stagl 2010). Several issues affect the territory and they require a variety of interpretations and discourses for their effective management (Brewington *et al.* 2013). Thus, it is essential to, first, analyze how positioned and adapted each stakeholder is in the face of present and future challenges, as well as to identify favourable affinities and avoidable confrontations between competing points of view. Secondly, it is useful to compile the weaknesses and potential attitudes of each stakeholder involved in the decision-making process (Figure 1).

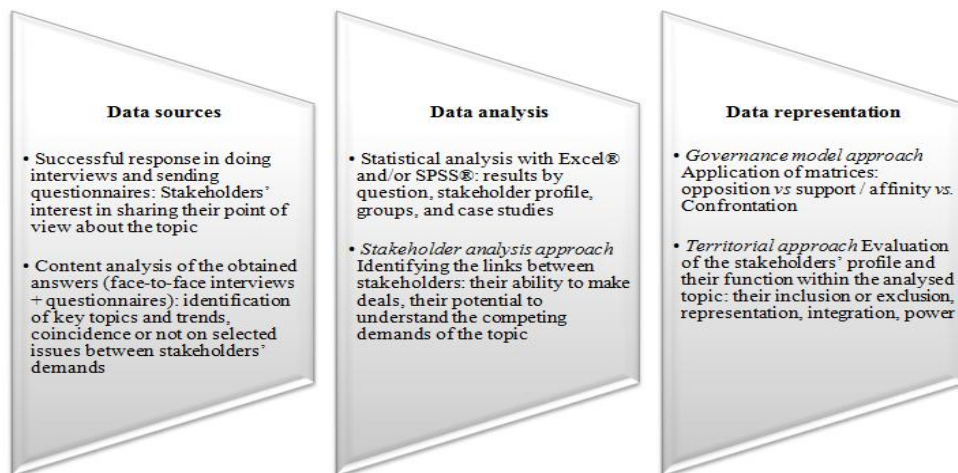


Figure 1: Data Sources, Data Analysis and Data Representation from Qualitative Approach

2.1 Face-to-Face Interviews and Digital Questionnaires

Two qualitative tools, the face-to-face structured interview and a multiple choice questionnaire, were applied. The interview was conducted from a script previously sent to the stakeholders and organized into five sections: 1) the role of irrigation and its socioeconomic context; 2) the European policies regarding agriculture, water, and the environment; 3) the irrigation system characterization; 4) the relationship between confronted demands from competing water uses; and 5) level of governance in the management of the irrigation system.

Key stakeholders were identified, consulted, and organized according to four interest groups that cover the potential multiple points of view and interests of the whole stakeholders' spectrum on each irrigated agricultural system management: public services (public administration and services delegation), private services (land and water consortiums and hydropower company), rural community (rural syndicates), and civil society (environmental and social platforms). The transcription of face-to-face interviews using qualitative analysis software Atlas.ti® 7 allowed highlighting concepts, perceptions and confronted points of view between the stakeholders. This implies, therefore, a first reduction and/or simplification of the initial transcription of the face-to-face interview. This is done by delimiting in quotes significant parts of the transcribed text that will be useful in characterizing the profile of each stakeholder, as well as for subsequent comparisons with the other respondents. The results obtained sought to understand the starting point of each stakeholder discourse regarding the topic. The next step is to encode this information in order to make an internal and/or external comparable analysis. This process can be carried out by incorporating original data (transcribed interviews) for identifying potential concepts and, subsequently, convert them to codes (*bottom-up* codification). A total of 30 new codes were created for characterizing the selected quotes from the face-to-face interviews. A table of contents has been prepared for each of the codes created (see example on Table 1). The quotes selected from the stakeholders' discourses are also organized into four family codes (WATER, IRRIGATION, AGRIC-ENV, and GOVERNANCE) as a representation of issues under debate.

Table 1: Table of Content of the ACORD Code

Code	ACORD
Code family	GOVERNANCE
Definition	Valuation of the (non-) necessity and (non-) achievement of agreement/s in order to improve the decision-making process.
Description	Discourses based on (non-)promotion of an agreement between competing demands to benefit the management of complexity. Includes variables related to the process of reaching an agreement, the factors that determine it and the stakeholders willing to carry it out.
When used	Apply to the set of references that promote, justify and/or criticize the agreement as a mechanism for improving governance.
When not used	Do not use it when exist a direct link with participation (PARTICIP code), conflicts between discourses (CONFLICT code) or examples of agreements (EXEMGOV code).
Example of quote	"It is very difficult to reach an agreement but we understand that it is the only way to benefit or damage anyone in the same way and intensity"

In addition, each stakeholder received a digital questionnaire by Survio® Platform. In this regard, the questionnaire was designed as a complement to the interview, and it was organized into three sections: (a) intrinsic characterization of the stakeholder and the valuation received from other stakeholders; (b) definition of potential (non-)links between conflicting positions and; (c) the ability to establish alliances to define an agreement that clears the way for and improves the irrigation project. The multiple choice questionnaire sought, first, to impact the diverse perceptions about the topic and, second, to collect assessments regarding affinities and confrontations between stakeholders. The aim was to reflect three key aspects of managing complex subjects: 1) to meet one's own demands in the context of the needs of the whole; 2) to identify potential agreements between stakeholders and; 3) to define the basis of building a potential agreement that includes participation. Each of the 13 questions of the questionnaire provided new knowledge about the stakeholder and the stakeholders' group, which in turn facilitated the identification of common profiles among compatible and incompatible discourses.

2.2 Stakeholder Analysis Approach and Governance Model Approach

Qualitative methods have the ability to make the invisible visible, and they can indirectly reduce the likelihood of a probable or existing confrontation. Qualitative analysis and its ability to structure the profile of each discourse allow us to identify the potentiality of an agreement. In other words, it is a key mechanism for addressing potential conflicts in the implementation of a major idea, policy and project. Here, the intensity and timing of the participation process and its analysis would be marked by two variables: 1) the presence of public discussion spaces and, 2) the ability to influence the decision system. Both variables contribute to a noticeable reduction in the conflict around a project, when positive spaces are provided for participation, the exchange of ideas, and the confrontation of discourses. Identification of each of the conflicting interests and their categorization are key aspects in understanding the dynamics of the debate and/or conflict, as well as in fostering their mitigation and resolution (Lienert *et al.* 2013). In this sense, the Stakeholder analysis approach is the dominant approach to analyzing conflicting interests, as it facilitates the incorporation of values and different demands into the same subject in order to understand the whole from its parts (Laplume *et al.* 2008). The *stakeholders* include all those who can individually and/or collectively determine or be affected by political decisions and actions. Stakeholders are connected in various ways, and they have the ability to influence each others' discourses.

The analysis of these connections and influence has facilitated the development of specific techniques and methods that are able to adapt to the spatial and/or social topic (Weible 2005). The decision about complex issues becomes, therefore, a process that requires mutual learning, which continuously improves the governance of the decision-making process (Pahl-Wostl *et al.* 2007). The Governance model approach is a method capable of responding to the implicit complexity involved in the management of competing and conflicting issues, as well as to the legitimacy of the decision-making process when it is based on social, economic, political, cultural and environmental demands (Wangel 2011). This process is illustrated graphically by social structures represented by nodes (stakeholders) that are connected by ties (relationships) showing different degrees of affinity, controversy and potential temporary agreements. In short, this method proposes a relational framework based on the analysis of the links between the diversity of the stakeholders and their capacity to build the territorial network and improve its governance in the management of the commons (Rijke *et al.* 2012). Cognitive maps are one of the simpler and clearer techniques for visualizing key concepts from stakeholders' discourses. Another useful method for representing the profile of the stakeholders is social network analysis. This method provides both the individual performance of the involved stakeholders and their ability to weave affinities and/or rivalries from among the remaining discourses in conflict (Prell *et al.* 2009). In short, the different categories of social networks reflect how collective decisions are influenced by certain stakeholders and how this influence is conditioned by time. According to Dougill *et al.* (2006), it is a method based on the analysis of electronic questionnaire responses and which allows determination of: 1) the degree and frequency of interaction between the diversity of stakeholders; 2) the degree of stakeholder confidence in establishing synergies; 3) the degree to which the respective discourses overlap; and 4) the ability to establish mutual recognition among them.

3. The Case Studies

The European rural mosaic is based on a combination of traditional irrigation systems – areas with extensive agrarian dynamism – and modernized or new irrigation projects – that were promoted under the criteria of water efficiency and food security (Silva, 2012). Countries like Spain, France and Italy largely symbolize the domain of water resources in any economic activity that is able to structure the territory (Malorgio 2008).

In such contexts, hydraulic constructions have played a central role in the attempt to *dominate* water resources, where the agrarian plains have played a key role in developing irrigation (Ertsen 2006). In consequence, the construction of dams and irrigation canals has placed the management of natural resources above all productive, rural development and demands for ecosystem conservation (Kaika 2006). The representativeness of each of the three irrigation systems selected within and outside its territorial context is defined by two factors (Figure 2). Firstly, by their matching factors: the cultural background of irrigation, the diversity of interests that are represented or not, the prioritization of certain water uses according to availability, and the intensity of citizen participation and/or mobilization. Secondly, by their particularities: an irrigation project recovered after 150 years that must adapt to environmental requirements – the Segarra-Garrigues system –; a centennial irrigation canal devoted to corn monoculture but with strong environmental pressure – the Neste system –; and an irrigation canal with high multi-functionality that simulates the environmental functions of a river – the Muzza system.

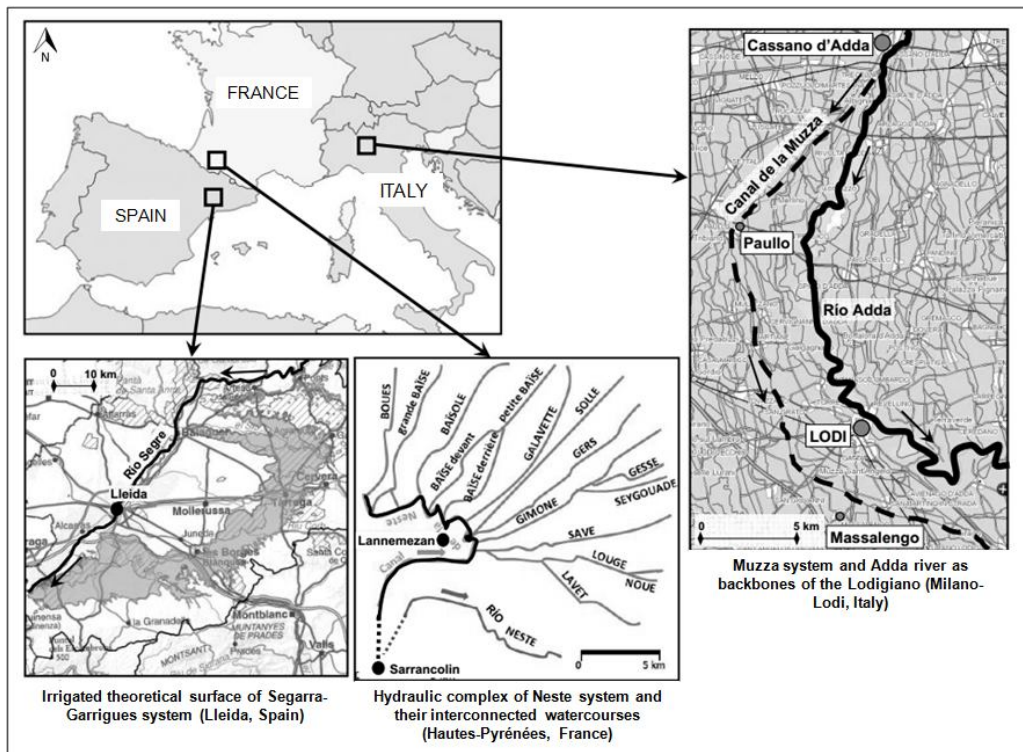


Figure 2: Location of the Three Irrigation Systems

3.1 The Segarra-Garrigues System

Conceived in the mid-nineteenth century and designed in the mid-1990s, its construction would not start until 2002. At 85 km in length from the Rialb reservoir to the L'Albagés Dam, this irrigation canal brings together a total of 70,150 hectares, affecting 73 municipalities across six counties: La Noguera, La Segarra, L'Urgell, Pla d'Urgell, Garrigues and Segrià. Its legitimacy was influenced by the debate on water availability and the priority of use, the economic viability of the infrastructure, the constancy of the conflict of interest between irrigators and environmentalists – which motivated a significant reduction in the irrigated potential surface – and the social mobilization around the uses of the canal (Ricart *et al.* 2013).

3.2 The Neste System

Opened in 1862, this 29 km irrigated canal carries the water within the Neste system by gravity from the Neste River – a tributary of the Garonne River – to the valley of Sarrancolin. It is a hydraulic complex of seventeen rivers that are artificially interconnected in order to overcome periods of water shortage. In addition to its agricultural function, this canal plays a strategic role in promoting environmental services (Ricart and Clarimont 2013). Since its inception, this project has had a multi-functional use: drainage, irrigation, navigation, hydroelectric power and urban use. While consumptive use of water will not be changed significantly over time, it is important to note the increasing of significance of the non-consumptive water uses associated with the canal, such as ecological flow and hydroelectric use.

3.3 The Muzza System

Located in the heart of the Lombard plain, the Muzza canal is major work of hydraulic engineering that has shaped the Lodigiano territory. Designed in 1220 as a derivation of the Adda River near Paullo, this canal runs 61 miles through 69 municipalities and distributes water through four secondary canals. Promoted to improve agronomic conditions in the valley by draining groundwater and the modernization of the traditional irrigation systems, both functions remain priorities with the passage of time but share the limelight with other economic functions – such as the production of hydropower and thermal energy – and with social services – such as area for recreation and environmental education.

4. Results

The following sections present the main results obtained from the qualitative analysis as well as the territorial approach to the selected irrigated agricultural systems from Southern Europe.

4.1 Characterization of the Segarra-Garrigues system

A total of 20 key stakeholders were selected from the Segarra-Garrigues system (Table 2). The face-to-face structured interviews were conducted in November 2013 and each interview was between one and three hours and a half in duration.

Table 2: Key Stakeholders Selected from the Segarra-Garrigues System

Key stakeholders	Acronym	Stakeholders' group
Confederación Hidrográfica del Ebro	CHE	Public services
Agència Catalana de l'Aigua	ACALL	Public services
Departament d'Agricultura, Ramaderia, Pesca, Alimentació i Medi Natural (DAAM). Subdirecció General d'Infraestructures Rurals	DAAMIR	Public services
Oficines comarcals del DAAM a la Noguera, el Segrià i Les Garrigues	DAAMOC	Public services
Oficina del Regant (DAAM)	OFREG	Public services
Infraestructures de la Generalitat de Catalunya S.A.U	INFRA	Private services
Aigües del Segarra Garrigues S.A	ASG	Private services
Comunitat de Regants del Segarra-Garrigues	CRSEGA	Private services
ENDESA	ENDESA	Private services
Unió de Pagesos de Catalunya	UP	Rural community
Associació Agrària Joves Agricultors–Associació d'Empresaris Agraris de Lleida	ASAJA/AEALL	Rural community
Joves Agricultors i Ramaders de Catalunya	JARC	Rural community
Institut Agrícola Català Sant Isidre	IACSI	Rural community
Federació de Cooperatives Agràries Catalanes	FCAC	Rural community
SEO/BirdLife	SEO/BL	Civil society
Institució de Ponent per a la Conservació i l'Estudi de l'Entorn Natural	IPCENA	Civil society
Institució per a l'Estudi, Gestió i Recuperació dels Ecosistemes Lleidatans	EGRELL	Civil society
Lleida Ambiental	LLAMB	Civil society
Compromís per Lleida	CxLL	Civil society
Plataforma en Defensa de l'Ebre	PDE	Civil society

The analysis of the face-to-face interviews has allowed us to collect a total of 411 quotes, of which civil society and the rural community contributed, respectively, 171 and 126 citations; public services 83; and private services 31. The main topics expressed by the stakeholders have been represented in a cognitive map (Figure 3).



Figure 3: Cognitive Map from Key Stakeholders Answers

4.1.1. Main discourses from face-to-face Interviews

The following quotes symbolize the main discourses that generate greater interest in the debate/conflict in the Segarra-Garrigues irrigation system: “The Ebro basin is a basin with a very strong agri-food tradition where, since the last century, administrations have pushed for the agricultural and rural sector as a strategic factor in preventing depopulation and to respond to the demand for food security” [CHE – public services] “The fact that people do not adhere to irrigation because they cannot pay for water suggests that the canal is a political rather than territorial project” [ACALL – public services] “A project like the Segarra-Garrigues canal, as all canals, was born as an irrigation canal, but in reality it is a tool for rural development” [DAAMIR and INFRA – public services] “The prospect of irrigation is better than drought, but not a panacea” [DAAMOC – public services] “This is an entropic landscape... these crops and these plains, suitable for all steppe birds, really are products of farming” [ASG – private services] “Water is culture, is industry, is food, is influence, is power... is everything.

Water is a strategic element in our land where droughts abound" [CRSEGA – private services] "Around the Segarra-Garrigues canal has been imposed a land bubble that moves many interests... If this canal were believed to benefit the territory, institutions would have provided more facilities to the potential of irrigation in order to adapt to this change" [UP – rural community] "The conflict has arisen between agricultural and environmental viewpoints. There has been no meeting to boost an agreement, not even the most minimal" [ASAJA/AEALL – rural community]

"The purpose of the canal was to settle people in the territory, and that is not happening" [JARC – rural community] "It is not imperative to stop irrigating a number of hectares to protect some birds that are already protected at the national level. The same birds that serve as an excuse to justify that we cannot irrigate with the Segarra-Garrigues canal are in the neighboring Urgell canal..." [IACSI – rural community] "It is true that the Segarra-Garrigues canal has been promoted in a context where the agricultural sector is more aged than ever, but it is also true that the people of the territory have not moved enough to defend its implementation" [FCAC– rural community] "We understand people... most of them have been waiting for water over one hundred and fifty years... but there has been no political will to explain to people that, unfortunately, the project cannot be completed and it is necessary to find alternatives for the agricultural activity" [SEO/BL – civil society]

"What is not justified is that the Segarra-Garrigues canal promotes a model of agricultural production opposite to the availability of water resources" [IPCENA – civil society] "It would have been more logical to work with large areas of landscape to define the Special Protected Areas and distinguish those farmers who do not want water from those who do. However, the management of the situation has encouraged land speculation" [EGRELL – civil society] "The Segarra-Garrigues canal is an opportunity for the country to propose a new model of rural development that incorporates environmental issues" [LLAMB – civil society] "The Segarra-Garrigues canal was a recurring project in the collective imagination of the society... those who live here have embedded the project in genetics... Politicians leave and we remain" [CxLL – civil society] "The Segarra-Garrigues canal is a deception to the Lleida territory because it is an infrastructure that has arisen to justify transferring water to Barcelona... this is the only way to finance a project that would otherwise not be feasible" [PDE– civil society]

4.1.2. Stakeholders' Affinities, Confrontations, and Interactions

The main topics expressed by the stakeholders representing public services are the social recognition of irrigation and the effects of irrigation in environmental flows. Private services agree on many of the references bounded by public services, especially regarding topics like the latent conflict between irrigators and environmentalists. The dominant discourse of the rural community focuses on the future agricultural model of the Lleida plain. Finally, civil society emphasizes the concern for water availability and its use by the agricultural sector; they also trivialize the environmental issues and criticize cereal monoculture. The analysis of the code families reveals how the quotations of WATER code family highlighted issues such as (a) concern for environmental flow, (b) the influence associated to water availability and control, and (c) the dominant agreement on the need to change the water management model. The quotes in the code family AGRIC-ENV include aspects such as (d) (non-)recognition of farmers for their environmental function, (e) lobbying practices of irrigators and environmentalists, and (f) the role of society in defending the general interest of public investments. References to the IRRIGATION code family show topics like (g) interest in the multifunctionality of the Segarra-Garrigues canal, (h) the lack of an alternative project for the agriculture of Lleida plain, (i) the economic and environmental cost of water and energy efficiency, and (j) the recognition of the Special Protected Areas for their contribution to the landscape matrix. Finally, quotes referenced in the GOVERNANCE code family are based on topics such as (k) the difficulty of reaching agreements between competing water discourses, and (l) the need to involve the demands of those who live in and manage the territory. In addition, a synthesis of the results obtained from the questionnaire, by stakeholder groups, can be compared in the next table.

Table 3: The Stakeholders Groups' Profile from the Segarra-Garrigues system

Question	Public services	Private services	Rural community	Civil society
Your inclusion on the irrigation canal management is...	Complementary	Essential	Necessary	Between essential and necessary
Do you feel represented in the canal?	Yes	Yes	No	No
What is the feeling of (not) being represented?	Be part of the decision-making process	Be part of the decision-making process	Non recognition as stakeholder	Non recognition as stakeholder
What level of representation do you have?	High level	High level	No representation	Minimum level
What is the reason that explains your (lack of) representation?	Institutional recognition	Social recognition	Lack of political interest	Lack of institutional recognition
What is your assessment of the other stakeholders?	Between necessary and essential	Between necessary and essential	Between necessary and complementary	Between complementary and necessary
Rating received by stakeholders (1-5)	2,9	2,9	2,5	2,4
Are you looking for an agreement?	Yes	Yes	Yes	Yes
What factors make the agreement possible?	Compatible discourses and Fluid negotiation	Fluid negotiation	Compatible discourses; Fluid negotiation	Compatible discourses; Fluid negotiation; Political strategy
What kind of agreement?	Permanent	Permanent	Permanent	Permanent
Types of relationships	Bidirectional	Unidirectional	Bidirectional	Unidirectional
What factors can benefit the agreement?	Predisposition to collaborate; Mutual recognition; Ability to listen; Fluid negotiation	Fluid negotiation; Predisposition to collaborate; Midterm synergies	Predisposition to collaborate; Ability to understand the others; Mutual recognition	Mutual recognition; Predisposition to collaborate; Ability to listen and understand; Midterm synergies
Do you have influence?	Yes	Yes	No	Yes

4.2 Characterization of the Neste System

A total of 11 key stakeholders from the Neste system (Table 4) were selected from their representativeness and interviewed. The face-to-face structured interviews were conducted in March 2012 and each interview was between one and three hours and a half in duration.

Table 4: Key Stakeholders Selected from the Neste System

Key stakeholders	Acronym	Stakeholders' group
Direction Départementale des Territoires Hautes-Pyrénées	DDT	Public services
Agence de l'Eau Adour Garonne	AEAG	Public services
Chambre Départementale d'Agriculture Hautes-Pyrénées	CDA	Public services
Compagnie d'Aménagement des Coteaux de Gascogne	CACG	Private services
Syndicat Irrigation Coteaux Gascogne	SICG	Private services
Association Syndicale Autorisée La Ribière	ASALR	Private services
Association Syndicale Autorisée La Basoile	ASALB	Private services
Fédération Départemental des Syndicats d'Exploitants Agricoles Hautes-Pyrénées	FDSEA	Rural community
Confédération Paysanne Hautes-Pyrénées	CP	Rural community
Coordination Rurale Hautes-Pyrénées	CR	Rural community
France Nature Environnement	FNE	Civil society

The analysis of the Neste system is based on the performance of the semi-structured interview and the digital questionnaire sent to a total of 11 representative stakeholders. They have posted a total of 203 quotes, of which 80 were provided by private services, 48 by the rural community, 43 by civil society, and 32 by public services. The main topics expressed by the stakeholders have been represented in a cognitive map (Figure 4).

**Figure 4: Cognitive Map from Key Stakeholders Answers**

4.2.1. Main Discourses from Face-to-Face Interviews

The following quotes represent the topics of greater interest in the debate/conflict in the Neste system: "In recent years the rational use of water in agriculture has been promoted by implementing best practices in gravitational irrigation, because we do not have a counterproposal capable of regulating the volume of water used" [DDT – public services]

“The AEAG financed works and techniques to modernize irrigation efficiency and imposes taxes on water consumed... we have a control role” [AEAG – public services] “The Neste system is a simple system where there is water available, [along with] socioeconomic demands and ecological flow... the hardest thing is to gather people around a table to discuss it” [CDA – public services] “Water availability is managed from the Neste Commission by bringing together representatives of the different uses of water, as an example of governance in the decision-making process” [CACG – private services] “Farmers have already accepted the existence of environmental factors that must be taken into account, and they are primarily interested in ensuring their implementation on farms” [SICG – private services] “In the Neste system the construction of water reservoirs is not considered to be negative, as they are considered useful for meeting the common demands of different water sectors” [ASALR and ASALB – private services] “We agree to make technical and cultural improvements in order to include the environment in the production process, but the profitability of the farm cannot be impaired” [FDSEA – rural community] “The discourse on global nutrition that the promoters of irrigation use is not valid when you are wasting tons of food and are unable to manage the distribution sector” [CP – rural community] “There are people who want to irrigate and improve the profitability of their farm, but cannot do it because the environmental pressure is very strong and limits all options for irrigation” [CR – rural community] “For us, water is a common heritage while for both the agricultural sector and the energy sector it is just a business” [FNE – civil society]

4.2.2. Stakeholders' Affinities, Confrontations, And Interactions

References to the social recognition of agriculture or the attention to water consumption are topics treated by the public services. In contrast, no attention emerged regarding issues such as environmental flows, the existence of a farming lobby, or Neste irrigation system management. Meanwhile, private services agree on many of the references bounded by the public services, especially regarding topics like the social function of irrigation practices or the latent conflict between irrigators and environmentalists. For the rural community, the dominant discourse focuses on the prioritisation of water resources among competing water uses, availability of water resources during periods of scarcity, or the water management model for non consumptive water uses. By contrast, the rural community does not take the opportunity to make any remarks about environmental attitudes or to highlight the environmental services of agricultural practices.

Finally, civil society' quotes emphasize the concern for the privatisation of water management model, water availability and its consumption by the agricultural sector, or the criticism to the maize monoculture. The analysis of the code families reveals how the quotations in the code family WATER highlights issues such as concern about the artificiality of the water cycle and its effects on ecological flow and the cost of maintaining the infrastructure of storing and distributing water, or the need to conceive of water in an integral way to promote agreements between competing water uses. Meanwhile, the quotes in the code family AGRIC-ENV include aspects such as: the animosity of irrigators to their adapting environmental requirements without economic compensation; the lobbyist practices of the agricultural and environmental sectors; and the need to involve the whole society in managing the commons. Regarding the references in the code family IRRIGATION, these show an interest in the balance between energy and the water efficiency of the irrigation canal; the multi-functionality of the water and land systems; and the need to support the management of the Neste system with consideration for the whole territory. Finally, the quotes referenced in the code family GOVERNANCE are based on topics such as the need to leave aside radicalism in the conflicting postulates or the role of government in promoting debates between competing water demands. In addition, a synthesis of the results obtained from the questionnaire, by stakeholder groups, can be compared in the next table.

Table 5: The Stakeholders Groups' Profile from the Neste System

Question	Public services	Private services	Rural community	Civil society
Your inclusion on the irrigation canal management is...	Necessary and Complementary	Necessary	Necessary	Necessary
Do you feel represented in the canal?	Yes	Yes	No	No
What is the feeling of (not) being represented?	Be part of the decision-making process	Be part of the decision-making process	Not be part of decision-making process	Non recognition as stakeholder
What level of representation do you have?	Medium level	Between high and low level	No representation	Medium level
What is the reason that explains your (lack of) representation?	Stakeholder and expertise recognition	Stakeholder recognition Institutional recognition	Environmental pressure	Lack of institutional recognition
What is your assessment of the other stakeholders?	Between necessary and essential	Between essential and necessary	Between necessary and complementary	Between dispensable and necessary
Rating received by stakeholders (1-5)	2,7	2,8	1,7	2
Are you looking for an agreement?	No	No	No	It depends
What factors make the agreement possible?	Favourable political strategy	Favourable political strategy	Mutual recognition between stakeholders	Compatible discourses
What kind of agreement?	By subject	By subject	Permanent	By subject or punctual
Types of relationships	Unidirectional	Unidirectional	Unidirectional	Unidirectional
What factors can benefit the agreement?	Mutual recognition; Ability to listen; Midterm synergies	Ability to listen and understand; Midterm synergies	Midterm synergies; Predisposition to collaborate	Mutual recognition; Ability to listen; Midterm synergies
Do you have influence?	Yes	Yes	Yes	Yes

4.3 Characterization of the Muzza system

A total of 15 key stakeholders from the Muzza system were selected and interviewed (Table 6). The face-to-face structured interviews were conducted in March 2013 and each interview was between one and three hours and a half in duration.

Table 6: Key Stakeholders Selected from the Muzza System

Key stakeholders	Acronym	Stakeholders' group
Regione Lombardia - DG Ambiente, Energia e Reti	RLA	Public services
Regione Lombardia - DG Territorio e Urbanistica	RLT	Public services
Regione Lombardia - DG Agricoltura	RLG	Public services
Regione Lombardia - DG Sistemi Verdi e Paese	RLV	Public services
Autorità di Bacino del Fiume Po	APO	Public services
Consorzio dell'Adda	CAD	Private services
Consorzio Bonifica Muzza Bassa Lodigiana	CMZ	Private services
Unione Regionale Bonifiche Irrigazioni e Miglioramenti fondiari Lombardia	URB	Private services
ENEL Lombardia	ENL	Private services
Confederazione Generale dell'Agricoltura Italiana Lombardia	CGA	Rural community
Confederazione Nazionale Coldiretti Lombardia	CLD	Rural community
Confederazione Italiana Agricoltura Lombardia	CIA	Rural community
WWF Lombardia	WWF	Civil society
Legambiente Lombardia	LAL	Civil society
Forum Italiano dei Movimenti per l'Acqua	FMA	Civil society

The analysis of the Muzza system is based on the performance of the semi-structured interview and the digital questionnaire send to a total of 15 representative stakeholders. They have posted a total of 209 quotes, of which 67 were provided by public services, 48 by the rural community, 48 by civil society, and 46 by private services. The main topics expressed by the stakeholders have been represented in a cognitive map (Figure 5).

**Figure 5: Cognitive Map from Key Stakeholders Answers**

4.3.1. Main Discourses from Face-to-Face Interviews

The following quotes represent the topics that generate greater interest in the debate/conflict in the Muzza system: “The system of lakes, rivers and irrigation canals in Lombardy is a model of connected reservoirs that we cannot lose... It is true that the infrastructure is old, but it is technically efficient and helps to maintain the good environmental status of natural resources” [RLA – public services] “Much of society considers agriculture to be responsible for soil pollution with nitrates, although nitrate pollution also has an urban character and it becomes difficult to separate the two origins” [RLT – public services] “For many people, irrigators are those who consume and waste water instead of seeing the function of returning water to the soil, drainage management, and landscape conservation” [RLA – public services] “In the case of the Muzza canal, it is true that the permeability of the canal makes it look more like a river and not an infrastructure that supports agriculture, and this facilitates their integration into the landscape” [RLV – public services] “The history of irrigation in Lombardy is inseparable from land management, and that helps us understand the Muzza canal as another element of the landscape” [APO – public services] “In managing the Muzza canal, there will always be someone who does not have a global view about water resources and those who defend their interests above the common good” [CAD – private services] “While the irrigators use water up to eight times before returning it to the ecosystem, the Lombardy Region is pursuing a policy that penalizes the use of water for agricultural purpose... this is not being serious” [CMZ – private services] “The Patto per l’Acqua (water agreement) was driven by the Lombardy Region in order to encourage different interests to sit at the negotiation table in times of water emergency: hydroelectric industries, municipalities, farmers, environmentalists, experts... A water agreement which did not serve to promote integrated water resource management because it was not binding” [URB – private services]

“It is very easy to promote environmental issues when the results are quantifiable... if not, everything remains at the level of good intentions” [ENL – private services] “The agricultural sector is not a lobby, although part of the environmental sector believes that agriculture is the source of all water problems” [CGA – rural community] “In Lombardy, water management has always been considered a cultural heritage of agricultural practices” [CDL – rural community]

“The agricultural sector has evolved in a clear and compelling way to incorporate environmental issues into traditional practices, but it is obvious that EU policies emphasize these aspects, and this has implications for the sector’s viability [CIA – rural community] “The main problem of the water management model at the national level is the diversity of involved stakeholders who have some type of responsibility” [WWF – civil society] “For politics at the national level, water is not a relevant issue... we did not observe concern for water resources at the quantitative or qualitative level” [LAL – civil society] “At the political level, there is no debate about agricultural water. On the contrary, silence on the issue of irrigation dominates, and that means that each interest intensifies its water demand without an integrated water management approach” [FMA – civil society]

4.3.2. Stakeholders' Affinities, Confrontations, and Interactions

References about the social recognition of agriculture, irrigation criticism in contrast to the positive externalities of its practice, or the attention to water consumption are topics treated by the public services. In contrast, no attention emerged on issues such as environmental flows, a critical perspective about the environmental discourse, the existence of a farming lobby or the Muzza irrigation system management. Meanwhile, the private services agree on many of the references bounded by the public services, especially in topics like the social function of irrigation practice or the latent conflict between irrigators and environmentalists. For the rural community context, the dominant discourse is focused on the prioritisation of water resources between competing water uses, the water resources availability during scarcity periods or the water management model between (non) consumptive water uses. By contrast, the rural community does not take advantage to make any remark about the environmental attitudes or to highlight the environmental services of agriculture. Finally, civil society’ quotes emphasize the concern for the privatisation of water management model, water availability and its consumption by the agricultural sector, or the criticism to the maize monoculture. The analysis of the codes’ families reveals how the quotations of WATER codes’ family highlight issues such as the key role played by water concessions, the decreased amount of precipitation on the last decade, or the debate between public or private management of water resources. Meanwhile, the quotes on codes’ family AGRIC-ENV include aspects such as the recognition of environmental adaptation by the agricultural sector and the inability to quantifying the cost of this adaptation, or promoting an agricultural model that maximizes quality before quantity of production.

Regarding the references on IRRIGATION codes' family, these show the interest on the Muzza system multi-functionality, the debate about water use or water consumption, or the recognition of the active role of the Consorzio di Bonifica Muzza Bassa Lodigiana in the integrated management of water resources. Finally, the quotes referenced on GOVERNANCE codes' family are based on topics such as the difficulty of reaching agreements even though they are considered essential, discussion on the Patto per l'Acqua (a 'Water Pact' promoted by Regione Lombardia and signed in 2009 by key stakeholders) as a mechanism for integrating water resources management, or the existence of a three-way conflict between irrigators, environmentalists and energy producers. In addition, a synthesis of the results obtained from the questionnaire, by stakeholder groups, can be compared in the next table.

Table 7: The Stakeholders Groups' Profile from the Muzza System

Question	Public services	Private services	Rural community	Civil society
Your inclusion on the irrigation canal management is...	Necessary and Essential	Essential	Essential	Between essential and complementary
Do you feel represented in the canal?	Yes	Yes	Yes	No
What is the feeling of (not) being represented?	Be part of the decision-making process and be influential	Be a leader	Being influential	Non recognition as stakeholder
What level of representation do you have?	Between high and medium level	Between high and sufficient level	Between high and medium level	Sufficient level
What is the reason that explains your (lack of) representation?	Institutional recognition	Institutional recognition	Stakeholder recognition	Lack of institutional recognition
What is your assessment of the other stakeholders?	Between necessary and essential	Between essential and necessary	Complementary	Between dispensable and complementary
Rating received by stakeholders (1-5)	3,2	2,9	2,4	2,3
Are you looking for an agreement?	Yes	Yes	Yes	No
What factors make the agreement possible?	Fluid negotiation	Compatible discourses; Fluid negotiation	Compatible discourses; Political strategy	Mutual recognition between stakeholders
What kind of agreement?	By subject or punctual	By subject	By subject or permanent	Punctual
Types of relationships	Unidirectional	Unidirectional	Unidirectional	Unidirectional
What factors can benefit the agreement?	Institutional recognition, Predisposition to collaborate	Midterm synergies; Mutual recognition; Fluid negotiation	Midterm synergies; Mutual recognition	Ability to understand the others; Predisposition to collaborate; Midterm synergies
Do you have influence?	Yes	Yes	Yes	No

5. Discussion and Conclusion

It is increasingly obvious that in order to face the complexity of water resource management problems and challenges, technical approaches are not enough. Based on the stakeholders' involvement, irrigation management can be the context to improve the relationship between competing water uses and multi-functional water demands. The current trend in natural resources management, and specifically in water and irrigation management, calls for an integrated approach in which all sectors are considered, social and environmental sustainability are safeguarded and stakeholders are able to actively participate in the management process. To that end, considerable effort has been made in recent years to develop integrated participative tools to improve the territorial knowledge and support decision making processes. Two of these tools are the Stakeholder analysis approach and the Governance model approach, which puts in common the diversity of stakeholders' discourses through the collected information in face-to-face interviews and digital questionnaires.

In countries such as Spain, France and Italy, who have a long tradition of irrigation, there are few examples of irrigation systems in which management promotes multi-functionality. The three irrigated systems presented in this paper framed much of the concerns, speeches and overlapping demands and can be extended to Southern European contexts. Their comparison has begun from contrasting the attitudes, demands, criticisms, affinities, and ultimately the discourses defended by the diversity of selected stakeholders. Despite not sharing origins or evolutionary aspects, the three irrigation systems agree on a narrow set of related topics. Thus, common factors among most of the stakeholders involved in managing irrigation systems are: the role of irrigation as a creator and manager of landscape and territory; the concept of water as a strategic factor of rural development, and the need to establish agreements beyond periods of water scarcity. In the opposite side, aspects like water availability and energy cost, the promotion of sustainable practices and recreational activities around irrigation systems infrastructure or the proposal of water pacts in order to promote good governance are topics that generate confronted points of view depending on each case study. That is, the three irrigation systems face the same challenges: to legitimize their existence as much as their development, to become essential in the development of the territory.

In this sense, the research results have shown that, if stakeholders do not feel adequately represented or engaged in a real analysis of alternatives, decision-making leads to controversy, and the resulting proposals will generate strong opposition that will simply translate to the infeasibility of the project itself. The obtained results can be used by the relevant authorities to customize their interventions, knowing beforehand and in a well-structured form which are the different stakeholders' priorities and in this way establishing more effective avenues of communication. For example, promoting social learning to cope with new challenges related to water uses on each area (water availability and energy nexus, environmental flow maintenance, food security, rural development, and recreational or educational activities). With this information, the authorities can promote solutions between competing water discourses in order to design well-balanced management plans. In addition, this research can provide a blueprint for extending similar analysis to the rest of the main irrigation systems of Southern Europe multi-functional irrigation systems in order to understand if stakeholders' preferences are homogeneous or heterogeneous and what are the issues to be analysed. This could generate useful information in prioritizing and developing joint river basin management plans based on irrigation challenges and promoting measures and policies focused on improving governance in decision-making processes.

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