

# SOCIOECONOMIC ISSUES IN IRRIGATION LITERATURE: APPROACHES, CONCEPTS, AND MEANINGS

Elma Montaña<sup>1</sup>, Gabriela Pastor<sup>2</sup>, and Laura Torres<sup>2</sup>

## ABSTRACT

“Knowledge Assessment on Sustainable Water Resources Management for Irrigation” (KASWARM) project made evident cases of unsuccessful or non sustainable irrigation experiences that could only be explained by the underestimation of deep socioeconomic issues. This involves not only the social factors related to the implementation/ adoption of new or better technologies by a wide spectrum of users but also the way in which water use and irrigation projects are conceived, planned and implemented by scientists, politicians and practitioners. The project was interested in assessing the social science inputs irrigation specialists receive. With this objective, this paper presents a state of the art on some selected socioeconomic subjects as they appear in the irrigation literature, and analyzes the way in which they are conceived, thought and articulated with the more “technical” factors of irrigation. This should be useful to raise new avenues of research and to enhance articulation of “technical” and social science approaches in quest of a more close to sustainability irrigation practices. A first search covered eight of the most prestigious journals devoted to irrigation subjects. After this search yielded meager results in terms of the amount of papers found, a new search was conducted, without restraining to specific journals but moving freely with a deliberate thematic purpose. The results showed less socioeconomic issues than desirable in the papers within easy reach of irrigation engineers, a meager presence of Latin American cases and an approach to socioeconomic subjects that lack comprehensiveness, as they did not appear to be fully articulated with the technical subjects of irrigation.

**Key words:** irrigation, socioeconomic issues, social sciences, state of the art.

## INTRODUCTION

When engineers talk social sciences, what do they mean? The aim of this work is to analyze the presence of social science topics in the recent irrigation literature. But, what is the point -the reader could ask- of looking for socioeconomic subjects within a scientific production mostly destined to engineers?

The “Knowledge Assessment on Sustainable Water Resources Management for Irrigation”(KASWARM) project has found some scientific and technological niches that ask for new research on the “technical” aspects of irrigation in pursue of sustainability, efficiency, productivity, lower costs, ecological sustainability, etc.

Also, the project has identified a number of consolidated technological innovations or improvements for making irrigation closer to sustainability that have not been adopted by agricultural water users along Latin America. But further than this, the project results have made evident many cases of unsuccessful or non sustainable irrigation experiences that could only be explained by the underestimation of deep socioeconomic issues. This involves not only the social factors related to the implementation/adoption of new or better technologies by a wide spectrum of users but also the way in which water use and irrigation projects are conceived, planned and implemented by scientists, politicians and practitioners. In other words, sometimes all the improvements already achieved in the “technical” aspects of irrigation seem not to be enough when socioeconomic factors have not been carefully addressed in each and every stage of irrigation projects. At this point, social subjects become a matter of attention for irrigation engineers and the KASWARM project was interested in assessing the social science inputs irrigation specialists receive.

From this point, the starting hypothesis of the review was that social science issues are not present as

<sup>1</sup>Instituto de Ciencias Humanas, Sociales y Ambientales (INCIHUSA), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) y Universidad Nacional de Cuyo, CC 131, M5502IRA, Mendoza, Argentina (emontana@lab.cricyt.edu.ar).

<sup>2</sup>Instituto Argentino de Investigaciones de las Zonas Áridas (IADIZA), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), CC 131, M5502IRA, Mendoza, Argentina (gpastor@mendoza-conicet.gov.ar; ltorres@mendoza-conicet.gov.ar).

it would be desirable and thus not sufficiently valued, and that the approaches to social issues in this field lack comprehensiveness. Beyond any assumption made, the review also aimed at exploring the particular ways in which social issues were approached in this literature and linked with the more traditional subjects.

With these objectives, the paper presents a state of the art on selected social subjects as they appear in the irrigation literature, and analyzes the way in which they are conceived, thought and articulated with the more "technical" factors of irrigation. This should be useful to raise new avenues of research and to enhance articulation of "technical" and social science approaches in quest of a more close to sustainability irrigation practices. In the context of the project agenda, this state of the art -along with detected needs of Latin American stakeholders- was an input to identifying gaps of knowledge towards sustainable irrigation.

Covering the most relevant of social science issues that aroused within the project discussions, five main subjects were investigated: a) Conflicts around water; b) Equity among users; c) Actors and stakeholders around water; d) Cultural background; and e) Gender. The time scope for the search was established in the last seven years, from January 2002 to December 2008, though some subjects demanded going back beyond 2002 for finding a minimum of papers to analyze. A first search included eight of the most prestigious journals devoted to irrigation subjects: 1) Agriculture Water Management, 2) Irrigation and Drainage, 3) Irrigation and Drainage Systems, 4) Irrigation Science, 5) Journal of Irrigation and Drainage Engineering, 6) Journal of Water Resources Planning and Management, 7) Water Resource Management, and 8) Water Resources Research. After the search within these journals yielded meager results in terms of the amount of papers found, a new search had to be conducted, this time without restraining to specific journals but moving freely with a deliberate thematic purpose.

## REVIEW

In spite of the amount of papers reviewed (more than 5000 just in the eight journals mentioned), those related to the studied subjects were extremely scarce. That was the first finding. Papers appeared to be more numerous when the search was extended to diverse social science subjects and when it reached other sources, but then they appeared mingled with a diversity of social science topics and scattered through an ample variety of social science editions, in which journals were only a portion. This situation implies difficulties for irrigation specialists to even be aware of their existence, not to mention to be familiar with them.

Even if it was complicated to separate the bibliography about water conflicts, the actors and stakeholders involved, the equity issues and the cultural and gender topics, the review was organized in five thematic cores:

### Actors and stakeholders around water

Some of the papers that analyze the actors involved in water management approach the issue from the study of the water-governance point of view: Who are involved in water policy processes? How do they interact? How is the State playing its role? How are users organized? Scholz and Stiffler (2005) answer these questions by trying to provide clues to management. In his analysis of the governance of irrigation systems, Palerm-Viqueira (2007) differentiates government from management and explores instances of self-governance. Rogers (2002) presented the fundamentals of water governance in Latin America and exemplifies with cases from Mexico, Brazil, Chile, Argentina and Honduras.

Concerning the actor typologies from which the problems relative to management of irrigation systems have been addressed, the analyzed literature poses a traditional division whereby those actors representing the State are distinguished from others that belong to the "self-management" category. Although this division has been commonly applied in the analytical field, and a proof of this is the fact that it has been supported by numerous authors (Maass and Anderson, 1986; Hunt, 1988; Pradhan, 1989; Svendsen and Vermillion, 1995), in the particular case of Latin America, there is a need for nourishing this scope by introducing a new category. This is to distinguish within the self-management group those social actors with a unified authority, who act as a specialized group within this frame, from those other systems where the actors operate on the basis of their own knowledge, both to distribute the resource and to organize the tasks inherent to the system and solve the problems generated in relation to these actions.

The growing presence of economic capitals over the traditional farming scheme in Latin America is present in the actors/stakeholder analysis. If, on its part, the State functions as the epicentre of the thematic issue and centre of legitimate authority, other actors render the panorama more complex by bringing onto the stage the equity issue. Irrigation systems, and more specifically the management of the water resource, acquire political edges, and water becomes an arena of dispute where there are actors from the State, from different civil associations organized on the basis of groups of experts and, moreover, from original peoples who claim for the application of sustainability criteria that engage in open competition with those supported by the former stakeholders.

Also related to the actor typologies, the irrigation

water user is the most frequent mentioned and analyzed stakeholder. Although present in some analysis, other water users are less frequently considered. It is interesting to refer to Molden *et al.* (2007) concerning included and excluded actors when establishing management specifications for pro-poor irrigation services. They pointed out the convenience of considering multiple uses and users of water and to give due attention to the many other people dependent on irrigation water including the landless, livestock keepers, fishermen and domestic water users.

Along with governance, the participation issue gathers a good deal of the discussion about actors and stakeholders around water. Participation and community involvement in water users management are the object of some papers, most of them presenting experiences in cases such as a canal management in Uzbekistan (Abdullaev *et al.*, 2009) and building and managing temporary check-dams in southern India (Balooni *et al.*, 2008). Singh *et al.* (2008) addresses the participation issue presenting the usefulness of water users involvement to enhance irrigation projects sustainability once the financial or technical initial support has been withdrawn. Participatory processes are also considered a lever to sustainability by Maleza and Nishimura (2007) when analyzing the national irrigation system management in Bohol, Philippines. Going back to Singh -and in tune with our assumptions-, the paper signals that perspectives of local people's needs are crucial to the development of research and extension efforts, which would also "help researchers and practitioners to make better choices and more informed decisions when designing their research, communication and dissemination approaches".

Users' perspectives are also taken into consideration for improving the performance of water users' organizations involved in poverty alleviation initiatives in the Fergana Valley, Central Asia (Yakubov and Hassan, 2007). The participation subject in the context of the stakeholder-researcher cooperation is analyzed by Ritzema *et al.* (2007), in this case as part of the research method. Ounvichit *et al.* (2008) presents the social relationships between individual farmers and their communities as "a promising scaffold for water users' organization" while Vandersypen *et al.* (2007) proposes didactic tools for participatory water management that could support water users' associations in coping with their responsibilities after the withdrawal of the State.

Great part of the revised papers deals with the identification (definition) and analysis of the actors and stakeholders involved in water management processes, either more or less conflictive. Some of these papers, especially those with a sociological background, understand the management of water -and of irrigation

in particular- in terms of actors, stakeholders, practices and power, revealing issues related to social interplay and to the mechanisms and conditions producing and reproducing material and symbolic relationships of social dominance.

### **Conflicts around water**

Although a variety of lines of thinking were found around water conflicts, almost all coincide in two shared elements. On one hand, water is considered a scarce good and, in this context, conflicts arise as a water shortage crisis and the subsequent water use concurrence. On the other, water is a common good exposed to private appropriation. Further than that, approaches to water conflicts diverge.

A first line of thinking found in the literature is built around the ecological sustainability of water uses. Under this point of view, conflicts arise when an intensive water use compromises the ecosystem integrity. These concerns are thoroughly developed for the global scale. The 2<sup>nd</sup> United Nations World Water Development Report: "Water, a shared responsibility" is an example of this. Its Section 2: "Changing Natural Systems" presents an overview of the state of water resources and ecosystems and explores current assessment techniques and approaches to integrated water resource management (U.N., 2006). Bos (2002) of the International Union for Conservation of Nature (IUCN) argues that ensuring water security requires integrated management of water resources, by balancing between natural and human needs at the ecosystem level, and by accounting for the actual value of natural services in development decision-making.

Also in this global scale, another group of papers refers to water resources as a mayor geopolitical problem, even as a potential war space where already existing problems could break out and new ones are expected for this century. Some authors identify "neighbour conflicting countries" or "transboundary conflicts" and even "terrorism of water resources" (Gleick, 1993; Amery Hussein, 1997; Fisher, 2000; Haimes, 2002; Dinar, 2004; OECD, 2005; Matalas, 2005; Gathanju, 2006; Sahni, 2006). There is even a special issue of Journal of Water Resources Planning and Management (2007) on "Transboundary Water Sharing" with different approaches: historical perspectives (Phelps, 2007); conflict (Matthews and St. Germain, 2007); governance (Draper, 2007); water management and water laws (Dellapenna, 2007); effects of climate change (Draper and Kundell, 2007), among others. Some other authors discuss water conflicts between rich and poor countries (Hoekstra and Chapagain, 2007). The first group assesses water war risk identifying even "hydrostrategic territories" (Wolf, 1996). The second identify countries-stakeholders in a conflict caused by unequal distribution.

In some papers, water conflicts express local-global

relationships. This is the approach developed by some papers analysing the local effects (upon water resources) of economic globalisation and global climate change upon water resources availability, allocation, management, etc. Within the first group, there are some papers on the commoditisation and subsequent privatization of water, denouncing the advance of economic powers over a strategic resource (Barlow and Clarke, 2002) and the introduction of water allocation market mechanisms (see below where referring to equity issues). Here, the water wars are between citizens and corporations (Shiva, 2001). In this context, some authors and also global institutions present water as a basic human right, nurturing a human rights-based approach to water (World Health Organization, 2003; Scanlon *et al.*, 2004). Some of these “conflict studies” lines have the correspondent “conflict resolution” papers, particularly those related to local conflicts: some propose prevention (Wolf, 1996), incentive-compatible cooperation strategies (Wu and Whittington, 2006), consensus based mechanisms (Pande and McKee, 2007) or a better water management for conflict resolution (Fisher *et al.*, 2002), among others. There are also “conflict resolution tools” of different nature: law based multi-criteria decision tools (Mimi and Sawalhi, 2003); decision support systems (Rajasekaram and Nandalal, 2005); game theoretical concepts (Eleftheriadou and Mylopoulos, 2008); graph models (Nandalal and Hipel, 2007) and database tools (Patiño-Gomez *et al.*, 2007). Not surprisingly, improvement of water managements systems is presented as the clue for solving an ample spectre of irrigation conflicts and beyond, the alleviation of rural problems, poverty in the heart of them (Hussain *et al.*, 2006; 2007).

With respect to those that look at water conflicts in the context of global climate change, Rojas *et al.* (2006) argued that power differentials in water conflict resolution between stakeholders may increase the exposure, hamper the adaptive capacity and therefore increase the vulnerability of communities to global change. These authors point out the utility of analysing water conflicts as they can provide insights that can be applied to understanding adaptive resolution of water conflicts and offer important institutional and social learning for adapting to future climate change-induced water conflicts.

On more delimited scales, a good deal of the conflicts referred in the literature are related to irrigation practices, as clashes between users of irrigation water, differences between agricultural users and other users (water for human consumption, industrial, recreational uses, mining uses, etc.) (Varis and Fraboulet-Jussila, 2002; Wilson, 2007). Rajabu and Mahoo (2008), for instance, presents a conflict solving tool based on participation of stakeholders and analyze its application in a sub-catchment in Tanzania.

Finally, a special chapter on water conflicts is developed around what could be called social effects of dams, these considered as mayor pieces of the irrigation systems. Supported by technicians, government officials usually say these dams and an extensive irrigation system will bring electricity and water to areas suffering from drought. Arguing that the benefits are exaggerated and the costs underestimated, a great deal of papers describes and analyzes the effects of big dams on vulnerable social groups, especially on aboriginal peoples, and those causing relocations. On these papers, the water conflicts are expressed in terms of equity and cultural struggles, themes that will be analysed in detail later on. “The colonisation of rivers” is the way in which Shiva (2002) refers to dams as associating them to water wars.

To sum up, water conflicts arise as a dimension built over struggles for a scarce resource as an arena where competing interests clash: water access problems, allocation disputes, availability, security and sustainability issues, etc. Interest conflicts and opposing points of view disclose different rationalities and particular cultural backgrounds at stake, attesting that cultural background, equity and gender (see below) turn out to be cross-subjects.

### **Equity among users**

At first, the equity issue appears in the irrigation bibliography as distributive conflicts among economic sectors (e.g., agriculture vs. industry), among users within the same sector (e.g., farmers vs. peasants), among countries, regions or places sharing a common source as in the typical case of the upstream-downstream conflicts (Gaur *et al.*, 2008), among urban and rural users, indigenous groups and modern communities, rich and poor, men and women, and even among present and future generations. Phansalkar (2006) distinguishes and defines social equity, spatial equity, gender equity and intergenerational equity. Wilder and Lankao (2006) and Moyo (2005), on their part, analyze the intergenerational equity specifically. But in many papers the concept of equity is often undefined and usually ambiguous as Wegerich (2007) argues as a prologue to the exploration of aspects of equity of water allocation between different riparian states and districts in Uzbekistan. Further than these uncertainties, the general consensus is that there are differential in access and appropriation conditions for different users. For the case of upstream-downstream conflicts, for example, Van der Zaag (2007) recognizes asymmetries for Southern Africa and addresses to the institutional arrangements that can be devised to (re-)establish an equilibrium between up- and downstream entities within a catchment area or river basin. It is also van der Zaag who proposes the concept of “hydrosolidarity” as “a normative value that may help to

recreate the balance between the various (asymmetrical) interests that exist within a river basin”.

In another significant number of papers -referred to different territories of the world- the water-equity concern is expressed in concerns about the impacts of markets mechanisms and property systems. Miller (2004) wonders about the objectives and effects of water reforms, more inspired by physical and technical objectives than by governability and equity issues. He also argues that in some cases, the losses and inefficient uses of water yield benefits to ecosystems. In a more specific approach, some authors wonder about the way in which the pricing of water impacts over a variety of stakeholders, each one affected by different situations (Çakmak *et al.*, 2004). On the same line of thinking, Manos *et al.* (2006) simulate the impact that various policies based upon the water price have on agricultural production and analyses the economic, social and the environmental implications of alternative irrigation water policies using a multicriteria model.

In reference to equity and water conflicts induced by the implementation or modernisation of irrigation systems, a series of papers explore the question of whether the improvement of the traditional irrigation systems bring benefits in terms of equity and in reduction of water conflicts. Some authors discuss the hypothesis of traditional systems improvements bringing more water to rural poor and thus mitigating inequities. For the case of a smallholder irrigation system in Tanzania, Lankford (2004) -for example- indicated that the improvement of the system does not necessarily result in improved water performance, greater equity and reduced conflict. The usual outcomes of such projects -he argues- is a gain in water for the system being upgraded, especially if located upstream, accompanied by less ability to share water at the river basin scale. In another paper, an irrigation improvement programme of modernization with a structured system concept is analysed by Sakthivadivel *et al.* (1999) for the Bhadra Project in India. They found that although agricultural productivity has not registered a significant decline since before the intervention, preferential allocation to head end of command continues and inequity sets in within the distributary commands. The tail-end water supply deprivation is partially offset by farmers practising deficit irrigation. Farmers' organization and participation in decision-making at scheme level and water distribution at distributary level and below are very low. With the same concerns but in a working line focused on the development of analytical tools, Thiruvengadachari and Sakthivadivel (1997) have used instruments such as satellite remote sensing, geographic information system (GIS) techniques, and hydrologic modelling to assess the same Bhadra Project in India.

Spatial and temporal information has helped analysts evaluate the performance of the agricultural system over several years and across the irrigation scheme. The results have shown significant improvements in agricultural productivity while confirming equity problems (The equity of the water supply is measured here through Christiansen's Uniformity Coefficient). For the case of the China's lower Yellow River basin, Roost (2003) introduced a new irrigation model (OASIS) that allows proper quantification of water use efficiency, productivity and equity under actual or hypothetical conditions of land use, infrastructure and water management.

Finally, it should be noticed that water equity issues have not only poverty implications but also gender and indigenous dimensions that will be mentioned below.

### **Cultural background**

The issues of water management and distribution and further on, the concerns of irrigation systems for their sustainability, has captured the attention of the scientific sector. However, a meticulous analysis of the existent literature shows that the orientation followed as well as their guiding hypothesis and supporting theories differentiate each other according to the disciplinary background of their authors. From the agronomy, and engineering sciences in particular, irrigation systems have been analyzed with higher emphasis on the quality, quantity and productivity of the water resource, or as means to operate improvements in these senses. In the case of social sciences and particularly of anthropology, the concerns have been oriented to show instead: 1) That water constitutes an asset that exceed its immediate materiality and that integrate symbolic dimensions (Contreras Gallego, 1998; Sanz Hernández and Celma Tafalla, 1998; Farfán Lobatón, 2002), and 2) That at the same time it shows a concrete materiality, water and irrigation schemes constitute channels that facilitate, promote and even explain forms of organization characteristic of certain social groups (Galván Tudela, 1980; Bolin, 1990; Gelles, 1991; Batista Medina, 1998; Castañeda Abanto, 2004). That means, water is the base of social relationships, generate forms of organization and at the same time show the non-material dimensions that are also part of the actors' social life.

In the case of agronomic and engineering sciences, as pointed out before, it can be observed an affinity to think about the more material aspects of the subject, furthermore it is necessary to notice that since some time ago, there are increasing concerns about equity in distribution and participation in management, because of conflicts about management that have emerged between actors. The knowledge emerged from the scientific sector about irrigation management came from sources linked

to social sciences and the data, to which is possible to have access correspond to a varied casuistry dispersed worldwide in which it can be observed a bigger Asiatic presence.

Reviewed bibliography show that the valuation of the cultural background is mostly related to traditional knowledge and linked to the casuistry considered. It is assumed that water is a public good and a valuable resource that is not to be wasted. Based on the former, arguments are formulated in favour of the sustainability that traditional knowledge bears in relation to the management of water for irrigation as well as for human consumption. On the other hand, it is stated that modern agricultural development efforts often ignore this indigenous knowledge, replacing traditional infrastructure with new construction, and replacing indigenous management arrangements with state bureaucracies (Groenfeldt, 2005) undervaluing what appears to have been quite productive and sustainable before extra-cultural influences began (Cleveland *et al.*, 1995). Because of it, it is also sustained that indigenous irrigation systems should be intelligently assisted, rather than mindlessly replaced. Coherently with the former, Varisco (1991) stated that farmer knowledge can contribute to sustainable production and can be grafted on to modern methods and technology. In this context it is stated the growing interest in using the traditional knowledge, which should be captured to aid in propagation of cultural methods of production and associated technologies (Gillespie *et al.*, 2004).

### Gender

Papers on this matter were not numerous. Two papers, one on an overview on gender and irrigation (Van Koppen and Hussain, 2007) and another approaching gender within the diversity issues (Hussain, 2007a) are part of the special issue of Irrigation and Drainage journal: "Irrigation and poverty alleviation: Pro-poor intervention strategies in irrigated agriculture".

Gender approach has increased its importance in the last decade. It includes the analysis of relationships between agricultural systems and the responsibilities and rights of male and female farmers, according to the local agroecological and cultural context in which they develop their (agricultural) activities. Nevertheless, these issues are not dealt in "main stream" publications about irrigation and water management but within policy and development studies, over all those promoting a reflexive approach to state interventions.

However, the increasing demand about participatory planning in agricultural sector is still far from being covered by practical solutions, to accomplish objectives of minimizing differences in socio-economic, cultural and gender terms (Koopman, 1997). Those objectives consist

not simply in (explicitly) including women in public and development policies (for instance in agricultural or irrigation policies). The approach analyses the different roles and responsibilities of both women and men, by recognizing their differences in access and control over resources, and therefore the consequences, conditioning factors and difficulties to reach such a goal.

The literature review shows a critical situation of water allocation and rights as a result of water scarcity and at the same time because of intervention programmes aimed to increase the efficiency of water allocation and delivery. The studies also underline how policy and irrigation planning have mainly focused on construction and maintenance of irrigation infrastructure, irrigation efficiency, water productivity as well as the evaluation of the effects of agricultural and irrigation practices on soil, ignoring the needs and priorities differentiated by gender as well as the nature of the cultivated products, the impacts on labour markets or the coexistence of multiple uses of water (for production or consumption) (Clever, 1998).

In the analysis is underlined how irrigation might, eventually, contribute to food insecurity, because of the trend to modify agricultural patterns that involved local knowledge and farming practices, soil management practices, etc., that are also replaced by new (cash) crops and technologies for export. There are evidences how children coming from cash-crops farms are poorly fed in comparison with those coming from the so called "traditional farms" producing a diversity of staple crops (Gender and Water Alliance, 1997).

There are no doubts that access to irrigation water constitutes not only an important asset, but also a source of power and conflict. In this sense, organizations promoting a gender approach vindicate the need to strengthen participatory spaces for capacity building and communication, oriented to create incentives for the different expressions of rights, duties and social inclusion. Some examples are those showing the importance of participation of different stakeholders (including women) in decision making, contributing thus, towards a more sustainable irrigated agriculture and water resource management and conceiving irrigation as a social construction (Boelens and Apollin, 1999).

Along with Singh *et al.* (2004), claiming for an holistic perspective on water management (in this case for domestic water supply systems), its worth to remark, as the other side of the coin, the need of objective improvements in the situation of women; because it is not always clear that the actual effects of those changes will improve in their social, familiar and personal situation. This is why Singh argues "the need to design participatory paradigms that are more realistically rooted in community-based

institutional frameworks so as to enhance effectiveness of the endeavors” (Singh, 2007).

Evidences show the difficulties in positioning the gender issue in the main discussion related to sustainable irrigation. When the discussion is included, it is done from a very specific, sector-oriented or institutional perspective. However some tools have been developed (for instance by FAO), to be used by irrigation engineers, government organizations and non-governmental organizations (NGO) to improve intervention projects by including perspectives from rural women or other disadvantaged groups.

Finally, it is important to state that in this respect, two perspectives converge. On the one hand, those promoted by donor and international agencies and special services from world agencies, which have developed the main documents to approach development from a gender perspective (FAO, International Union for Conservation of Nature, World Bank and others); on the other hand, intervention agencies such as NGOs, which promote the linkage with local groups. Between these two perspectives, it is still incipient and very limited the capitalization of those approaches related to the production of scientific knowledge on irrigation and the application of this knowledge among irrigators.

### Others issues

Within a variety of social issues related to water and irrigation that were found in addition to those mentioned above, poverty showed to be a recurrent subject linked to irrigation impacts. A major contribution to issues linking irrigation and poverty (or fight against poverty) is made by a special issue of *Irrigation and Drainage* journal: “Irrigation and poverty alleviation: Pro-poor intervention strategies in irrigated agriculture” (Volume 56, Issue 2-3, 2007). Some of the papers on this issue present results and insights coming from the International Water Management Institute (IWMI) studies and projects on Asian cases. They explore the relationships between irrigation and poverty, and particularly the irrigation initiatives as poverty alleviation strategies. Some papers summarize the results, conclusions and lessons learnt from cases of pro-poor interventions (Hussain 2007b; 2007c; 2007d; Lipton, 2007; Thirtle and Piesse, 2007). Others approach poverty alleviation strategies through reforms in irrigation water rights (Bruns, 2007) or irrigation management reforms (Wang *et al.*, 2007). Molden *et al.* (2007) calls attention to performance assessment in irrigation for poverty reduction, while Namara *et al.* (2007) introduced land issues and gives insights on land and water management innovations. It is also interesting the analysis of Narayanamoorthy (2007) on the nexus between groundwater irrigation and rural poverty, stating

that access to groundwater is a poverty protection factor. But groundwater use is not a panacea as Llamas and Martínez-Santos (2005) identify it as a potential source of social conflicts.

Finally, it is relevant to bring up that a few papers show concerns about the role of science in contributing to social benefits through improvements of irrigation projects and practices. Inasmuch as experiences of implementation of irrigation systems show that a good part of the problems originates within the social field, the development of irrigation in the real world imposes some demands on the scientific sector. This dilemma about the direction of the scientific development is addressed by Shuttleworth (2007) when he wonders about a “Stakeholder-driven, enquiry-driven, or stakeholder-relevant, enquiry-driven science?” Apparently simpler but not least important is the concern about available river basin management insights and information not being of help for water managers. Pahl-Wostl and Borowski (2006) realized that simply providing information does not result in an effective communication across the science-policy interface. In addition to Pahl-Wostl, other authors contribute to this Water Resource Management special issue: “Methods for Participatory Water Resource Management”. Borowski and Hare (2006) identify a gap between water managers and research community that is evidence of a mutual misunderstanding of the fundamental activities of both communities, while Brugnach *et al.* (2007) refer to computer models pointing out troubles for integrating the information derived from models into policy. They partially explain this situation in the lack of confidence policy makers have on the incorporation of modeling information into policy formulation; they examine the reasons for this apparent lack of confidence and explore how some tools, presently in use, address this problem. Beyond this special issue but related to the subject, Keuls (2008) approaches the issue from a capacity building point of view asking for a knowledge network development for the water resource management sector, while Maguire (2003), for a case in USA, identifies the most serious shortcomings resting not with the scientists or the stakeholders, but with the too narrow structure of a regulatory process unable to encompass the stakeholders’ wide-ranging concerns.

## RESULTS

In spite of the amount of papers reviewed, those related to the studied subjects were extremely scarce. More papers were found scattered on social sciences editions, but far from the reach of irrigation specialist and not always close to implementation purposes. In the context of this meagre presence, it looked like social

issues tend to appear more frequently in the recent years suggesting an increasing interest in the socioeconomic dimensions of irrigation, although a sample limited to a seven years search is not enough to establish a clear trend.

In addition to the five specific social science topics deliberately looked for, poverty appeared as a recurrent concern. The role of science and the relationships between scientist, policy makers, decision makers and other stakeholders was also present in some papers.

Cases in Latin American countries seem to have a minor representation in relation to developing countries in other continents, particularly Asia. The same happens in terms of language, being most of the scientific production written in English language and in much less proportion in Spanish. This may constitute a barrier for the access to scientific knowledge by Latin American researchers, apart from technological and financial barriers to access such literature.

Social aspects of sustainable irrigation are not considered or just as a "context" issue in classic irrigation journals. When the five specific social science topics of this state of the art appeared in the universe of the selected irrigation journals, it can be observed that in most of the papers they are not the key issues but rather side topics related to problems that focus on the "harder" aspects of sustainable irrigation. For instance, in papers making their contribution to multiple attribute systems, integrated management or planning or multi-agents, what is being afforded to the traditional engineering view is either environmental issues that attempt to ensure or facilitate the ecological integrity of the water system, or economic factors that internalize costs not previously considered, bring transparency to subsidies or assess the situation of different stakeholders with higher or lower payment capacity in systems pointing to "economic sustainability". The journals selected for this search are highly prestigious and widely consulted by those involved in studying and practicing a more sustainable irrigation. They show a particular bias as they prioritize the most technical sides of the problem: channel, pipes, reservoir, barrage design and calculations, different irrigation technologies, irrigation performance, efficiency, infiltration, evapotranspiration, aquifer performance, groundwater flows, etc. A marked orientation toward action -typical of engineering disciplines- is, on the other hand, observed, as well as the will to spread the advances relative to tools, techniques and methodologies: equations, algorithms, coefficients, matrix, formulas, numerical simulations, models, etc. Social issues are not yet the concern of these publications and are rarely addressed. And when they are, the overall purpose is usually to contextualize technical hydraulic or agricultural problems or to give a reference frame to their

implementation. It could be concluded that the treatment of socioeconomic factors lack comprehensiveness, as they don't appeared to be fully articulated with the technical subjects of irrigation, at least in this type of publications.

There is a trend to discuss social issues as emerging elements from the actual practices and intervention processes, being that such process were initially conceived from a technical and engineering point of view. Therefore, most of the literature dealing with the five subjects discussed is reported as experiences though case studies. In many cases water and irrigation is directly associated to the notion of development as a desirable and ideal situation, and embedded to the notion of "progress", as a component of "civilization" and, in an opposite direction to "savagery" and as a mean of transformation towards a capitalist and modern economy, including and "integrating" cultural minorities and ethnic groups. It is remarkable that the studies under this perspective, instead of promoting exhaustive analysis of such complexity, tend to define the studied situations as a traditional, or "defective" situations (underdeveloped, backwardness) and also omitting in the analysis, the multiple dimensions (economic, cultural and political) explaining social practices (for instance agricultural or irrigation practices).

Related to the previous discussion, it is important to state that, beyond the material and technical dimensions associated to water and irrigation, extra-economic and symbolic dimensions have been approached mainly from anthropological perspectives and in a less extent from other disciplines.

## CONCLUSIONS

Even though there is strong evidence that socioeconomic issues are at the base of a good deal of unsuccessful or non sustainable irrigation processes, socioeconomic subjects are not frequent in the irrigation engineering literature. When they appear, they are often reduced to references to contexts more than an object of study by themselves or an input for decision making. Although disciplinary biases and preferences are perfectly reasonable, omissions in this field may result in serious risks to sustainability of intervention processes. A desirable trend would be that social dimensions of irrigation would be incorporated in scientific knowledge according to the current demand in practical situations, strengthening thus the development of new approaches to irrigation management. But irrigation engineers cannot be held responsible for not reading social sciences issues as scientific editorial lines -and moreover- scientific research trends often lead to ever more specific knowledge.

The situation, as seen from this state of the art and



from the KASWARMÍ project results, lies in an irrigation science and practice getting increasingly complex and progressively more concerned about sustainability. The notion of sustainability requires thinking economics, social and environmental as three interrelated dimensions, posing a challenge to science and scientific literature, as they have to achieve the frequently proclaimed interdisciplinary approach. It also defies practitioners, as irrigation projects need engineers interested in social issues working together with social scientists willing to involve themselves in engineering projects.

## RESUMEN

**Problemas socioeconómicos en la literatura de riego: Enfoques, conceptos y significados.** El proyecto “Knowledge Assessment on Sustainable Water Resources Management for Irrigation” (KASWARMÍ) puso en evidencia que muchos fracasos de proyectos de riego o su falta de sustentabilidad sólo podían ser explicados por una deficiente consideración de los profundos factores sociales involucrados, no sólo aquellos relacionados con la implementación o adopción de nuevas o mejores tecnologías por parte de un amplio espectro de usuarios, sino también a las maneras en las que los proyectos de irrigación son concebidos, planificados e implementados por científicos, políticos y ejecutores. El proyecto se interesó en evaluar los insumos de ciencias sociales de los que se nutren los especialistas en irrigación. Con este objetivo, el trabajo presenta un estado del arte de cinco temas socioeconómicos tal como aparecen en la bibliografía especializada, y analiza las maneras en las cuales éstos son concebidos, pensados y articulados con los factores más “técnicos” de la irrigación. Esto debería contribuir a vislumbrar nuevas líneas de investigación y a fortalecer la articulación entre los abordajes “técnicos” y sociales a favor de acercar crecientemente las prácticas de irrigación a la sustentabilidad. Una primera búsqueda cubrió ocho de las más prestigiosas revistas científicas dedicadas a temas de irrigación. Los escasos artículos encontrados, determinaron la necesidad de efectuar una nueva búsqueda, esta vez ampliada a otras fuentes en función del recorte temático. Los resultados muestran una presencia menor que la deseada de las problemáticas socioeconómicas en los artículos de fácil acceso para los ingenieros en irrigación, una escasa presencia de casos latinoamericanos y un abordaje a los temas socioeconómicos que puede ser considerada no integral, en tanto no se articula profundamente con los factores técnicos de la irrigación.

**Palabras clave:** irrigación, problemáticas socioeconómicas, ciencias sociales, estado del arte.

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