

Struggles at the social interface: developing sociotechnical research in irrigation and water management

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Introduction: why struggle, what struggle?

Why struggle for interdisciplinary concepts, when they are often challenging to their users to develop and disliked, if not ignored, by disciplinary researchers? Why use the term 'sociotechnical', without a hyphen, for work in irrigation? As Mollinga (1998) discussed, interdisciplinary research (and the ideas it can then bring into learning) has at least 'two gaps to bridge...' The first is the conceptual gap between the technical and social sciences, and the second is 'the gap between theory and practice, or knowledge and action' (Mollinga, 1998, p. 5). I would add others. One would be to bridge the 'learning gap' between theory, knowledge, practice and action in order to get new understanding of change processes through better communication, recognition and reflexive analysis. In 2001, agrarian questions are still important and serious, but there are other frameworks beyond political economy to study them, while new resource management questions loom for people and societies. These give other gaps to bridge between other sciences and the professions. Since 1980, the Irrigation and Water Engineering Group, hereafter referred to as IWE, has striven to relate its teaching and research with emancipation. This understands irrigation and water management from the perspective of small and marginalised water users, and others employed in this water use, to work for irrigation and water resource management that better supports them. To develop irrigation studies to this end, the Group has worked to develop new ideas, and to engage critically and constructively with mainstream thinking on modernisation and reform. It is with all these purposes in mind that the sociotechnical approach to irrigation has evolved. This has not only led the Group to interact with many different academic disciplines. It has also looked at the work of these groups through the critical lens of their engagement with the forces of social transformation and the world of development assistance.

This contribution shows how and why the IWE Group has evolved their sociotechnical research as an interdisciplinary approach to the study of irrigation. It has been written not only to show how IWE has engaged with actor-oriented

theories from sociology and social anthropology (and the ideas of Norman Long). It has also been written to show our work with ideas from the sociology of development and development theory in irrigation studies. This has been an interesting and sometimes more serious struggle by the IWE Group with the work of Norman Long and his group at Wageningen, in relation to his political economy framework and its linkage with actor-oriented analysis. For this reason, this paper is structured to present the work of the IWE through its publications on irrigation, and their links with development.

This is also done for another reason. I was not involved in the early struggles to develop a sociotechnical approach and I do not want to reproduce work already written. What I can do, however, is hold a mirror up to the IWE, Norman Long, and Wageningen University to show the nature and dynamic of interaction over time. This can also explain the contemporary interdisciplinary focus and struggle of IWE in understanding irrigation and water management. This review is based on my own understanding of how others and myself were interacting with the Irrigation and Water Engineering Group, and Norman Long's work over time.

Any such discussion of course, requires me to say how I had interacted with Norman Long's ideas before coming to Wageningen. Actually, I first read Norman Long around 1989 when I moved to the Overseas Development Institute and started work for a book on hill irrigation (Vincent, 1995). Prior to this I had spent three years in Yemen 1984-87 in an assistance programme. This ended after a spring-fed water point was destroyed. A local political struggle crystallised into a proposal to remodel a very small irrigation system, which might change water rights and would change the power balance in decision-making over water rights. Almost everyone misjudged the strength of the collaborative front created by local representatives and villagers to support the scheme. I had engaged with Norman Long's work from Peru and Bolivia (in Long and Roberts, 1984; Mallon, 1983; Dandler, 1987), before I had read his work on actor-oriented theories and concepts, such as 'Encounters at the Interface'. Thus, I engaged first in his work that looked at individual struggle and action in a kind of 'non-structured' political economy - which I first found quite powerful given my recent work - before I began to look critically at his actor work. I reflected on this lack of previous contact. I realised how my knowledge of social science and the struggle for interdisciplinarity had been shaped in Norwich more by structural theories about development and underdevelopment which were then dominating the public debate there (Barnett, 1977; Harriss, 1982). They had also been shaped by the difficulties I had in the late 1970's to connect with them. I realised that I, like perhaps many natural scientists and some social scientists, had been drawn into farming systems and participatory frameworks of analysis, as a different and radical means to explore social reality, natural resource use, innovation, and social action. This, I think, explains an important point. Norman Long's work provided a new kind of entry point to social realities of development work and social action, for those struggling with theory and searching for a 'people-based' perspective to natural resource management. Later I was often frustrated, if always informed and entertained, by the way he described development interventions and change processes. I nevertheless always found the interaction creative.

What social analysis in the sociotechnical approach?

Much internal review already exists on the sociological research that has been drawn into the IWE Group. Mollinga (1994) explains how the Group has drawn not only on actor-oriented theory, but also on the work on the social construction of technology and Marxist theory, particularly labour process theory. All these opened up possibilities to see social processes linked to engineering technology and water distribution. After IWE had debated this review, it opted to follow an actor-oriented approach in research methodology, rather than specific actor-oriented analysis. Wester and van Halsema (1995) looked at how all these bodies of theory would shape such an actor-oriented approach in research with a sociotechnical perspective, putting forward the actor-network framework. Hoogendam (1993) showed how actors and practice came into design, through a wider focus on technology and its paradigms. In these reviews, the role of Norman Long is recognised for his contribution in further developing actor-oriented theory but as one of many who have shaped thinking in this area and in 'sociotechnical' analysis. His work remains a guide and a discussion point for actor-oriented methodology and research design, and we recognise the continued value of his concept of social interfaces and arenas.

In the wider study of the sociology of development, and social processes of transformation, Norman Long's work has been valued for helping to open the development debate at Wageningen. However, it has also generated frustration for some within the IWE. Thus I would like to summarise the contribution of Norman Long here in three ways, simultaneously showing some of the stresses that his work brought for irrigation research. These are:

1. As an active debater of social theory and the clash between structural and actor approaches to the study of development, and eventual proponent of actor-oriented theory. His work provided references, and acted both as a lens and a springboard for IWE students and staff already beginning to explore and review ideas about social and development theories to understand the role of irrigation in society. His critique is one of several that IWE put alongside others in the early 1980s, in their own wider reading of development theory and development practice. His actor-oriented perspective was one that helped in the conceptualisation of irrigation and water management distribution, and in the understanding of the processes shaping and reshaping water management and water use. The concept of the 'social interface' has been used to explore the role and significance of irrigation infrastructure and institutions in social action, and the social interface of knowledge between irrigators and engineers. However, Norman Long's own political economy perspectives, which focused very much on relations of production, restricted exploration into the world of irrigation. His framework of interpretation on agency in development policies and programmes limited reflection on public action, and on social relations acting within technology and not just across it. It also restricted exploration of the ways in which, and how, micro-and macro forces come together in irrigation. All these reasons explain why the Group rejected his ideas in actor-oriented analysis, but did keep their own actor-oriented approach as a research methodology.

2. *His work on deconstruction of 'planned intervention' and actors' behaviour with such programmes.* This linked with the Group's own desire post-1980 to

understand more about processes of intervention and how outcomes were shaped by actors and events. His open descriptions of social action and strategy by people, and even irreverent treatment of development programmes and organisations, were quite revolutionary eye-openers to the way development contexts could be explored. It opened up some new ways to see change and struggle over water management. Again, however, stresses have emerged. Sometimes development policies and programmes got reduced to an unexplored status of some kind of 'Technical Mission', and technical workers to undifferentiated '*tecnicos*', against which local actors played out and evolved strategies. This not only reduced understanding of wider agrarian dynamics. It also gave little help in learning for development practice.

3. *His work was accessible, readable, personal, and often humorous.* It was an immediate entry point to anyone who had struggled in development work. It enabled engineers and natural scientists to see ways they could critique development work, and start to explore the complex inter-disciplinary world of both water distribution and development work. The irreverence mentioned above has made Norman a fairly open partner to those wanting to learn about and work with social perspectives, even if they eventually moved into other ideas from sociology and development. However, for some, Norman Long's pursuit of his own actor-oriented analysis lacked reference to other work on social change. While people in the Group found some of his concepts useful, they wanted to move beyond these into studying possibilities on negotiated innovation, and contest around water. They also sought new sources of complementary theory. This pushed the Group out to other new interfaces with other researchers working in rural transformation, farming systems and innovation, law, philosophy and political ecology.

What I argue here and in the following sections, is that the interdisciplinary quest in irrigation studies has never been just about developing more social science or development theory, or researching the sociology of development. For the Group, this objective is derived from recognition of the understanding necessary to work in the complex world of irrigation. The Group must understand the processes that shape water distribution and shape the work of engineers acting in irrigation systems design, water delivery, and water management reform. They must also understand the social and political world in which engineering is (re)negotiated. As both planned development and wider forces of change shape and reshape irrigation, they wish to understand how and why these processes impinge in water management and are translated in irrigation systems by their users. They also want to present concepts that challenge professional and development orthodoxy that is socially constructed and without empirical validity.

I now present some elements of our interdisciplinary approach, using the above-mentioned overview of where I think struggle has come from, as my starting point. The oldest and most developed of these is that irrigation is a sociotechnical phenomenon, and an irrigation system a sociotechnical system. Also that, in wider water resource management, irrigation systems are sociotechnical systems within wider agroecological dynamics and water resource management systems - where change is contested and mediated within, between and around them. I focus now on the approach to irrigation and water management as a sociotechnical phenomenon. The lack of a hyphen is deliberate

to indicate it as a distinct approach. In fact, the Group responded to a growing use of sociotechnical terminology from several areas of research work and innovation theory, but adapted it for themselves. The first use was from social scientists within the field of irrigation and development (Uphoff, 1989). The second was its use in the field of the social construction of technology and actor-networks (Bijker *et al.*, 1987). Yet a third was from the work of engineers concerned with understanding innovation processes and design processes (Checkland, 1981). As I show in the following sections, the Group explored these ideas but moved beyond them, in their drive for interdisciplinary understanding.

Irrigation is a sociotechnical phenomenon because it is socially constructed, has social conditions of use, and has social effects (Bolding *et al.*, 1995; Mollinga, 1994, 1998). Operational water management is also an interplay of domains and of practice and control in crops, water supply and people (Manzungu, 1999). An irrigation system can be seen as a network of heterogeneous elements held together by a diverse set of relationships, and is both social and technical at the same time. This network is held together by people, who mobilise resources to link these elements and consolidate their control over them, through various forms of control acting together in the system and beyond it. It is here one can see the social interfaces and arenas. Thus the social and the technical act together.

From this starting point we have also developed a 'sociotechnical approach' to irrigation and water management, working from a starting point on the nature of technology. Technology defined in its widest sense, is a capacity for transformation or what Benton (1992) describes as mediation between society and natural resources (Knegt and Vincent, 2001; Vincent, 1997; Mollinga, 1984). How we choose to see, describe and act towards this transformative capacity is also socially constructed, has social conditions of use and has social effects. There are many social structures in which people act – relationships, norms, institutions and knowledge - embedded in technology and its infrastructure. They interact and shape this transformation in the supply of a resource, between society and the natural world. In my inaugural address, I thus described how irrigation is both a technology and a resource. Irrigation and water systems are technologies - and bring transformation of society and natural resources - through social action. Secondly, that irrigation water, and water for other uses, is a resource, the regime of which is shaped by societal and environmental structures and processes. Thus, in irrigation there is an ongoing interdependence between the infrastructure system, the normative system and the organisational system (Boelens and Davila, 1998): change in one affects the other. We can also explore design further within these interdependencies, recognising that transformation involves work and power in an environment. This requires control but also creates dependencies. Thus one can open up interplay of these dimensions in social and technical relations. This allows more detailed exploration of infrastructure and system design, and water delivery. It also allows us to look at adaptive design and actions for change.

The Group works with this approach in several ways. One is to continue to do interdisciplinary research and define interdisciplinary concepts, in thematic areas of research, which are also contemporary development questions. These questions include continued work on irrigation as a sociotechnical phenomenon,

but also on water as a contested resource and, policy as process. The interdisciplinary concept of a sociotechnical system is one also used to explore interactions between society and natural resources. Another concept is the typology of 'water control', developed by Mollinga (1998) and Bolding *et al.*, (1995). This shows that hydraulic, organisational, political and social control interact to determine water distribution. The Group has added to this, to distinguish between sociolegal and political control, and cultural and metaphysical control (Boelens and Davila, 1998). Others under development include 'irrigation design concepts' (van Halsema, 1996) and the 'instructions for use' of a water resource (Knegt and Vincent, 2001). These act to open up discussion and negotiation about designs of technology to provide equitable and sustainable irrigation. They also form part of the work being carried out to develop a 'sociotechnical design' approach, as distinct from others (see Vincent, 1995), so we can argue constructively with engineers and planners. We also work on particular normative structures, knowledge systems and social relationships that work through technology and shape the delivery of irrigation and water as a resource. These include water rights, gender, organisational change, and agro-ecological design.

Contrary to the perception of some social scientists, we have never been forcing a 'technology structured' entry to the study of social action and society. Rather, we have tried to search with social scientists (and other professions) to find complementary theory. This helps understanding of the dynamic interfaces of water technology and management, with wider social, political and ecological structures and processes.

Norman Long has often challenged interdisciplinary research to show its recognition of social theory, even if not his own. Without this it could be technocratic, populist and even dangerous in its assumptions, and concerns for joint action and learning. The Group has always accepted this point, although not always his theory – which also perhaps explains our capacity to work alongside each other. Firstly, this is done through the search for complementary theory to build upon the sociotechnical approach. Secondly it is done through the research design of students. The search for complementary theory has differed with the entry point of research. Mollinga (1994) summarised key social theory in use for looking at transformation in technology and its links with society. For others entering from natural resource perspectives and interests in local adaptive design, theories from social anthropology have been used to study the adaptive design of technology and water management by society, and their transformation with new social orders (Cohen, 1976; Hunt, 1987). The research methods also focus on key actors and their social networks and knowledge systems. This research entry from ecological perspectives can also link with theories describing wider processes of social and agrarian change reshaping irrigation technology and water management. These perspectives also draw on cultural theory to explore social concerns, concepts and cosmologies manifested in technology design and water resources management. They can also engage with conceptual frameworks to explore innovation in irrigation and water management.

Interdisciplinary irrigation and development studies

To explore how the Group has struggled over time for these ends, this section takes a chronological approach based on the publications of the Group over the years. The sections below are titled according to these publications.

1978-1985: Irrigation and development 1: irrigation, peasants and development

Looking back, it is probably hard to reproduce on paper the intellectual excitement of the development debate in the decade 1975-1985. Liberal and Marxist theories of development were under attack, but the debate had not reached the crisis of development theory recorded by the end of that period. Processes causing underdevelopment were discussed equally as much as approaches to development. The Green Revolution was openly critiqued in its impacts, and more generally the neutrality of technology was openly questioned. Those involved in development - which included irrigation engineers - were in the thick of a range of debates about transformation and approaches to development. Parts of the irrigation profession involved in development assistance and international research began to respond to this debate. Norman Long was not at Wageningen early in this period. I discuss this to show my view of the ideas shaping the start of the interdisciplinary approach, which also influenced work in my tenure.

The work from other universities, and by irrigation professionals working in new intervention programmes, impacted into Wageningen as well as many other irrigation groups concerned about social change. So too did debates about the problems of 'development'. Cornell University set up its Tropical Agriculture programme in 1963, as part of an inter-University programme with the Philippines. By 1970, PhD research on field (rather than model) water balances showed

'something rather surprising for that time. They suggested that farmers were rational, if not totally optimal in their water management, notwithstanding that water deliveries were unknown in amount and irregular in timing...The studies showed that farmers actually managed the systems at physical levels that were nominally the responsibility of the irrigation bureaucracy...Our experience made it clear that reasonable understanding was only possible if (irrigation) systems were considered from a holistic perspective that included social, economic and cultural understanding, as well as engineering...'(Levine, 1977:26 in: Diemer and Slabbers 1992)

Levine was the first to discuss the concept of irrigation performance and 'performance indicators', in his work on Relative Water Supply (Levine, 1977). He used it as a means to study what farmers were doing at local level. However, these indicators increasingly became tools to judge main canal system water distribution, and to compare agency with farmer-managed schemes and prescribe change. Thus at the outset, a tension emerged between research aimed at opening up understanding on irrigation and scope for its transformation, and research designed to objectify problems and find generic models and approaches to help plan change. This has been a key tension that the Group has also tried to struggle with. This shift into more theoretically prescribed and 'logical' thinking on how to improve irrigation was led by the World Bank (Bromley, 1982) and the

CGIAR system. The Cornell Group, with others, led greater efforts to understand the social, economic and cultural dimensions integrated with engineering, and how intervention transformed their interactions.

Unlike Cornell, Wageningen had long colonial roots in its agricultural science, with interests in modelling and trial-based research that restricted easy change. In 1979 a group of students set up a research group on irrigation management to spearhead review and research on social knowledge that irrigation engineers and professionals needed to work with. Almost from the outset, the group moved to look critically at social theory on processes of transformation. They also looked at how development assistance – such as projects of intervention – were also processes of social change with outcomes shaped by local action.

In 1985 Eggink and Ubels published the first review in the name of this group, with the same title as this section. Both these authors worked with Norman Long, and his influence on their ideas is clear. The review set out to analyse how irrigation development was a factor in processes of social change. Irrigation was looked upon as a way of producing – a social activity – shaped by dialectical interaction of social forces, becoming a social force in itself within that process and influencing further developments in society. In identifying wider development theories and concepts relevant to this view, the study looked closely at neo-Marxist theory, and also comparative cultural analysis, as a means to examine and explain irrigation and development. It recognised how irrigation involved wider social processes of articulation through commoditisation and labour processes. To this aim, they represented irrigation as a ‘social force’, to distinguish Wageningen work from the older ‘Technocratic Approach’ characterising much of irrigation teaching and research, and from the new and emerging ‘Management’ Approach coming from the World Bank and CGIAR.

Beyond this review of theory, the authors, and the students they represented, took specific recognition that they must have a normative element to see (as interveners) their own culture and the biases they bring to it. However, this did not really evolve further until the next era, which identified a powerful theme of discussion and work focused on the ‘irrigation engineer’ and the social analysis they can engage in.

The book sat above some complex differences in ideas within the Group about approaches to a broader study of irrigation: these surfaced further in research published during the following period. Some accepted this approach. Others could work with the concept of irrigation as a social force, but wanted it developed in other ways. They wanted to study other relationships in design and management, and other social relationships between politicians, bureaucrats and engineers and farmers, who had their own goals and paradigms. Also, they wanted more a contextual focus on wider (and other) forces of agrarian change acting in irrigation. It was certainly possible to look at local water delivery for production through this ‘actor’ and practice lens. However, it restricted attention to wider institutions and the technology of irrigation. Thus others saw limitations in the ‘social force’ approach. The book’s focus in contemporary modernisation restricted study of older historical paradigms of technology. Also, it combined with other theory to have designs always described in language of paradigms and hegemony. While there was truth in this, it became tiresome for field engineers trying to work with change. It was also limiting for those working with locally created irrigation schemes, that often had many more coherent and positive

dimensions of design and management, and different relations of work and exchange practised within them. Additionally, it became problematic for the study of changes in thinking about irrigation reform and water reform. In some places, the separation of these Approaches has remained in irrigation and water reform, with institutional reform superimposed on a technocratic bureaucracy. Elsewhere, however, the problem was how the Management and Technocratic Approaches were actually coalescing into general 'technoeconomic' models for irrigation management and its reformulation, specifying preferred technology and institutions in designs, and the performance levels to be expected from them. I have referred to this as the 'sociophysical approach' to irrigation (Vincent, 1995).

Here, the real issue was the shift from the 'holistic' field studies of Levine (1977), Coward (1979) and Wickham and Valera (1978), to later 'holistic' views. These transformed schematic models of systems, successful institutions and design management relations into systematised models of relationships in irrigation (Small and Svensen, 1992). The authors of these schematic views (Uphoff, 1989, Uphoff et. al., 1990; Keller, 1986, 1990; Ostrom, 1990) were actually non-prescriptive, using insights from fieldwork. However, their ideas got taken up into prescriptive, often untested generic models to structure proposed change. Critique alone could not attack their power. Only research in the field on the realities in design and management, and the different ways that people could share, distribute and manage water could have an impact on that. This set in motion further work on irrigation practices. Myself, together with others in the Group, tried to further this work after my appointment in 1993 to show how a 'sociotechnical approach' to irrigation design exhibited different realities and options. These later studies aimed to examine 'development' orthodoxy in recommending change in irrigation and water management, through studies into the realities of irrigation performance and its assessment under a range of preferred institutional regulations and design concepts.

For all these reasons, the 'integrative view' of Eggink and Ubels (1985) became transformed, and the search for an inter-disciplinary approach began. This was not only to give real impetus to defining approaches for analysis of sociotechnical phenomena. It was also to highlight conscious discussion of what it was to be an 'irrigation engineer', why an engineer's ideas and actions might be different to a farmer's, and the social and political world in which (re)engineering takes place.

Internationally, the work of IWE that made the biggest impact was the 'grey' network publication by Luc Horst (1983), critically comparing 'schools of thought' on irrigation control technology. To many engineers at large, it created a new basis for discussion on water distribution in relation to irrigation development concerns. Until then they had been largely minor commentators on issues of design or maintenance, within the debates on implementation and management of irrigation systems. The Irrigation Group first became more known in international development for its ability to raise new debate on design and operations related to development, in both technical and interdisciplinary ways. However, it attracts criticism from some within Wageningen for its supposedly sociological preoccupations. This paradox has not been lost on its staff and students. Perhaps this chapter goes someway to re-balancing the view.

1985-1993: Irrigation and Development II: understanding water distribution - irrigators and engineers, crops, water and people

Fuelled by these internal and international debates, a new study programme and the strong 'Artefacto' debate on technology in the Group (Artefacto, 1990), the IWE embarked on serious thinking about research - thematically, conceptually and methodologically. The title of this section refers to two books (Diemer and Slabbers, 1992; Diemer and Huibers, 1996). These books include reviews of practice in irrigation in general, and the results of field studies, some of which began in the previous period. The books began to show what really happened in irrigation management, the conflicts that could arise in design and in operational water management, and issues within this for small farmers. They show the start of the focus onto technology that grew in this period, especially after the 'Artefacto' study. These studies did not yet locate themselves in wider social dynamics. However, this was a period when the Group began to draw on other social and development theory, political economy and innovation perspectives, and to develop an interdisciplinary perspective with a focus around technology.

The group decided to focus on case study and field research in offices, canals and fields of irrigation systems. This was then characterised as 'action research' or 'operational research' as distinct from 'field experiments' in agricultural research. This made the Group look to social science for methodological as well as theoretical insights. Actor-oriented approaches became a means to identify key human agents in water allocation and distribution, where they interacted, and the role of technology and institutions in these interactions. As both van der Zaag and Ubels point out in their papers in Diemer and Slabbers (1992), physical settings influence the social practice of water management, and create interfaces between actors in irrigation management. Norman Long, in his advocacy of actor-oriented analysis, became a focus of much attention. However, students actually often went on to work with much wider ideas drawn from social science, most notably with the concept of 'practice' (Bourdieu, 1977, 1990), with agency and structure (Giddens, 1981) with action and knowledge (Latour, 1987), and actor-network theory.

At this time, some staff and students also became more heavily involved in the actual project work of the Group, most notably with project-related support to development of small irrigation systems in Senegal and in the large Tungabhadra irrigation system in India. They also became involved in University collaboration in Pakistan and Mozambique. The contact with Norman Long expanded through contacts in teaching and research supervision, with students moving to work within his research programme in Mexico. These activities offered students not only new bases for field research, but also the possibilities of longer-term involvement for more historical analysis, and more direct contact with government engineers and operational staff. Thus beyond analytical research, the group also became involved in new learning and negotiation about development and change in irrigation systems. This active period also brought out some creative tensions within the group that had begun earlier in the 1980's. Some stressed continued attention to broader processes of agrarian change and development paradigms within the study of local action. Others, however, wanted to open up creative study of local water management devoid of systematic critique of agrarian change and forces of development, and left more open to see local strategic action. Yet another group wanted to focus more on the

process of development and innovation, to see how irrigation design and development might be better negotiated. While the first of these had tensions with Norman Long's work at the time, the second interacted far more openly with it. The latter group, moving much more towards work under the Chair of Communications and Innovation, saw much less of the tension, and was happy simply to use Long's ideas as tools. As Scheer wrote on social interfaces:

'...It is beyond the scope of this thesis to judge the ideas of Bourdieu or Long, and I use their approaches and concepts as tools...The reason why I wish to add elements of the social interface is that, as van der Zaag points out, the practices at social interfaces are more dynamic than others. The social interface concept of Long leaves more space for possible conscious learning...' (Scheer, 1996, p.17)

However, if this was to cause momentary stresses and disagreements in the group, all three lines of work brought their contribution to sociotechnical perspectives.

Once again, it is helpful to reflect on how the professional world saw the Group through its publications. The biggest impact came from its workshop on 'Irrigation design in Africa' in 1990, whose breath of coverage drew recognition (Ubels and Horst, 1993). It was admired for the way it opened up the complex world of irrigation and its different domains of action and for the way criticisms of both design ideas and development interventions were presented in very readable and empirically grounded text. Also admired was research into irrigation systems that showed the relationships between technological change and social change in irrigation systems and the historical changes of 'modernisation' in this relationship (Bolding et al 1995). The Group interacted in contact and networks in research on Farmer Managed Irrigation Systems (Bleumink et al. 1993) and it was during this period that I initiated contact (Diemer and Vincent, 1992). However, while relations have usually been amicable with the international agencies, it was still difficult to challenge design and development paradigms in mainstream irrigation. As mentioned earlier, these were shaped by techno-economic models, strongly based on performance valuation, which I call the 'sociophysical' approach to irrigation (Vincent, 1995).

The Group began to publish a series of papers (Bleumink et al. 1993, Bolding et al, 1995; Diemer and Slabbers, 1992; Horst, 1990; Hoogendam, 1993; Ubels and Horst, 1993; van der Zaag, 1992). These showed the complexity and interdisciplinary nature of irrigation, the parts played by social actors in water distribution, and the struggle around technical intervention in development. With hindsight, these texts are important to discuss, because they were both admired but also criticised. They showed the richness of interactions shaping agrarian dynamics in irrigation schemes, and the delivery of water. They also showed the detailed ways in which design paradigms played out, clashed with local principles and often were inconsistent within themselves. Finally, they were also instructive to engineers about the range of social awareness necessary in work with change of irrigation and water management practice. However, to social scientists they seemed like poor or biased attempts at thick description that no one but social scientists could or should do. On the other hand, "mainstream" irrigation and development critics bemoaned the lack of clear guidelines, typologies or lessons that they could learn from. Villarreal (1992) also discussed this problem for actor-oriented studies.

The recognition that irrigation was a sociotechnical phenomenon grew out of a wide range of work and struggle in this period. It was the beginning of an interdisciplinary approach internally important for understanding irrigation and water management. However, the approach was also externally important for opening up criticism of wider paradigms in irrigation, development transformation and development practice.

Since 1994: Irrigation and Development III – interdisciplinary development studies, lively practice and hardened history, and making water work

The year 1994 was not only the start of my tenure as professor, but occurred in a watershed period for development. A range of new development policies and new development theories came more prominently into action and discussion – particularly neo-liberal reforms, the ideas of ‘social capital’, ‘new institutional economics’, and ‘entitlements theory’. These changes impinged forcibly into irrigation and water management. There were new international programmes for ‘participatory irrigation management’ and ‘good water governance’ to increase the responsibilities of farmers and local organisations in water management, and radical new Water Laws in some countries. A range of environmental concerns put natural resource scarcities centrally into development debates and even generated new social and political movements. Development intervention evolved further in approaches to facilitating change and also into conciliation work in struggle and conflict over natural resource management. The title for this section refers to three papers, none of which have been published. The first presented the theoretical fields and key interdisciplinary concepts of the interdisciplinary approach to study in irrigation (Mollinga 1994). The second developed ideas for studying design in interdisciplinary but theoretically consistent ways. It looked at studying changes and the struggle to transform old canals and dominant and hardened ideas (Hoogendam, 1993). The third refers to a leaflet that summarises the sociotechnical research and teaching of the group, and its concern to understand how irrigation can work in equitable and sustainable ways (Irrigation and Water Engineering Group, 2001).

This return of social and economic theory to shape intervention, and re-emergence of social struggle around resource access and proposals to change it, was important in several ways. It became possible for some in the Group to engage with development intervention and public action in new ways, as institutional reform looked to define new articulations between state and civil society, and society and natural resources. It also put a new technical and ecological debate into play in irrigation around paradigms of integrated water resources management and river basin development (Bolding *et. al.*, 2000). This opened up discussion beyond irrigation water delivery, in the contest over reforms in water management. This was a new debate for intervention that went beyond improving ‘performance’ of main system management. It also existed both in the resource dimension and for production – as threats of water scarcity created attention to pollution, degradation, and future food security. This period has been a very different period of interaction with Norman Long, moving beyond alignment and constructive frustration, into tolerant collegiate working. This included the multidisciplinary ZIMWESI programme in Zimbabwe, and

students seeking joint supervision to explore realities in irrigation systems under radical management reform.

To cope with change and create space to reflect on new policies and research questions, the group restated its emancipation objectives, to work for equitable and sustainable irrigation and water resources management, keeping its perspective from that of small, marginalised and vulnerable actors in water use. With this it recognised that, while still committed to understanding the negative and marginalising effects of public intervention in irrigation, it also connected with new collective action at the interface of society and water management. It has done this by aligning more with what Gasper (1996) describes as 'Cultural and Development Ethics'. This approach allows a range of perspectives and interests to shape research on processes of change acting in water technology, rather than restricting study to certain dominant social relationships. The group can no longer be divided and labelled as social scientists or engineers. Perhaps the difference is more between backgrounds in development research and development practice, and in interests in transformation and action. This has brought more light to bear on what Mollinga (1998) saw as the problem between theory and practice, and knowledge and action in interdisciplinary work in irrigation, and what I saw as gaps in bringing them together. The group is structured around contemporary problems in water management and areas of international action within them, drawing on interdisciplinary and social, technical and environmental knowledge for these fields. These include the study of water rights and design of community schemes, gender in water management, organisation change in large water systems, optimal water use, water delivery practice, integrated system design and conflict resolution. These all contribute to our broader concerns of agro-ecological design, water development, social change and public action in water management.

We have worked to extend research showing the realities of water delivery to challenge dominant ideas. To the same end, we have also struggled to make our work more visible and our ideas more accessible in their analysis of irrigation questions and challenges. We seem to be valued internationally for our books and papers challenging normative ideas structuring irrigation development and reform (Horst, 1998; Boelens and Davila, 1998; Koppen and Mahmud, 1995; Mollinga, 2000; Zwarteveen, 1998). Design and policy debates have been influenced by research showing the practice and control in shaping operational water management (Manzungu, 1996, 1999), and the agroecological dimensions of design (Parajuli, 1999). The works of Mollinga (1998) and Kloezen and Oorthuizen (1995) have shown the sociotechnical reality of large-scale irrigation systems in the interaction between people, technology and water, shaping water delivery and shaping change in irrigated areas. In current PhD research we are using performance measurements to reopen examination of field realities, to criticise models for contemporary intervention and thus challenge mainstream thinking (Wahaj *et. al.*, 2000).

Many people cannot understand how, if we can write language like this, we are not social scientists and do not do social science. It is rather that we struggle to engage in the language relevant to society and social action. It allows us to argue how, and why, our sociotechnical approach to irrigation and water engineering is relevant to development questions and global change. Also how it is more likely

than other approaches to irrigation to fulfil concerns for more equitable and sustainable irrigation and water management.

Conclusions

This chapter has used the term 'social interface' in its title, in several ways. First, to highlight the use of what is probably the enduring element of Norman Long's own conceptual work in the Groups interdisciplinary approach, and study of irrigation as a sociotechnical phenomena. Second, it has also tried to show the interface the Group has had with Norman Long and his work on the sociology of development over time, and the wider questions the IWE has pursued at the 'social interface' of irrigation and development, to develop its own sociotechnical approach. Finally, it was used to show the constructive struggle within the Group as it searched to find effective ways to study the social interfaces of irrigation technology. The term 'struggle' has been used primarily in its sense of great effort, exertion, and contention between people to understand and develop ideas between our groups, but also to recognise an element of resistance. The Group has an actor-oriented approach in research, and works with the concepts of interfaces and arenas, but did not accept the actor-oriented analysis that Norman Long used in studying agrarian change. The effort has come in the Group, in its own deep engagement and commitment to struggle with development questions, and not just development theories. In this it has worked with the social sciences, development practitioners and the irrigation profession. This struggle has not only been about theory, but also about how and why theory, practice, knowledge and action can inform each other. Norman Long's work has been a lens, a key, a tool and sometimes a source of constructive frustration to the IWE Group, changing over the time of his tenure. But it has been much less of a battlefield than with other disciplines, and there has almost always been a dialogue.

To use a metaphor from Norman Long's work, we have evolved in a social arena of debate on social action and social change around technology and resource use, interacting with him, other irrigation professionals and social scientists. Contrary to many critics of the Irrigation Group, we have never become purely involved in sociology. Rather ideas from sociology, and the sociology of development, have just been some of many we have worked very seriously with. Our aim has been to generate understanding at the social interface between irrigation and development, between engineers and water users, and between water users and policy actors in irrigation and water management reforms. These inform the engineers, professionals, and water users who work with the ever evolving and complex challenges of water management, - for which action - material and social - will continue to be engineered.

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