IRRIGATION PRACTICES, STATE INTERVENTION AND FARMER'S LIFE-WORLDS IN DROUGHT-PRONE TIGRAY[1]

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Abstract

This study is about irrigation practices, State intervention and the responses of farmers in the Tigray region of Ethiopia. The study examines two small-scale irrigation systems located in the drought-prone Tigray through an ethnographic method.

Although governments have been involved in the construction of irrigation infrastructure since the mid-1980s to mitigate drought and famine in many parts of Ethiopia, the responses of irrigators to such interventions have never been studied. This study documents the interfaces and social discontinuities between the live-worlds of irrigators and government bureaucrats embedded in irrigation management. The study shows that irrigation system management sits uncomfortably between government bureaucracies and water users. The central argument is that there is a need for irrigation systems on the part of the farmers, but the provision of irrigation and agricultural services does not dovetail effectively with the life-worlds of farmers.

3. THE PROBLEM

In Ethiopia, government has been the main actor in initiating, planning and implementing development interventions since the mid 1950s. Modernization has been the driving ideology behind the various development plans that aimed at transforming the backward economy. Government is considered as 'the main provider of all benefits (Dessalegn, 1994) or as a Tigrian farmer conceived it '*Mengist Lehezbu Egiziabher Lefteretu*' meaning 'government is for its people, and God is for his creature'. The top-down nature of major development programs including the 1975 land reform, resettlement, villagisation, cooperativization and agricultural extension programs, indicate the history of forced change in the country. Local people were

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either forced or mobilized to 'participate' in the implementation of such projects, which were supposed to be 'beneficial' to local people.

Since the mid-1980s government has responded to drought and famine through the construction of irrigation infrastructure aim at increasing agriculture production in drought-prone regions of Ethiopia. Planning of irrigation projects has been done at the centre. However, not enough is known about farmers' reactions and responses to these government initiatives.

This study concerns state irrigation interventions in a drought-prone area designed to increase crop production to achieve food security at household level, and explores the planned interfaces with irrigators' life worlds in two small-scale irrigation systems located in Tigray region, northern Ethiopia.

4. CONCEPTUAL AND THEORETICAL APPROACHES

Erratic rainfall and frequent droughts characterize Tigray region. Between 1961 and 1987, for instance, the mean rainfall of Tigray was 578 mm with a coefficient variation of 28 while the national average rainfall was 921 mm with a coefficient variation of 8 (Webb et al., 1992:24). Subsistence agricultural production is almost entirely dependent on *keremt* (wet season) rainfall (between June and September), although in some parts of the region irrigated agriculture is practiced. In Tigray, 90 percent of employment is in the agricultural sector, which is traditional based on animal traction.

Tigray farmers need drought-proofing strategies to manage water better but also to spread risks. Farmers still have rainfed and/or irrigated plots and many are involved in multiple livelihood strategies. Local people employ numerous coping strategies with respect to drought and famine. Resource-poor farmers, for instance, have adopted fitting access strategies to resources such as land and oxen through sharecropping arrangements.

The two irrigation systems selected for study are the Gum Selassa and Hewane irrigation systems located in the southern Tigray region. A micro-dam is the source of water for the Gum Selassa irrigation system, which was constructed in 1996 by the regional government. Hewane irrigation is a longstanding 'system' reconstructed under land reform where 15 offtakes take turns to use the river water.

The conceptual and theoretical framework of this study highlights the interfaces and social discontinuities between the life-worlds of irrigators and government bureaucrats embedded in irrigation management. An irrigation intervention

constitutes an arena of struggle in which access to resources such as land and water provides the central point of dynamic interactions, encounters, confrontations and negotiations between different social actors. As Long and Ploeg (1989:226-227) explain, 'focusing upon intervention practices allows one to take into account the emergent forms of interaction, procedures, practical strategies, types of discourse, cultural categories and the particular 'stakeholders' (Palumbo 1987:32) present in specific contexts and to reformulate questions of state intervention and agrarian development from a more thoroughgoing actor perspective'.

In the livelihood domain, interlocking relationships among the different social actors including landlords (during the imperial regime), farmers, local government administrators, development agents, and *Abo mai* ('father of water') are central. The concept of 'domain' best expresses the nature of these interlocking relationships. As Long (2001: 241-242) notes:

> *Domains represent the loci of rules, norms and values that become central to this process of social ordering and to the establishment of certain pragmatic rules of governance. The idea of domain is also important for understanding how social and symbolic boundaries are defined and upheld, though precisely which normative or strategic principles will prevail situationally or over the longer term remains an open question. Domains should not be conceptualised as 'cultural givens' but as being produced and transformed through actors' shared experience and struggles'.*

2.1 Irrigation and irrigation management

2.2.1 Management tasks

In irrigated crop production a number of interrelated activities ranging from designing and constructing of the irrigation infrastructure to water acquisition and watering crops are carried out. Uphoff (1986:42) identifies three categories of irrigation management activities, namely water use activities, control structure activities and organizational activities. The first involves water acquisition, allocation, distribution and drainage. The second focuses on design, construction, operation and maintenance. The third focuses on conflict management, communication, resource mobilization and decision making.

The management aspect of irrigation is often neglected while priorities are given to the construction of irrigation infrastructure, although both the human and physical aspects interact in an irrigation domain. Uphoff (1986:4) also notes that 'the social dimensions of irrigation management have been too often neglected, handled badly, assumed not to require any special knowledge or expertise'.

While Uphoff's work addresses irrigation management tasks, the crucial issue, water control and power relations in irrigation management does not get much attention. Vincent (1995:94), criticizing Uphoff's model of irrigation management tasks, argues that 'de-politicizing and de-culturalizing irrigation activities to create this model has improved understanding of management activities. However, this approach can reduce understanding of the way governments and farmers may be using irrigation organization for multiple reasons, and not only for irrigation activities'. In Ethiopia, for instance, during the *Derg* regime farmers were not willing to become involved in irrigated farming by taking land from the government because they were required to form producer cooperatives (FAO, 1994; Dessalegn, 1999).

2.2.2 Property rights and hydraulic tenure

In terms of intervention, Coward (1984) distinguishes between direct and indirect investment approaches. Under direct investment, the agency takes full control of implementation activities including design and construction. In these cases, the agency often takes over the management of the system, though it may aim to turn it back to the farmers for operation and maintenance after construction is complete. Under the indirect investment approach, the agency provides resources (financial, technical assistance, materials) to an existing irrigation organisation in the form of grants, subsidised loans, and technical assistance, which support that organisation in improving its irrigation system. Management control of the system remains with the farmers.

Underlining the importance of the indirect investment strategy, Coward (1986:502) argues that 'it provides a means for the state to invest in irrigation development and simultaneously reinforce or create property-based local irrigation groups'. Yoder (1994) argues that any assistance to irrigation systems should contribute to the irrigators' capacity building in terms of operation and maintenance of systems. Farmers should be encouraged to mobilise their material, labour and financial resources to sustain their irrigation systems. The danger of dependency on external assistance is well-documented (Merrey, 1997; Yoder, 1994; Underhill, 1984). Vincent (1994:310) notes that 'as the state withdraws and specific public assistance programmes for SSIS decrease, there may be a special need to ensure that an enabling environment does remain for SSIS'.

2.2.3 Governance in irrigation systems

Ostrom (1992:45) identifies three layers of rules that cumulatively affect irrigation systems. *Operational rules* refer to the day-to-day decisions concerning when, where,

and how to withdraw water, monitoring of actons, and rewards and sanctions assigned to actions. *Collective-choice rules* are used by irrigators, their officials, or external authorities in making managment policies. A change in policy implies a change in oeprational rules. *Consitutional-choice rules* determine who is eligible to participate in the system and what specific rules will be used to craft the set of collective-choice rules. In the crafting of irrigation institutions, suppliers and users should be encouraged to design their institutions (ibid.).

Commenting on the governance model developed by Tang and Ostrom, Vincent (1995:94) points out that ' they distinguished governance from management activities, in order to study how governance functions are increasingly controlled by external agencies. However, governance and management activities may well be coordinated within the same organizational framework'.

2.2 Irrigation system as a sociotechnical system

Different approaches have been employed in the analysis of irrigation. Eggink and Ubels (1984:121-122) identify three approaches: the technocratic approach, the organisational approach and the social force approach. The technical infrastructure of the irrigation system is the main focus of the 'technocratic approach'. Importance is given to large-scale construction and rehabilitation works. Irrigation management is confined to the operation and maintenance of the irrigation infrastructure. The 'organisational approach' mainly focuses on the management of irrigation systems. Organisational problems with respect to water distribution in large-scale irrigation systems are studied. The 'social force approach' considers irrigation as 'a way of producing, a social activity, shaped by the dialectical interaction of social forces and, in that process, becoming a social force in itself and influencing further development in society' (ibid.). Problems in irrigation systems are examined as an ongoing struggle between different interest groups over water. These approaches have attempted to examine irrigation in a non-comprehensive way using individual disciplines such as engineering, management, anthropology and economics.

Mollinga (1998:11-12) criticises the professional irrigation literature by pointing out three limitations: the treatment of technology as a black box; a limited concept of human agency and the absence of the study of the social relations of power. He argues that an interdisciplinary investigation of irrigation requires insight into its technical, organisational or institutional, and socio-economic and political aspects.

In the present study, an irrigation system is considered as a 'sociotechnical system' (Mollinga, 1998; Vincent, 1997, 2001). Such an approach 'gives explicit attention to

the multiple ways in which technology shapes social action, and is also shaped by it' (Vincent, 1997: 45). Mollinga (1998:14) outlines the social dimensions of an irrigation system in terms of three basic concepts: social construction, social requirements for use and social effects.

2.3 The dynamics of State intervention: some central concepts

Development intervention is an arena in which infusion of resources takes place in order to 'improve' or 'prevent' difficult situations (e.g. drought, famine, disease, alcoholism, soil erosion). As Long (2001:242) describes, 'arenas are spaces in which contests over issues, claims, resources, values, meanings and representations take place; that is, they are sites of struggle within and across domains'. In Ethiopia, for instance, a state sponsored resettlement program was carried out following the 1984/85 drought and famine that claimed thousands of lives. In the implementation of the settlement program, coercion, cooperation, resistance and rejection were all manifest.

Long and Ploeg (1989:230) argue that 'Intervention (…) implies the confrontation or interpenetration of different life-worlds and socio-political experiences, which may be significant for generating new forms of social practice and ideology'. An actor-oriented approach is useful then in understanding and analysing the process of change initiated by the government such as irrigation intervention and farmers' response. Farmers are not passive recipients of an intervention. Planners with linear thinking may assume that planned projects could get full acceptance on the part of 'beneficiaries'. But, as Long and Ploeg (1994:69) note farmers '…try to create space for their own interests so that they might benefit from, or, if need be, neutralize, intervention by outside groups or agencies'.

Long (1992:9) argues:

> *Applied to the field of development research, an actor-oriented approach requires a full analysis of the ways in which different social actors manage and interpret new elements in their life-worlds, and understanding of the organising strategic and interpretive elements involved, and deconstruction of conventional notions of planned intervention. Rather than viewing intervention as the implementation of a plan for action, it should be visualized as an ongoing transformation process in which different actor interests and struggles are located. Integral to this type of approach are two other crucial aspects: an understanding of the processes by which knowledge is negotiated and jointly created through various types of social encounter, and understanding of the power dynamics involved.*

Thus the interaction among social actors is dynamic and entails the shaping and reshaping of planned intervention. On the part of the 'target population' adoption, transformation or rejection of the intervention can take place. Such results are an outcome of power and negotiation among the social actors. The concept of 'social interface' is important to explore planned intervention and irrigators' life-worlds. Long (2001: 177) defines '…social interfaces as critical points of intersection between different social fields, domains or lifeworlds, where social discontinuities based upon differences in values, social interests and power are found'. And Vincent (2001:67) affirms that 'the concept of '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'.

2.3.1 Agency and social actors

In understanding the life-worlds of social actors we must give weight to the meanings and motives attributed to events and relationships by the actors themselves. Furthermore, as Long (2001: 241) explains, 'social actors are all those social entities that can be said to have agency in that they possess the knowledgeability and capability to assess problematic situations and organise 'appropriate' responses. Social actors appear in a variety of forms: individual persons, informal groups or interpersonal networks, organisations, collective groupings, and what are sometimes called 'macro' actors (e.g., a particular national government, church or international organisation)'. In the context of irrigation intervention, the social actors include farmers, government and non-government bureaucrats involved in administration, agricultural workers, and agencies involved in dam construction and credit services.

Human agents are knowledgeable and capable of taking actions meaningful to their life. Agency commonly refers to the ability of actors to operate independently of the determining constraints of social structure. The concept of 'agency refers to the knowledgeability, capability and social embeddedness associated with acts of doing (and reflecting) that impact upon or shape one's own and others' actions and interpretations. Agency is usually recognized *ex post facto* through its acknowledged or presumed effects. Persons or networks of persons have agency. In addition, they may attribute agency to various objects and ideas, which, in turn, can shape actors' perceptions of what is possible. Agency is composed, therefore, of a complex mix of social, cultural and material elements' Long (2001: 240-241). Agency suggests not merely the ability to act, but to act in ways that demand the recognition and/or response of others.

2.3.2 Life-Worlds

Long and Ploeg (1994:64) argue that 'all forms of external intervention necessarily enter the existing life-worlds of the individuals and social groups affected, and in this way are mediated and transformed by these same actors and local structures. Also to the extent that large-scale and remote social forces do alter the life-chances and behavior of individuals, they can do so only through shaping, directly or indirectly, the everyday life experiences and perceptions of the individuals concerned'.

As developed in the phenomenological sociology of Alfred Schutz (Schutz and Luckmann, 1974), the life-world is the taken-for-granted stream of everyday routines, interactions, and events that make up individual and social experience. 'Lifeworlds are 'lived-in' and largely 'taken-for-granted' social worlds centring on particular individuals. Such worlds should not be viewed as 'cultural backcloths' that frame how individuals act, but instead as the product of an individual's own constant self-assembling and re-evaluating of relationships and experiences. Lifeworlds embrace actions, interactions and meanings, and are identified with specific socio-geographical spaces and life histories' (Long, 2001: 241).

2.3.3 Livelihood and practices

The concept of livelihood has been defined in different ways. The dictionary meaning is 'the way by which one earns enough to pay for what is necessary' (Longman Contemporary English). Rennie and Singh (1996) explain that a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. These definitions mainly focus on the material resources and labour that are the basic components for the maintenance of livelihoods. Others view livelihoods as something more than the means of earning incomes. De Haan (2000:343) notes that 'livelihood is not necessarily the same as having a job and does not necessarily even have anything to do with working. Moreover, although obtaining a monetary income is an important part of livelihood, it is not the only aspect that matters'. Furthermore, Ellis (1998) states that 'a livelihood encompasses income, both cash and in kind, as well as the social institutions (kin, family compound, village and so on), gender relations, and property rights required to support and sustain a given standard of living'. Long goes on to stress that one should not focus only on material and labour resources but also on adaptive and coping strategies that individuals and groups employ to sustain livelihoods. Hence, he argues that 'livelihoods are made up of practices by which individuals and groups strive to make a living, meet their consumption necessities, cope with adversities and uncertainties,

engage with new opportunities, protect existing or pursue new lifestyles and cultural identifications, and fulfil their social obligations' (Long, 2001:241).

According to Giddens (1976:75) the concept of practice involves 'regularised activities that take the form of habits, traditions or customs', and as Arce (1994:156) underlines, this entails 'analyzing the ways in which people operate in their everyday life'. Hence, the usefulness of concept of practice as applied to irrigation that it 'enables us to assess how a particular type of irrigation infrastructure is related to particular actions of people' (van der Zaag, 1992:4).

Irrigated agriculture is one set of livelihood practices designed either by local people or government/NGO to enable crop production by removing 'the uncertainties inherent in reliance on natural rainfall' (Carter 1989:5). Guijt and Thompson (1994:294) argue that 'an environmental and socio-economic analysis of irrigated agriculture challenges us to come to terms with the complexity of local livelihood strategies in diverse and risk-prone environments. This, in turn, demands a redefinition of irrigation as a means to an end and not an end in itself'.

Understanding how irrigation fits into farmers' livelihoods is one of the important lacunae in irrigation studies. Many studies on irrigation development focus on the productivity of irrigation systems, but Chambers (1994:55) writes 'to my knowledge, livelihood thinking has been little applied to irrigation. Arguments for improving the performance of canal irrigation systems are usually couched in production terms'. Furthermore, feasibility studies of irrigation often exclusively consider the economic internal rate of return. Tiffen (1987:5) argues that: It is necessary not only to look at benefits to the national economy as a whole, but also to the costs and benefits created for the project beneficiaries and for the project administration'. Furthermore, Chambers (ibid:50) believes that 'benefits from irrigation can be assessed in terms of its livelihood-intensity—the number of households enabled by irrigation to gain adequate and secure livelihoods'. The Kenyan experience of the Mwea irrigation settlement project, for instance, reveals that farmers were not able to generate sufficient income to sustain their families due to the high cost of farm inputs, particularly fertilizers and other agro-chemicals (Aluknoya, 1993). In irrigation intervention, due consideration should therefore be given to the various livelihood practices pursued by farmers before considering irrigated agriculture as a viable solution.

2.3.4 Power and authority

There have been many debates concerning the meaning of power, yet, as Waters (1994:218) notes, 'there is widespread disagreement about the meaning of power and its sources'.

Power is a crucial instrument of social and economic change and we need first to identify it as a relation rather than a possession that one might enjoy independently of others. Moreover, power implies much more than how hierarchies and hegemonic control demarcate social positions and opportunities, and restrict access to resources. Power, as Scott (1985) points out, inevitably generates resistance, accommodation and strategic compliance as regular components of the politics of everyday life.

In irrigation intervention water control is the central activity which determines irrigators' access to water. Mollinga (1998:28-29) identifies three dimensions of water control—*technical*: guiding-manipulating-mastering of physical process; *organizational*: regulation and control of human behavior, particularly with regard to the forms of cooperation necessary to make irrigation systems function; and *socioeconomic and political*: the conditions of possibility of technical and managerial water control. Mollinga argues that it is 'the concept of power that binds the three dimensions of water control together'.

In this study, the power of bureaucratic actors involved in the fields of hydraulic organization and political control is examined. As de Vries (1995:42) argues such 'intervention includes institutional models about how to deal with farmers, tactics for dealing with 'recalcitrant' and 'uncooperative' farmers, and strategies by which farmers cope with the state bureaucracy'.

In order to get to grips with such complexities, we need to indicate how issues of power, authority and intervention are to be approached in respect to irrigation and livelihoods. Long (2001: 242-243) provides a useful set of suggestions:

> *Power configurations are depicted in terms of the idea of interlocking actors' projects made up of heterogeneous sets of social relations imbued with values, meanings and notions of authority and control, domination and subordination, and sustained by specific patterns of resource distribution and competition (i.e., power construction). Power cannot simply be possessed or accumulated. Nor can it be precisely measured in terms of quantity or quality. It emerges out of social processes and is better considered a 'product' rather than a 'given'. Having power does not entail that others are without it: there is no zero-sum*

> *game. However, power may become reified in social life; that is, people often think of it as a unitary coercive force wielded by 'the ruling class', 'agents of the state' or 'establishment'.*

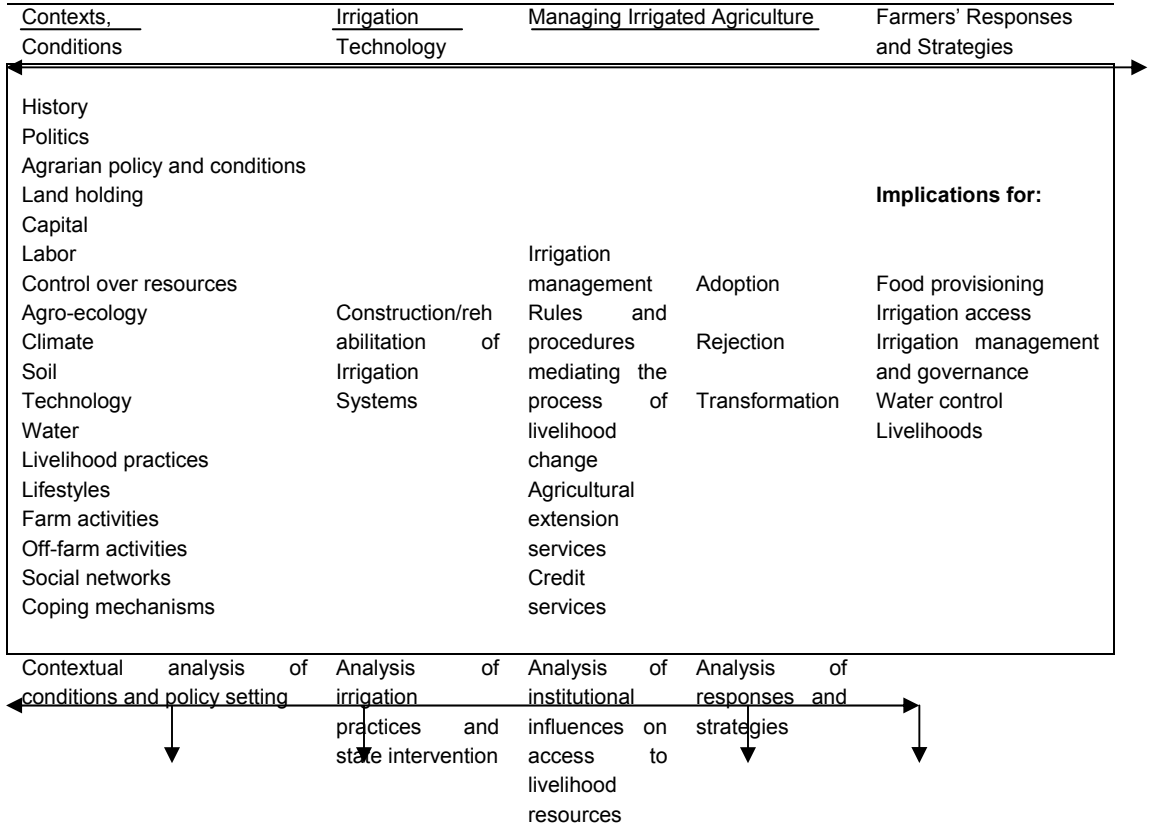
On the basis of this approach one can explore how various forms of state and non-state power are constituted and reconstituted in the settings and practices of everyday life. The approach also highlights the processes by which the relatively 'powerless' appropriate, manipulate and subvert outside authority in their struggles to defend and promote their own interests and 'projects'.

National institutions and objectives exert a pervasive influence on farmers' life-worlds. For instance, government social and economic policies and institutional arrangements, legislation, market, etc. may influence household livelihood strategies and can have durable effects on livelihood practices. I agree with Chambers (1983) that for adequate and decent livelihoods to be sustainable much depends on the policies that affect agriculture. Yet as Long and Ploeg (1989:234) point out: 'since it is seldom the case that evaluations question the whole idea of planned intervention and the rationality of planning, it is usually the farmer, environmental factors or the mysteries of distant commodity markets that are blamed for failure, not the package or the activities of the agency itself'.

As discussed in this study, concept of power and authority are used in the context of:

- irrigation practices;
- the enforcement of standardised agricultural extension packages and credit services; and
- the implementation of 'development projects' (e.g. irrigation, soil and water conservation).

Figure 1.1: Interlocking Relationships and Actors' Strategic Actions in State Irrigation Intervention: A Framework for Analysis



2.4. The Research Questions

Based on the above theoretical discussions, the following central research question has guided this study.

How do state irrigation interventions interface with irrigators' life-worlds in a drought-prone region of northern Ethiopia?

- The sub-questions are:
- *What state interventions have taken place and how have they affected agrarian relations and irrigation technology choices in Ethiopia?*
- *How is irrigated agriculture practiced, and what is the value of irrigated agriculture in the life-worlds of irrigators?*
- *How do local government bureaucracies intervene in everyday irrigation management and irrigated agriculture and what are the key interfaces and arenas shaping interactions and outcomes between agencies and farmers?*
- *What are the coping strategies in respect to drought and famine employed by local people, and what other food provisioning/livelihood strategies exist apart from farming?*

2.5. Methodological Considerations

In the implementation of irrigation intervention interaction takes place between the intervening actors, the government and non-governmental agencies involved in the irrigation development on the one hand, and the farmers (often called 'beneficiaries') on the other. Of particular concern is the issue of the institutional control, at farm, *tabia* (sub-district), district and regional levels of state officers of government bureaucracies and NGOs. In view of this, I was interested to investigate how actors adopted, transformed or rejected the irrigation intervention by adopting 'pragmatic moves' (Schutz and Luckmann, 1974). Such an approach enabled me to take into account social actors' reasons and the social context of action.

A case study method was employed to conduct the research. One of the characteristics of qualitative research is the use of case studies (Stake, 1995; Neuman, 1997). Yen (1989:13) states that 'in general, case studies are a preferred strategy when "how" or why" questions are being posed, when the investigator has little control over events, and when the focus is on contemporary phenomenon within some real-life context'. Thus, it was appropriate to undertake case studies that allowed me to investigate the life-worlds of farmers within the context of two irrigation systems. The approach taken was largely ethnographic, that is, it has been

concerned with understanding social life and discovering how people construct meaning in natural settings. I wanted to learn what is meaningful or relevant to the people being studied, and how individuals experience daily life. The methodology was designed to employ a variety of methods to capture different aspects of complex relationships. Thus, ethnographic interviewing, participant observation and a total of 60 household interviews were carried out in Gum Selassa and Hewane irrigation systems.

The methodology designed for the study established a number of requirements for the selection of the case study area. Tigray region was preferred on a number of criteria: First, in order to understand the coping strategies of local people since the region is affected by recurrent drought and famine; and second, the presence of both longstanding river diversions and government-initiated irrigation systems. The locations, then, were suitable for exploring the role of irrigated agriculture in curbing drought-induced food insecurity at household level.

The fieldwork was carried out in two phases. The first phase was between January 2000 and September 2001. During this period visits were made to ten irrigation systems to gain first hand information about the implementation of irrigation development and management of the small-scale irrigation systems in Tigray. This was followed by the selection of two irrigation systems for further in-depth study. This second phase of the fieldwork was carried out between August to October 2002.

Hewane irrigation system (river diversion) and Gum Selassa irrigation system (micro dam) constructed by the regional government were chosen for detailed research. The selection was made on the basis of three criteria: age of the irrigation system, medium scarcity of water, and accessibility and proximity of the micro dam and river diversion. Hewane and Gum Selassa irrigation systems are located at a distance of 20 kms in Hintalo Wajirat Woreda (district), southern zone of Tigray, which is frequently affected by drought and famine. Research on two irrigation systems was considered necessary in order to understand whether there existed significant differences in the irrigation management or not.

6. AN OVERVIEW OF IRRIGATION DEVELOPMENT AND TECHNOLOGY CHOICE IN ETHIOPIA

Rainfed agriculture is the dominant form of farming in Ethiopia. Government intervention in irrigation development is a recent phenomenon, though the first government advice given to farmers to construct canals and sow seeds and plant

vegetables to mitigate the looming drought effects was in 1928 through the issuing of the following proclamation.

> *Gizew dirk hono lesebel yemiasega bemhonu awaj. Megabit 8 ken 1920 (E.C) Bealfew zemen sebel metatat senazen yehw zendrom gizew endamenaw lemhon yemiasega honalena ahun sele dirkum wode egziabher ezen. Mesnom eyawetah ehel zera atakelt tikel. (Mahetemselasse 1942: 532)*

A proclamation for the current drought that would threaten crop production. 1st of March 1928.

> *While we were sad at losing crops last year, this year also has become fearsome like the previous. Now pray to God. Construct irrigation canals; sow seeds and plant vegetables.*

Although traditional irrigation was practiced in the highlands for centuries, it was only in the early 1950s that modern irrigation technologies were adopted in large private and government-owned schemes, primarily in the Awash River Basin. Surface irrigation with mainly furrow irrigation had been in practice for cotton and fruit production. Most of the early schemes were pump-irrigation projects, but later gravity irrigation schemes were introduced (FAO, 1997).

The imperial government was much interested in modernising the agricultural sector by inviting foreign investors to develop large-scale irrigation projects particularly in the Awash valley. The early planned small-scale irrigation intervention made by the Ethiopian government was an attempt to settle the Afar pastoralists living along the Awash Valley in the 1960s when the government decided to give the grazing land to local and foreign investors to promote commercial irrigated farming (van Lier, 1970). The Afar settlement schemes were not successful for various reasons including the poor participation of the Afar settlers in agricultural activities, and the fact that a large proportion of the irrigated land remained uncultivated, and the settlers were unable to feed themselves, and as a result, they became dependant on food relief (Tadesse, 1988).

In many countries the failure and inefficiencies of large-scale irrigation systems have resulted in the shift of attention to small-scale irrigation systems assuming their cost effectiveness and manageability by local people. However, in the Ethiopian context small-scale irrigation intervention on the part of the Ethiopian government took place mainly because of the 1984/85 drought and famine that affected millions of Ethiopians (Dessalegn, 1999).

In the Ethiopian context, irrigation systems are classified on the basis of size. Small-scale systems cover an irrigated area of less than 200 hectares, growing primarily subsistence crops. Irrigation systems between 200 and 3000 hectares are medium and large systems cover an area of 3000 hectares or more. The small-scale irrigation schemes fall under the general authority of the appropriate peasant association, whose members are expected to contribute to construction and maintenance efforts (Zewdie, 1994).

In the Ten-year perspective plan, an irrigation development program was included as one of the major agricultural projects, although it was planned to cultivate some 13 thousand hectares with medium and 113 thousand hectares with large-scale irrigation systems (ONCCP, 1984). In addition, the Ministry of Agriculture was made responsible for the development of small-scale irrigation. In 1983 the Irrigation Development Department of the Ministry of Agriculture was put in charge of the initiation, study, design and construction of small-scale irrigation systems. Between the mid 1980s and 1991 the department constructed and rehabilitated 35 small-scale schemes, of which nearly one-third were formerly traditional schemes used by peasants. Later in 1994 the department was dissolved (Dessalegn, 1999).

In Ethiopia, small-scale irrigation systems have encountered numerous problems. Anderson and Flynn (1989:198-199) report the following:

- poor canal alignment, longitudinal slopes, and cross section;
- complete blocking of the river by weirs constructed from stones, earth and timber;
- lack of intake structures to control both the amount of water taken out and also to prevent floods entering the system;
- water abstractions were not related to the water needs of the crops, thus the [sic] water diverted in almost all cases exceeded need;
- land levelling and cultivation practises under rainfed and irrigated conditions have remained the same. Farmers do not understand the differences between flood irrigation and rainfall and consequently erosion, water logging, and moisture stress can sometimes be seen within the same irrigation plot; and
- no control structures were provided to reduce erosion in field channels and to measure and control water use and no surface drainage or gully crossing were provided.

In a government-sponsored national irrigation policy and strategy workshop in 1990 it was reported that almost all the irrigation schemes initiated in the past were functioning below anticipated targets. The core cause of this problem was that farmers were reluctant to participate in irrigation development activities (ONNCP, 1990). So what was the cause of this reluctance on the part of farmers? Most

smallholder farmers were not willing to become involved in irrigated farming by taking land from the *Derg* government because they were required to form producer co-operatives, which the government considered the most important rural institution for bringing about socialism in Ethiopia. Producer co-operatives were unwanted organisations among farmers in Ethiopia (FAO, 1994).

Dessalegn (1999:12) also notes that '*Derg* almost destroyed traditional irrigation schemes by confiscating them and handing them over to producer co-operatives'. Furthermore, he (1999:14) argues that, 'the management of the projects themselves were in the hands of party or government functionaries, and not in the hands of beneficiaries. The irrigation schemes lacked operational autonomy, and there was no sense of ownership on the part of the beneficiaries. Because of the association of irrigation with collectivisation, many peasants shunned irrigation and remained suspicious and reluctant to return to it even after the fall of *Derg'*.

No new irrigation policy was introduced until 1999. At this time, the government introduced an irrigation development policy under a general water resources management policy. The policy document describes general water resources and sectoral policies including irrigation, hydropower, and water supply and sanitation. The policy also includes crosscutting topics such as trans-boundary issues, groundwater resources, watershed management, water allocation, water quality, technology and engineering, and disasters and emergencies. The Ethiopian water resources management policy includes the following objectives:

- The development and optimum allocation of the country's water resources for the benefit of the people on an equitable, efficient and sustainable basis;
- Managing the effects of drought and other associated disasters through efficient allocation, redistribution, transfer, storage and efficient use of water resources;
- Controlling and regulating floods through sustainable mitigation, prevention, and other practical means; and
- Conserving, protecting and enhancing water resources and the overall aquatic environment on a sustainable basis.

The policy objectives of the irrigation sub-sector include:

- To achieve food production at household level by developing and promoting small-scale irrigated agriculture operated at farmer level;
- Promotion of small, medium and large scale irrigated agriculture to supply raw materials for industry; and at a national level, to achieve food security and earn foreign currency;
- To promote manageable, sustainable, equitable, reliable as well as environment-friendly irrigation systems; and

- To develop techniques of water use efficiency, water wastage control, maintenance of irrigation infrastructures and drainage (MoWR, 1999 (1991E.C): 21).

The current government appears to be committed to the promotion of irrigation. Parliament has endorsed the establishment of the Water Resources Development Fund, an institution that is in charge of the mobilisation of resources for the development of Ethiopia's water sector. The fund, which was established by proclamation No. 268/1994, has been described as expediting the efforts for the tapping of the vast water resource potential for sanitation, drinking and irrigation purposes (WIC, 2002). Furthermore, regional governments including Amhara, Tigray, Southern Peoples, and Oromia, have established Commissions for Sustainable Agriculture and Rehabilitation which are involved in the construction and rehabilitation of irrigation systems in their respective regions. The Agriculture and Natural Resource Bureaux provide technical support with respect to crop production to irrigation systems.

3.1 Irrigation Development in Tigray

Tigray region is situated in the northern tip of Ethiopia. The topography of the region is predominantly mountainous and the elevation ranges from 500 meters above sea level in the eastern part of the region (Erob) to 3900 meters in the southern zone near Kisad Kudo (Tassew, 2000). The climate includes all the three categories: *kolla* (lowlands), *weyna dega* (midlands) and *Dega* (highlands). The average minimum temperature is 5^0c and the maximum 40^0c.

The estimated population of Tigray is 3,494,000 of which 565,000 are urban and 2,929,000 are rural inhabitants. Over 90 percent of the population are followers of Orthodox Christian Church. The total area is about 80,000 square km of which the arable land is estimated to be 15,000 square km. The average holding is about one hectare. This varies from 0.5 hectare to 0.9 hectare in the densely populated highlands and nearly 2 hectares in the lowlands. (CSA, 1997).

The region is primarily agricultural and the majority of the population is employed in this sector. Agriculture is dependent on unreliable rainfall. For many years rainfall has been very low and erratic. As a result, repeated crop failure and scarcity of food have forced inhabitants to depend on famine relief in the form of food for work.

The Tigray farmers have a long history of practising irrigation to supplement rainfed agriculture. Local people's initiative has been in practice using the available water

supply for irrigation purpose. As Pankhurst (1986: 137) writes, quoting Plowden and Salt:

> *Irrigation, though far from universal, was practised, Plowden notes, "whenever necessary" – or possible, and in view of the "numerous rivulets" was "an easy task." Small channels, as Salt noted in Tigré, would be dug from the higher parts of a stream to conduct water across a nearby plain, which would be criss-crossed with small ditches to form "small compartments." Irrigation of this kind on ditches about two feet wide was also used in some areas for the cultivation of cotton.*

Surface irrigation including river diversion, spring development and pond systems, is widely used in the region to irrigate plots. In the highlands of Tigray, farmers construct *dorra* (ponds) for the storage of spring water to irrigate their farms (Mitiku, et al.2001). In Tigray 15,495 ha is irrigated using traditional methods and make up 5 percent of the estimated irrigable land of 324, 286 ha (ibid: 9). Diversions structures are made simply of stones and wood. They are frequently washed away by the floods. The canals are not lined and water loss through seepage is significant.

The current government believes irrigation intervention to be a drought-proofing strategy in Tigray. To this end, international organisations such as UNDP, UNECA and FAO have participated in designing of a project on 'Sustainable Agriculture and Environmental Rehabilitation in Tigray'. Nana-Sinkam (1995: 87) reports:

> *With the framework of its 'Agenda on Emergency, Humanitarian, Rehabilitation and Reconstruction Affairs' and more specifically in consonance with 'its objective in Poverty Alleviation through Sustainable Development', UNECA, at the request of the Transitional Government of Ethiopia (TOE), has launched a major undertaking called 'Sustainable Agriculture and Environmental Rehabilitation in Tigray (SAERT), which is only the first of 8 Programmes being elaborated in co-operation with UNDP and FAO within the framework of what is known as 'Sustainable Agriculture and Environmental Rehabilitation, Reconstruction and Development (SAERRD) for Ethiopia'.*

This program has been developed to address not only the issue of food security in Ethiopia but also the whole area of sustainable development in agriculture and natural resources. One of its objectives is 'to increase production as quickly as possible using extensive water harvesting systems for irrigation' (ibid: 88). Furthermore, as Nana-Sinkam explains:

> *The design process for the Tigray region anticipates the building of 500 irrigation schemes, principally using micro-dams within a period of ten years. This undertaking, ambitious as it may appear, has been carefully targeted taking into consideration the experiences of the region in irrigation as well as in participatory labour processes. The undertaking of the proposed schemes will*

involve extensive watershed management as well as adequate preparatory measures in organizing the agronomy components of irrigation schemes to an extent that the region can be self-sufficient in food resources and export to other Ethiopian regions and to other countries in the Horn of Africa (such as the neighbouring Eritrea) within a matter of ten years (ibid.).

Upon the recommendation of the above mentioned international organisations, the regional government established the Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray (Co-SAERT) making it responsible for the construction of micro-dams in the region.

In Tigray, the main institutional actors involved directly or indirectly in the irrigation intervention include the Commission for Sustainable Agriculture and Environmental Rehabilitation of Tigray, the Bureau of Natural Resources and Agriculture through the woreda department of agriculture, local government administrations, and non-governmental organisations such as the Relief Society of Tigray (REST) and the Dedebit Credit and Savings Institution (DECSI).

3.2 The Research Sites

3.2.1 Hewane Irrigation System

The Hewane irrigation system is situated in Hewane *tabia,* on the road connecting Addis Ababa with Mekelle some 55 km south of the regional capital of Tigray. The fields of the irrigation system encompass parts of the territory of four k*ushets* (villages) called Ayboto, Korora, Maine and Hewane town[88].

Hewane tabia is located at an altitude of 1800 – 2000 mts. The total area of Hewane *tabia* is 4558 hectares[89]. The cultivable land is 2405 ha (53%). There is no rainfall gauge in the *tabia* so only the regional average is available (see chapter 2). The soil types are 20% *tikur* (black), 19% *maek*l (average), 40% *huthu* (sandy), 5% *mkeyh* (red), 16% *tikur+maekl* (black+average). The soil fertility is classified as 5% *woferam* (fertile), 65% *mekakelgna* (average), 30% *rekik* (poor).

The population of Hewane *tabia* is over seven thousand. Subsistence rainfed farming is the main occupation of the people. Rainfall is variable, making the local people vulnerable to recurrent famine. The worst recurrent drought and famine took place in

Notes
88 According to the Central Statistics Authority, a settlement with two thousand persons or more is a town.
89 The data were collected from the Hentalo Wajirat Woreda Agriculture Department.

1984/85, which claimed thousands of lives in the region. In addition, the area was affected by the civil war between the TPLF and the then *Derg* government that lasted seventeen years.

The Mikorer-Betmera and Adi-Mesano streams supply water to 36 ha plots in the Hewane irrigation system during *bega* (dry season). Historical evidence is lacking as to when irrigation started in this area. Local people said, 'our forefathers started irrigation long ago'. The Mikorer-Betmera stream passes along the eastern side of Hewane town, whereas, the Adi Mesano stream cuts across the farms located between Hewane town and Ayboto *Kushet*. The two streams meet at a junction called Gudif where these rivers become the Hewane River. Apart from irrigation, the river water is used for various purposes including drinking, washing clothes, cooking and watering animals.

The Hewane irrigation system starts from south of Hewane, Menkuse village, and extends to Mai Neberi *tabia*, which is about 12 kms in length. The stream passes along the up-hill side of sloping to moderately flat agriculture lands. Gravity irrigation is carried out using earth canals bifurcating from the main stream.

There are 15 diversion canals along the Hewane river that transport water to farm plots. The farmers have constructed three aqueducts at places where water cannot be diverted to the field due to the presence of gullies. The width of the earth canals ranges from 0.5 m to 1 m and that of the field canals from 0.1 m to 0.2 m. The canal intake structure is an impermanent construction made of stones and wood. Its shape and size is subject to fluctuations in water flow in the river and the changing water requirements of the users who can easily adjust the intake by changing the placement of and/or removing stones. Floods occur during the *keremt* (long rainy season), usually causing substantial damage to headwork, and bringing large quantities of silt and debris into the head reaches of the system.

There is no standard sluice gate on the diversions to control the flow of water. Farmers use grass, stone and soil to stop water flowing. The diversions delivering water to the cropped fields are usually in the form of a direct cut in the bank of the canal, which is closed with silt and stones when irrigation is completed. There is no regulator, as such, in use in the system. Opening or closing the headwork with stones regulates discharge into the canals. Water flow is stopped at the headwork by removing a few stones and letting the water flow to the river. No measuring devices are used in this system. Since cultivated fields are located on fairly steep slopes, drainage is not a problem in the area. Any excess water drains readily into the Hewane River.

Water availability in the Hewane river varies substantially from season to season, largely as a function of rainfall. This affects discharge from the spring, which is a source of its recharge. The *keremt* rainfall usually starts late June and peaks in August. After mid-September the rainfall stops. Farmers or the *tabia* agriculture office do not take water flow measurements in order to calculate the amount of discharge into the canals. Simple observation is employed to estimate the amount of water that could be obtained.

The water users

During the Imperial regime, two groups of irrigation water users could be identified in Hewane. The first were non-resident landlords who were not directly engaged in farming but cultivated their lands either through sharecropping arrangements or by hiring labour. The second group consisted of peasants who cultivated their own land and/or were involved in sharecropping. Later the landlords lost control over land when rural land was nationalised in 1975 and peasants were given land use rights under the *Derg* regime. Currently, there are two types of irrigators based on the 'water allocation principle' adopted by the water committee. The principle is classifying plots into *mesno* and *hayfo.* The *mesno* (irrigation) plot holders receive river water from January onwards because they have been under the agricultural extension program 'Sasakawa Global 2000[90]' since 1993. In this group, 220 farmers cultivate plots ranging from 0.015 ha to 0.125 ha including 'kitchen gardens'. This group is under an obligation to use chemical fertilisers and other modern inputs and follow agricultural extension advice. The *hayfo* plot holders mainly depend on rainfed agriculture. This group, however, gets water until the end of December depending on the availability of river water. The *hayfo* group will not obtain water after January because the river water is diverted to the *mesno* irrigators. About 210 *hayfo* farmers cultivate 20 –25 ha of land planting barley, lentils, vetch and chick-peas which require two or three times watering between September and December. Individual land holding ranges from 0.25 to 0.5 ha. In addition, both *hayfo* and *mesno* irrigators cultivate rainfed plots within Hewane *tabia*.

3.2.2 Gum Selassa Irrigation System

The Gum Selassa irrigation system encompasses parts of the territory of Adigudom and Arra Alemsegeda[91] *tabia*s (sub-districts). It is located four kms east of Adigudom town. Adigudom is the main town of Hintalo Wajerat *Woreda* situated 39 km south of

[90] Sasakawa Global 2000 project was initiated in 1993 by the Sasakawa Africa Association and the Global 2000 programme with the co-operation and support of the Ethiopian government
Notes
[91] Arra and Arra Alemsegeda tabias were merged into the Arra Alemesegeda tabia.

Mekelle. Gum Selassa irrigation system is at an altitude of 2061 m.a.s.l. The area is known for its flat agricultural land with no tree cover. Agricultural production is dependent on unreliable rainfall. During the last two decades, the agriculture of the *woreda* has suffered frequently from the scarcity and/or irregularity of rainfall.

Establishment of the Gum Selassa Irrigation System

Land reallocation study

The Gum Selassa micro dam was the first irrigation infrastructure constructed by the current government. There was no experience on the government's part on how to select water users and how much irrigable and rainfed land should be distributed to a farming household. Thus, the regional government set up a five-man committee to develop guidelines for land reallocation and the selection of irrigators in the Gum Selassa and Adha irrigation systems[92].

The study committee carried out a land holdings inventory to identify the size of individual land holdings and the number of farmers who were cultivating land in the reservoir and command areas prior to the construction of the micro dam. According to the inventory, 368 farmers from the three *tabia*s were cultivating 735.3 tsimdi (147.06 ha.) rainfed plots. In terms of landholdings, Adigudom farmers had the lowest area of plots (161 *tsimdi* (32.2 ha) while Arra farmers had 398 tsimdi (79.6 ha). The average plot size ranged from 1.2 (Adigudom) to 3.5 (Arra) *tsimdi.*

The committee (Bedini, et al. 1996: 3-4) made the following key assumptions to determine the upper and lower limits to irrigable plot size that a household could cultivate.

- Input requirement for irrigated crops should include: seeds, labour, draught animals and inorganic fertiliser;
- A household was composed of 5 people;
- Rainfed land holding was 3 tsimdi;
- Minimum annual grain requirement for a family of 5 was set at 11.5 quintal
- *The household would directly utilises all of its land, i.e. would neither sharecrop nor rent out land* (emphasis added).

The committee recommended that a minimum of 0.2 ha and a maximum of 0.25 ha of irrigable and 0.75 ha of rainfed plot should to be allotted to farmer to achieve food

[92] The committee was composed of agricultural economists, a rural sociologist, an engineer and economist drawn from Mekelle University College, the Relief Society of Tigray, and the Bureau of Natural Resources and Co-SAERT.

security at household level (ibid: 6). The regional government approved 0.2 ha irrigable land and 0.75 ha rainfed to a household.

The command area of the Gum Selassa irrigation system was taken as 120 ha. Based on the 0.2 ha allotment to an individual farmer, 600 farmers could get plots in the irrigation system. The committee suggested three different options of land allocation. One of the options was to allow '… only … those farmers with land displaced and those farmers with land currently in the command area to be allocated irrigated land. This option was rejected as it would reduce the number of potential beneficiaries to be ensured an acceptable level of food security and thus affect the achievement of the principal objective of the project' (ibid: A 4 – 1).

Land redistribution and selection of irrigators

The study committee identified two groups of potential irrigators. The first consisted of 368 farmers who had lost land in the reservoir and command areas. The second group of farmers was those who had no land in the command area, but cultivated close to the irrigation system. Since the first group of farmers had rights to irrigable plots, the land reallocation committee had only to select the remaining 232 farmers to make up the 600 farmers who could join the Gum Selassa irrigation system. Thus, farmers from the first group, from the reservoir or command areas (Ara and Arra Alem Segada *tabias*) whose overall land holdings had been reduced, were allocated an appropriate amount of land in the rainfed areas. The selection of the second group of farmers (Adigudom *tabia*) was based on the proximity of farmers' land and the ability to indirectly compensate 161 *tsimdi* (32.2 ha) with rainfed land to those farmers who have given away a portion of land in the command and reservoir areas.

To implement the allotment of 0.2 ha irrigable plot to a household, land redistribution was an important task for the regional government since the irrigation command area was in the hands of a relatively small number of farmers. It established a committee at *Woreda* (district) level chaired by the *woreda* administrator to carry out the land redistribution in Gum Selassa. Based on the land reallocation guideline, land was pooled from Arra, Arra Alem Segeda and Adigudom *tabia*s, and redistributed to the farmers who joined the irrigation system.

Although 600 farmers could had been designated for plots according to the study, the land reallocation committee selected 550 people[93] drawn from Adigudom, Arra Alem Segeda *tabias* and distributed 110 ha on lottery basis. It was planned to distribute the remaining 10 ha of irrigable land in the second round. Among those selected, 447 were men and 103 women received the designated 0.2 ha irrigable land. In addition,

[93] Interview with irrigation expert of the Hentalo Wajerat Agriculture Department

499 farmers were each given three *timad* (0.75 ha) rain-fed land to supplement the irrigated agriculture. Among those who joined the irrigation system, 51 farmers received no rain-fed plots at the time of land re-distribution and received between them 10.2 ha irrigable land to compensate what they have lost in terms of rainfed land. These farmers did not cultivate their plots themselves but leased to sharecroppers for a share of the harvest.

Farmers' reaction to the land redistribution

In the beginning, local people were suspicious of the introduction of irrigation in Gum Selassa assuming that the government would take their land. The construction of Gum Selassa dam had displaced 368 farmers who were cultivating 185 ha both in the reservoir and command areas. In addition, Gum Selassa farmers had no prior experience of irrigated agriculture. They complained that 0.2 ha land would not be sufficient for agricultural production. Consequently, they wanted to retain the rainfed land they used to plough which was relatively bigger in size. The average rainfed holding of the three *tabia*s was Arra 1.6 ha, Alem Segada 1.23 ha, and Adigudom 0.85 ha. (ibid: 7).

Thus it was not an easy task for the land redistribution committee to 'convince' the farmers. There was a strong opposition particularly from farmers in Edmo *kushet.* The committee had several meetings with the displaced farmers over a period of one month to get them to accept the irrigation project and land redistribution.[94] In the meetings farmers opposed the inclusion of farmers from Adigudom *tabia* in the intended irrigation system. The option of inter-*tabia* compensation and land allocation could exclude farmers of Adigudom *tabia*. This was due to plot sizes in Adigudom, both in the rainfed and command area, being on average smaller than those in the other two *tabia*s and so having little capacity to compensate (…). Another reason for this exclusion springs from Adigudom being in a separate *tabia* from that of Arra and Alem Segada under the new political boundaries. This would imply that Adigudom would not bear any of the costs of compensation **(**ibid.**).**

The Construction of Gum Selassa Micro dam

Gum Selassa irrigation system was not the first irrigation infrastructure in Adigudom. Although they were short lived, the former government had constructed three small earth dams namely, Mai Genet, Mai Debleat Adi Ake and Hay Engula through food for work programmes. Mai Genet earth dam was operational for one year and farmers planted tomato on one hectare. The other two dams have never been operational because of siltation and other technical problems.

[94] Interview with the Woreda Irrigation Development Expert.

The Gum Selassa irrigation system started operation in 1996. The construction took nearly two years, involving time 472, 000 man days. The total cost of the dam was US $ 487 720. Local people participated in the Gum Selassa dam construction through a 'food for work program'. In addition, able-bodied people provided 20 days free labour in a year for the construction work.

The total storage volume of the Gum Selassa micro dam is 1,902,000 m^3 as. Co-SAERT engineers estimated 1,366,485 m^3 net storage for the irrigation of 120 hectare land considering evaporation loss, dead storage, conveyance water losses, extreme rainfall that could not be captured, human consumption and animal consumption (Yigzaw, 1994: 45).

The canal system is 'hierarchical' (Horst 1998), in which water is distributed from the two main canals to secondary, tertiary and field canals.

The height of the concrete drop structures is about one meter. There are five division boxes along the primary canals. The longer primary canal is 3 kms while the shorter is 2.4 kms. Excess water from the fields runs to the drain where seepage water flows. In 2000, a small part of the main canal (about 100 meters) was concrete-lined by Co-SAERT.

4. KEY FINDINGS

4.1. On the question of agrarian policies, State intervention and irrigation development

Briefly, the study shows how agrarian policies, State agricultural interventions and irrigation development have evolved in Ethiopia since imperial times. Agriculture in general, and smallholder practice in particular, was neglected during the imperial regime. Development strategies did not focus on peasant production and the existing land tenure systems acted to constrain peasant production. Furthermore, the imperial government paid little attention to the drought and famine that affected millions of Ethiopians. The government was forced to consider these problems only when local and international pressure obliged it to do so. Although the government was interested in the modernisation of its backward economy, the strategy followed did not address the root causes of poverty and backwardness. In addition to the failure of the development strategy, recurrent drought and famine constantly compounded the problems faced by rural people.

Following the downfall of the imperial regime, the *Derg regime,* adopting a Marxist-Leninist ideology, sought to resolve the land tenure issue through the introduction of a radical land reform. It engaged in the promotion of collectivization, villagisation, forced resettlement, compulsory grain procurement, and the control of grain marketing and pricing. The government, in other words, tried to transform agrarian relations through heavy-handed state interventions. Farmers were not happy with the *Derg* reforms. As the economy collapsed and discontent grew, the government attempted to change its policy, but it was too late.

Irrigation Development

Though irrigation in Ethiopia has been practised since time immemorial, the first attempt to promote irrigated agriculture was during the imperial regime in the 1950s when pump irrigation was introduced. The objective was to promote large-scale irrigation in the Awash valley. The government then planned small-scale irrigation intervention in order to settle the Afar pastoralists, which was not successful.

Although drought and famine affected millions of Ethiopians during the imperial regime, the government did not consider irrigation technology as a way of mitigating drought- induced famine. It was during the 1984/85 drought and famine that the Derg regime attempted to establish small-scale irrigation in the country as a means to increase food production in drought-prone areas. However, the regime did not create a favourable environment for irrigation development since farmers in the irrigation systems, including the longstanding ones, were required to form producer co-operatives based on collective organisation, which irrigators were unwilling to join.

The current government has adopted an Agricultural-Development-Led Industrialisation (ADLI) policy to promote rural development. The policy gives priority to the improvement of traditional agricultural practices to increase agricultural productivity. Irrigation development is one component of this policy. The government has issued a new irrigation policy whose main objective is to achieve food security at household level. Regional Commissions for Sustainable Agriculture and Environmental Rehabilitation have been established.

The Commission for Tigray (Co-SAERT), which was established in order to promote irrigation in the Tigray region, did not, however, achieve its 10-year target for micro dam construction. It constructed 44 dams, only a small proportion of the dams promised. These micro-dams had numerous technical and management problems. As a result Co-SAERT has now discontinued their construction.

At present, the Ethiopia government is encouraging farmers to construct low-cost small ponds in all drought prone areas, and as yet the social effects of the new technology are unclear.

4.2. On the question of the practices of irrigated agriculture and its value in the life-worlds of the irrigators

The study shows that farmers in Hewane and Gum Selassa cultivate both rainfed and irrigated plots. While the Hewane system obtains water from a river, the Gum Selassa irrigation system abstracts water from a micro-dam constructed by the current government. Mixed farming is practiced in both irrigation systems. All irrigators use ox-plough cultivation. Close to one-third of the farmers do not own oxen, though they could obtain credit to purchase them. Farmers with or without oxen adopt various strategies to obtain oxen for ploughing, such as through *lifinti* (teaming up) and borrowing oxen from relatives. Household members participate in activities such as weeding, thrashing and collecting the harvests. Although women have the right to own land, they do not plough due to the taboo attached to it. Particularly women headed households are forced to lease out their plots to sharecroppers, and many are engaged in small trade selling of *tela* (local beer). Neighbors and/or kin support each other in activities such as harvesting and weeding on a reciprocal basis, which is locally known as *lifinti*. Furthermore, 40 percent of the irrigators indicated that they hire laborers whom they pay either in cash and/or grain. Observance of Saints' days and holidays is one factor that accounts for the shortage of labor in Gum Selassa and Hewane. It was found that over 50 percent of the informants observe 5-7 Saints' days or holidays dedicated to holy figures per month.

Over a period of six years, the average yield of maize, onion and tomato has increased significantly in Gum Selassa and Hewane irrigation systems. For instance, the average yield went from 24 to 167.5 quintals of maize for Gum Selassa, and for Hewane, from around 16 to 83.5 quintals (Chapter 5). Although the Agriculture Department advises farmers to observe its cropping pattern, farmers do not do so. They usually plant maize, onion, tomato and wheat. Maize is a crop preferred for household consumption, and onion because of the 'good income' earned from its sale. Furthermore, there was no effective advice given on irrigation scheduling or input supply. Water was sometimes applied in such a way that instead of irrigating crops, soils became flooded.

The study also finds that irrigated production interferes with rainfed agriculture and with off-farm activities. This is mainly because irrigated plots are harvested in May

and June, which coincides with the need to plough both rainfed and irrigated plots that take advantage of the long rains.
The study indicates that no irrigator survives from rainfed and irrigated farming alone. All still need multiple livelihood strategies to survive. In addition, marketing is so insecure that farmers can lose the investments they make in agricultural inputs, which makes irrigated agricultural practices uncertain.

Credit organisation and debt trap

Although a credit service is available, the number of customers is limited. At Hintalo Wajirat *Woreda* level less than 50 percent took credit. Of those who did not take up credit, over 70 percent depended on local moneylenders. The leading credit institution DECSI in Tigray has high repayment rates and does not look out for the welfare of its customers, particularly with respect to the repayment schedule, whereby farmers had to deal with the negative impact of having to selling agricultural products during a low price period in order to pay back their loan. Furthermore, the study shows that the majority of DESCI borrowers settle their debts by either selling their property including their oxen and/or by borrowing cash from local moneylenders, paying 5 to 10 percent interest per month.

The practice of Woferit (sharecropping)

The study documents that *Woferit* (sharecropping) is widely practised in Gum Selassa and Hewane irrigation systems. In 2001, 41.5% of men and 83.2% of women in Gum Selassa, and 44% of men and 56% of women in Hewane leased out their plots. 'Uncertainty of access to irrigation water' ranked as the first reason for leasing out land. This was followed by 'not able to purchase fertiliser' and 'being a woman I cannot plough'. A large majority of the plot holders make agreements with the farmers leasing the land to collect one-third of their harvest (Chapter 5).

The study concludes that the need to access irrigable land is the main reason for tenant farmers to lease in land. Land fragmentation and landlessness have become major problems in the region. As cultivable land is limited, further land redistribution has remained difficult on the part of the government. Thus, *woferit* (sharecropping) has been opted for as a major mode of accessing cultivable land in the two *tabias.*

4.3. On the question of intervention by local government in everyday irrigation management and irrigated agriculture, and on the key interfaces and arenas shaping the interactions and outcomes between agency staff and farmers

In principle, water allocation is the responsibility of the 'water committee' (in Hewane) and 'irrigation committee' (in Gum Selassa). However, uncoordinated water allocation decisions on the part of local government bureaucracies have compounded water scarcity in the irrigation systems.

Irrigation governance and water control

The study shows that the pattern of irrigation management has remained largely the same since the imperial regime. In all three regimes, 'irrigation practices are inherently political practices' (Mollinga, 1998:30), since the local government bureaucracy has been embedded in their management. Earlier the landlords and local governors, and later the Agriculture Department and local government bureaucracies were involved in decisions of water allocation and conflict resolutions. Farmers had very weak negotiating power over their water rights.

In Tigray, there has never been an irrigation agency responsible for irrigation management. In the mid-90s, the government established Co-SAERT, responsible for construction of irrigation infrastructure in Tigray. Likewise, since Imperial times, there has never been either a government-initiated water users' association or indigenous irrigators' organisations responsible for water management in the Hewane irrigation system. Farmers have been requested by the local government to elect *Aferchecka* and later *Abo mai* who handle the tasks of water distribution and canal cleaning and maintenance. The link created through *Abo mai* between the local government bureaucracies and farmers has made irrigation management an appendage of the local government bureaucracy.

The study shows that, in the absence of a legal framework, the regional government attempted to establish a water users' association by simply handing over the micro-dam to water users. It was an imposition on the water users. Many farmers were not involved in its establishment nor did they participate in the water users' association. Representatives like the chairman were selected in their absence. As one informant noted, 'until recently it was the agriculture office that administered the irrigation system. But now we hear that farmers have taken over the dam'. The government did not discuss with farmers the conditions of its transfer, the power of the water users' association, nor the role of farmers or government support to sustain the irrigation system. As Vermillion (1995: 146) notes 'where farmer organizations lack full legal

and political recognition to make all decisions necessary to manage the irrigation system they appear to have difficulty achieving cost efficiency, raising adequate revenue, applying sanctions and entering into contractual relationships with their parties'.

The claims of Co-SAERT that dams have been transferred to water users' associations is bogus. In terms of governance, the status of the irrigation systems is unclear. Co-SAERT's objective to bring about sustainable agriculture and environmental rehabilitation in Tigray is questionable. Interestingly, the Commission has recently transformed itself into the Bureau of Water Resources Development by merging agencies involved in the water sector, while the management of the newly constructed irrigation systems is unknown.

Reconstruction of water rights

Traditional water rights took account of the uncertainty of water supply through the construction of *mesno/hayfo* rights of use. These have continued in Hewane although only in respect to smallholdings. In Gum Selassa no attention was initially given to the fact that there could be rainfall levels of water in the dam, to which allocation might be adapted. Predictions concerning the area to be irrigated remain unclear.

The study shows how the 1999 land re-distribution in the town of Hewane gave rise to a reconstruction of water rights. All those living in the town originally had the right of access to irrigable land. Under the TPLF re-distribution of land, the irrigators who resided closer to the river on the eastern side of the town were given all the irrigated plots. Consequently, farmers who lived on the western side of the road lost their irrigable land and water rights.

The recently constructed Shelenat diversion canal, which transports floodwater during the long rainy season to Shelenat micro dams, initially blocked the canal that went to the *hayfo* plots in Korkora k*ushet*. Here we may note an unintended negative effect of non-consultative irrigation intervention, i.e., the erosion of water rights. Although the farmers constructed three outlets on the Shelenat diversion weir, the government, while constructing the new irrigation infrastructure, did not (though they should have) maintain the old system, which had enabled *hayfo* farmers to produce. This has since been put right.

Irrigation management tasks

Every year the *Woreda* irrigation committee has to decide on the area to be irrigated based on Co-SAERT's measurement of the quantity of dam water. The study has shown, however, that the size of irrigated plots did not correspond to Co-SAERT's estimation between the 1998 and 2002 production years. The irrigation committee

does not take account of the dam water measurement of Co-SAERT. The power to allocate water in the Gum Selassa irrigation system is mainly in the hands of the experts of the Woreda Agriculture Department. Guesswork has prevailed thus ignoring the professional support of Co-SAERT. The guesswork in the water allocation has tempted the Agriculture Department to reduce the size of irrigable plots to obviate shortages of water.

Until 2002, not all of the 110 ha of farmland of Gum Selassa were supplied with dam water. The highest share of irrigated land was 78.4 percent in 2002/03 while lowest was 7.5 percent in 1998/99. It was noted that 16.3 percent of the irrigated plots in 2002/03 were 'rainfed plots', which were not supposed to get dam water. In other words, among the 550 farmers who joined the irrigation system initially, between 119 and 470 of them received no water for six years

In Hewane, water allocation to users is based on the principle of classifying plots into *hayfo* and *mesno* (irrigation). The *mesno* plots have water priority over *hayfo* plots because they entail the use of improved agricultural inputs. But the switching of plots from *hayfo* to *mesno* or vice versa often takes place.

In both irrigation systems *Abo mais* are annually elected to carry out water distribution tasks. The source of water influences their number. 12 *abo mais* serve at 15 diversions in Hewane while only four are assigned to do so in Gum Selassa where only some of obtain water day and night. The availability of seepage water in Hewane means day and night distribution. While the water distribution system is an established and accepted practice, it is not always accepted by individuals. Irregularities in water distribution occur that lead to petty feuds. Rotational scheduling of water regulates access to water and is based on the principle that he who sows first gets water first. Blocks get water by turn according to the requirement of each crop. While internally rotations are largely accepted, appropriateness to improve crop yields is still only poorly understood.

Irrigators are involved in canal cleaning every year, although their participation is not as expected. The most serious issue in system maintenance is the disiltation of dams which is no ones work in Tigray. Experts of Co-SAERT have clearly indicated that most of the micro dams will not serve the expected life span time due to siltation.

The study shows that conflict resolutions are carried out at three levels, at field level involving irrigators, elders, *Abo mais* and development agents, at Department of Agriculture and *tabia* administration level, and thirdly, depending on the seriousness of the conflict, at the *Maheberawe firdebet* (social court) which can impose fines.

Farmers often appeal to the local administration or Agriculture Department when they cannot solve conflict over water at field level.

Imposition of fertiliser technology drives farmers away from irrigation

Farmers in Hewane and Gum Selassa lease out plots to sharecroppers due to the inability and/or unwillingness to purchase chemical fertiliser. The study shows that in Hewane and Gum Selassa over two-thirds of the farmers purchased fertiliser through coercive persuasion, with the fear that they might be denied credit, food aid or employment opportunities in various construction works or with the threat of no access dam water. Local government bureaucracies did not pay any attention to farmers' unwillingness to purchase fertiliser. In contrast, since farmers were not coerced to purchase improved seed, the numbers buying it was very low.

Policies that encourage farmers to participate in the implementation of agricultural extension packages represent a significant shift from the top-down approach. In theory, government officials and rural development workers support the idea of farmers' participation from technology identification to technology evaluation in the implementation of extension services. The former Minister of Agriculture is recorded as saying:

> *'It is always important to keep in mind that it is the farmer who decides on how to manage the soil. Hence, his or her views and perceptions are central to achieving [sic] sustainable pattern of management. These views will strongly be enhanced by the prices he or she receives on marketing the products, accessibility to inputs, access to credit, training opportunities, and a reliable moisture regime. If farming is not profitable, farmers are reluctant to venture on something different' (SOS Sahel,* et al *2001: 39).*

In Tigray, agricultural extension was based on the diffusionist model. Agricultural workers and local government officials were preoccupied with achieving the targets set for fertilizer sales to farmers and as a result, recommendations on fertiliser application to demonstration plots were 'a one-size fit-all' solution. As Chambers, *et al* (1989: 23) argue:

> *it is not uncommon to find extension staff distributing undifferentiated blanket recommendations to farmers, making no concession to their varied economic capacities and widely different farming systems.*

Such blanket solutions cannot work for heterogeneous farming population who Long (2001: 181) points out use a variety of strategies for solving the production and other problems they face. The perceived benefits of using agricultural packages have a marked influence on farmers' receptiveness. For individual farmers yield increase per hectare does not correspond to their technical and social conditions since local soil

conditions vary a good deal, not only from one *tabia* to another but also from one field to another. Oliver de Sardan (1988: 222) also notes that 'the minimization of risks and the search for security are the focus of many economic strategies. Mistrust of high yield varieties (more risky if effective rainfall is below the average taken into account by agronomic researchers), reluctance to adopt new crops when marketing is hazardous'.

Commenting on participatory extension practice in the dry lands of southern Ethiopia, Dejene (2000: 6) maintains that 'the participatory approach is therefore considered as essential if extension is to be more client-oriented. However, our field observation shows that these principles are not followed in the current extension system. What is being practised is top-down'. Thus the Ethiopian governments desire to help people overcome poverty has resulted in spearheading coercive strategies in the name of 'participation'.

4.4. On the question of local coping strategies in respect to drought and famine, and other food provisioning/livelihood strategies apart from farming

Coping strategies with drought and famine

Local people employed a combination of four categories of coping strategies with respect to the 1984/85 drought and famine. All employed one or more of the depleting, maintaining, reductive and/or regenerative strategies to cope with drought and famine. Food relief ranked first as a strategy for survival under severe drought and famine situation.

Livelihood strategies

The data presented earlier indicate that the Hintalo Wajerat Woreda (district) is still food insecure. Over 30 percent of the population receives food aid. Gum Selassa and Hewane *tabias* are located in the same agro-ecological zone. Farming has been and still remains the main source of livelihood there. Except for the irrigators in the two irrigation systems, farmers depend entirely on rainfed agriculture. The intended level of food security has not been achieved in Gum Selassa and Hewane tabias (since 66 percent of the households consumed what they produced within 6 to 9 months), and therefore many people have to combine farming and non-farming or trading activities. However this is not easy for people since in Hintalo Wajerat *Woreda* there is a lack of jobs available in the area.

The food security program, which was aimed at increasing the incomes of food insecure households by engaging farmers in various agricultural activities, had major

drawbacks. Initially 1600 farmers showed interest in the four *tabias* of the program, but only 22 percent of the farmers were able to take out credit. The Agriculture Department did not trust the farmers to use the money for the purpose intended. Another reason for the poor uptake was that the farmers themselves did not agree with the purchasing arrangements operated by the official committee.

The government's decision to deploy local labour during slack period on the construction of Shelenat dams had the unintended negative effect of halting the soil and water conservation project. This work was halted for over five years, aggravating the gully erosion and slumping in the *tabia.* In Hewane this agro-ecological problem, mediated by political power, compelled farmers to find something else. Bee keeping thus became a livelihood strategy as their harvests from the shrinking farmland declined every year.

Traditional bee keeping is expanding in Hewane. Conversely, the rate of adoption of government promoted modern bee keeping practice has been low. The constraints quoted were the unaffordable price of frame hives and the lack of technical assistance from the Agriculture Department.

The study documents few formal and informal social organisations such as *Mahber* (religious associations) and *equb* (saving groups). These are weak social networks for developing survival strategies.

5. IMPLICATIONS OF THE STUDY

I repeat here some of the implications of this study pertaining to the issue of livelihood practice, household food provisioning, irrigation access, water control, and irrigation management and governance.

First, irrigated agriculture is a complex livelihood activity and thus the analysis of existing livelihood practices is essential before embarking upon irrigation intervention. Interventions that do not consider local people's life-worlds are likely to pave the road to underdevelopment.

Second, the regional government assumed that irrigators cultivating their own plots could achieve household food security. However, the majority of plot holders, particularly women headed households, as I have shown, lease out their plots and collect one third of the yield. This had serious implications on food provisioning at household level since the anticipated amount of grain is not available for household consumption. Another factor was that the credit service, although an important input

to increase agricultural production, operated loan repayment schedules coincide with harvest time when prices were at their lowest. This reduced their purchasing capacity at a time when grain prices were higher. In both instances household food consumption is affected.

Third, numerous socio-technical problems resulting from poor irrigation management frustrate irrigation interventions. These range from crop failure due to moisture stress, the lack of effective water harvesting strategies. Building irrigation infrastructure is less problematic than putting it to good productive use to service unmet demands.

Fourth, the study shows that irrigation system management is embedded in local government bureaucracy and sits uncomfortably between government bureaucracies and water users. The water users themselves or an irrigation agency might better be able to appreciate the performances of an irrigation system or deal with the issue of water equity. The local government bureaucracy, involved in numerous non-irrigation activities, finds it difficult to identify internal irrigation management problems encompassing water delivery schedules, and to make fair decisions in conflicts over water. On the other hand, the institutional viability of water user associations is questionable because or the absence of clear water rights which demotivates farmers from participating in irrigation management.

Moreover the distancing by the bulk of farmers from irrigated agriculture through leasing out their plots to sharecroppers provides a good indication of the lack of enthusiasm amongst them to commit themselves to irrigated cultivation. Sharecroppers, on their part, cultivate the land for a limited period (one or two harvesting seasons). It appears that there is no appropriate incentive structure for sharecroppers to take over the irrigation infrastructure while they are cultivating on temporary basis. Under such cultivation arrangements it is not surprising that water user associations under-perform.

Fifth, bureaucratic performance highlights a lack of expert knowledge and capacity in designing functional systems that provide what is needed in Gum Selassa. Furthermore, the absence of water management expertise has been noted in irrigation scheduling in both sites.

6. LOOKING TO THE FUTURE

The need for irrigation systems on the part of farmers of Gum Selassa and Hewane is there, but the provision of irrigation and agricultural services does not dovetail effectively with the life-worlds of farmers. Although the provision of water, land and

agricultural inputs to irrigators is a big stride towards mitigating drought-induced famine, other measures must be put in place to enable irrigators to provide their families with adequate food.

- Inappropriate irrigation technology contributes to social disruption and a waste of resources. Thus, technology choices should be commensurate with the capacity of the final users of irrigation infrastructure. The technology choice appears to be uncritically adopted. Faulty maintenance of the infrastructure, seepage, siltation and environmental deterioration are obvious problems, which are not dealt with adequately.
- Irrigation development should take into account not only the provision of water but also the agricultural production system
- Intrusive practices, such as coercing farmers to adopt modern agricultural technologies like fertilizer packages, are inimical. Farmers are knowledgeable and struggle to reconstruct life cycles to bring about security and dignity for themselves. Acknowledging this and giving greater respect to their own potential and options can enhance development intervention. New reflections on how to maintain soil fertility and yield acceptable to farmers should be sought.
- The need for more defined and coherent institutional arrangements in irrigation development is essential. There is a need to have a clear and well-defined policy on the handing over of micro dams to farmers, which should be specific as to the respective roles of farmers and government after hand over.
- An area of concern is the preoccupation of government and NGOs to simply construct irrigation infrastructure to solve production problems in drought prone areas. In years of recurrent drought, rivers and micro dams dry out and groundwater levels drop. Hence, under these circumstances irrigated agriculture is more vulnerable to drought than some less intensive forms of agriculture. As farmers have smaller and smaller plots, irrigation development in these areas may not be a fully effective means to mitigate recurrent drought and food insecurity.
- Differential access to water contributes to weak operation of the irrigation system. The provision for special water distribution arrangements at times of water scarcity can increase farmers' participation in irrigation management.
- Considering recurrent droughts in Tigary, food aid probably needs to continue. However, there is a need to work out how to link food-for-work to sound and wider investments.

7. ON THE NEED FOR FURTHER RESEARCH

This study has attempted to look into the social dimensions of irrigation with particular emphasis on state intervention and life-worlds of farmers. It is hoped that more research will be addressed to the question of farmers' knowledge, to options for irrigation that recognise the life-worlds and environment of farmers, and to the technical optimisation of irrigation without the preoccupation for bureaucracy.

In conclusion, as Chambers *et al* (1989) say, like all development activities, irrigation works when it contributes to the individual's need for 'subsistence, security and self-respect', and that the 'environment can be made valuable by first valuing the people who live in it'.