Irrigation Practices, State Intervention and Farmer's Life-Worlds in Drought-Prone Tigray

Woldeab Teshome
Addis Ababa University
woldeabt@yahoo.com

Abstract

This study demonstrated that there is a need for irrigation systems on the part of the farmers, but the provision of irrigation and agricultural services don't dovetail effectively with the life-worlds of farmers. Since the mid-1980s, the Ethiopian 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 center. However, not enough is known about farmers' reactions and responses to these government initiatives. This study started off by asking a central question: How do State irrigation interventions interface with irrigators' life-worlds in Tigray, a drought-prone region of northern Ethiopia? Two small-scale irrigation systems were examined through an ethnographic method. Interviews were carried out with various community members including women, priests, irrigators, Abo mais ('fathers of water'), engineers, and executive committee members of the water users association and government and NGO officials. This study documents the interfaces and social discontinuities between the live-worlds of irrigators and government bureaucrats embedded in irrigation management. Irrigation management sits uncomfortably between government bureaucracies and water users. In principle, water allocation is the responsibility of the 'water committee'. However, uncoordinated water allocation decisions on the part of local government bureaucracies have compounded water scarcity in the irrigation systems. Numerous socio-technical problems resulting from poor irrigation management frustrated irrigation interventions. These ranged 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. 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. No irrigator survives from rainfed and irrigated farming alone. All still need multiple livelihood strategies to survive.

1. 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 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.

2. Theoretical Approaches

2.1. An Actor orientation

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'.*

2.2 Irrigation system as a socio-technical system

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.

3. 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:

1. What state interventions have taken place and how have they affected agrarian relations and irrigation technology choices in Ethiopia?
2. How is irrigated agriculture practiced, and what is the value of irrigated agriculture in the life-worlds of irrigators?
3. 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?

4. 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?

4. 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 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 Augusts to October 2002.

5. 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 ^{o}C and the maximum 40 ^{o}C.

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 is follower 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 practicing 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 practiced, 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 organizations 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 Program 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'. 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 labor 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 neighboring Eritrea) within a matter of ten years (ibid.)*

Upon the recommendation of the above mentioned international organizations, 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 organizations such as the Relief Society of Tigray (REST) and the Dedebit Credit and Savings Institution (DECSI).

6 The Research Sites

6.1 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 kushets (villages) called Ayboto, Korora, Maine and Hewane town[1].

Hewane tabia is located at an altitude of 1800 – 2000 m.a.m.s.l. The total area of Hewane tabia is 4558 hectares[2]. 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% maekl (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 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.

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

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 20003' 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 fertilizers 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

[1] According to the Central Statistics Authority, a settlement with two thousand persons or more is a town.

[2] The data were collected from the Hentalo Wajirat Woreda Agriculture Department.

3 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.

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.

6.2 Gum Selassa Irrigation System

The Gum Selassa irrigation system encompasses parts of the territory of Adigudom and Arra Alemsegeda[4] tabias (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 Mekelle. Gum Selassa irrigation system is at an altitude of 2061 m.a.m.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.

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[5].

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 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

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 programs. 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.

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 labor in a year for the construction work.

The total storage volume of the Gum Selassa micro dam is 1,902,000 m3 as. Co-SAERT engineers estimated 1,366,485 m3 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.

[4] Arra and Arra Alemsegeda tabias were merged into the Arra Alemesegeda tabia

[5] 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-SAE

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.

7. Key Findings

7.1. On the question of irrigation development

The current government has adopted an Agricultural-Development-Led Industrialization (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.

7.2. On the question of the practice 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.

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. 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 organization 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 practiced 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.

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.

7.3 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' organizations 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 are 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.

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 fertilizer 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 fertilizer. The study shows that in Hewane and Gum Selassa over two-thirds of the farmers purchased fertilizer 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 fertilizer. 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 fertilizer 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 practiced is top-down'. Thus the Ethiopian governments desire to help people overcome poverty has resulted in spearheading coercive strategies in the name of 'participation'.

7.4 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 government's decision to deploy local labor 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 organizations such as Mahber (religious associations) and equb (saving groups). These are weak social networks for developing survival strategies.

8. 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.

9. 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.

10. 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 recognize the life-worlds and environment of farmers, and to the technical optimization 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'.

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