

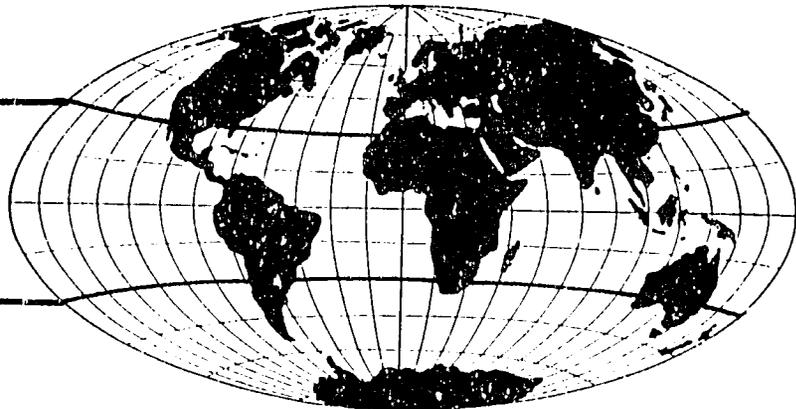
COOPERATIVE AGREEMENT ON SETTLEMENT AND RESOURCE SYSTEMS ANALYSIS

THE PANGANI RIVER BASIN

by

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June 1988



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Foreword

This paper is the combined work of four authors, Len and Eileen Berry, who are responsible for this draft of the document, and Ophelia Mascarenhas and Josephine Msangi, who worked with us in the field and each took responsibility for supplying follow-up field data and reports. These reports, as well as being used in the main paper, are also included as annexes.

Table of Contents

	<u>Page</u>
Introduction - Why Pangani?	1
The Characteristics of the Basin	3
Physical Features	3
The People and Land Use	6
Development	9
Institutional Structure in Tanzania and in the Pangani Basin	10
The Development of the Pangani Basin	12
The Organization of Irrigation in Tanzania	15
Irrigation in the Pangani Basin	17
Institutions and the Utilization of the Pangani Basin	22
Annex I - Notes on Institutional Arrangements in River Basin Management in Africa: Pangani River Basin, Tanzania	31
Annex II - Institutional Analysis of the Pangani River Basin	45
Annex III - Institutional Development Leading up to Lower Moshi Irrigation Project (LMI)	51
Annex IV - Nyumba ya Mungu	65
References	71

List of Tables

	<u>Page</u>
1 Project Development in the Pangani Basin	13
2 Some Key Legislations in the Development of the Pangani Basin	15
3 Irrigation by Region and Mode 1980	19

List of Figures

1 Pattern of Stream Before Dam Construction	8
2 Lower Moshi Irrigation Project - Organization Chart at O&M Stage	27
3 Lower Moshi Irrigation Project - Organization Chart at Implementation Stage	28

List of Maps

1 The Pangani River Basin	5
2 Nyumba ya Mungu Reservoir Catchment	7

INTRODUCTION - WHY PANGANI?

The Pangani River Basin in North Tanzania is different in scale and in some aspects of management history from most of the other basins studied in this Clark/IDA analysis. Most of the other basins are larger, are multinational, and have central authorities as the main river basin planning and development institutions.

The Pangani is some 450 km long from its headwaters in Mt. Kilimanjaro and Mt. Meru to the coast at Pangani south of Tanga. Its flow, which varies between 10 and 20 m³/sec is the most utilized of Tanzanian rivers, first being harnessed in the 1930s. Despite a number of ordinances which provided guarantees of water flow for TANESCO, the Tanzania Electric Supply Company, the basin has never been under the aegis of any one authority though recommendations to that effect were made by several FAO and other reports. At various times, the dominant agency appears to have been TANESCO, the Water and Irrigation Department, the regional administration, and even private companies in the basin area.

In spite of the lack of a coordinating authority, the major development projects in the basin, such as the production of electricity by TANESCO or the irrigation scheme of Tanganyika Planting Company (TPC), have survived, progressed, and coexisted without major conflicts. What is more interesting is that the developments in the Pangani Basin have utilized the existing administrative, political, and social institutions in the form of a loose cooperation and on a "need to use" basis. There, therefore, appears to be a constant expansion and retraction of the levels of coordination in the basin.

With the more recent trend to decentralize the national government, the basin also illustrates how parastatal organizations like TANESCO and TPC, which are national organizations, have learned to cooperate with regional, district,

and even village level institutions when the need arises. The national organizations can act quite independently but must be aware of the parameters of the local political and administrative powers, while the latter, in turn, recognize the importance of the national organizations to the local economy which, in turn, affects their powers. This symbiotic relationship is worked out without any rigid formal links and with the minimum of formal contacts. On some occasions, it works well, on others, it works not at all.

This study of the Pangani Basin is made, in part, because it is a smaller, more defined, basin with multiple uses than others studied, i.e., it is a microcosm of the larger basins; in part, because it is a basin without a central authority coordinating activities; and, in part, because of the active policy of decentralization in Tanzania which has affected developments in the basin during recent times. In each of these characteristics, it was thought that the Pangani Basin could provide lessons, both positive and negative, which might be applied to other basins in Africa.

THE CHARACTERISTICS OF THE BASIN

Physical Features

The Pangani river basin (Map 1) includes parts of Kilimanjaro and Meru mountains in its upper catchment area and also the flanking hills of the Pare and Usambara mountains in its middle and lower basins. The highest point in the basin is over 5,850 m, and the course to the sea is only a little over 450 km. Much of this height differential is achieved in a little over 50 km distance in the headwaters of the basin, and the gradient of the river is quite gentle over much of its middle section, which averages about 1,000 m above sea level. The river is lightly incised in the African Plateau in this section; however, there are steep sections nearer the coast, especially around Hale, where falls made it possible to generate electricity with very little storage or construction needed. Quite extensive areas in the upper/middle catchment, around the Nyumba ya Mungu and Lake Jipe are naturally flat and swampy, again providing a good site for shallow storage utilized by the Nyumba ya Mungu reservoir. The river, both topographically and, as we shall see, hydrologically, can be divided into two main segments.

The upper catchment includes snow covered and cold areas of upper Kilimanjaro and Meru, which give way down slope to a forested or cultivated high rainfall zone on the mid and lower mountain slopes. The 1,300 to 2,000 mm of rain which falls in these areas is mostly absorbed by the volcanic rocks of the mountain slopes, and a much lower percentage flows off than is common under such conditions. Some of this infiltration reappears as springs and shallow or deeper ground water on the lower slopes. The 1,000 to 3,000 mm of rainfall on the Pare and Usambara mountains produces much more rapid run-off partly because

of the impervious soils and partly because of the deforested nature of the uplands.

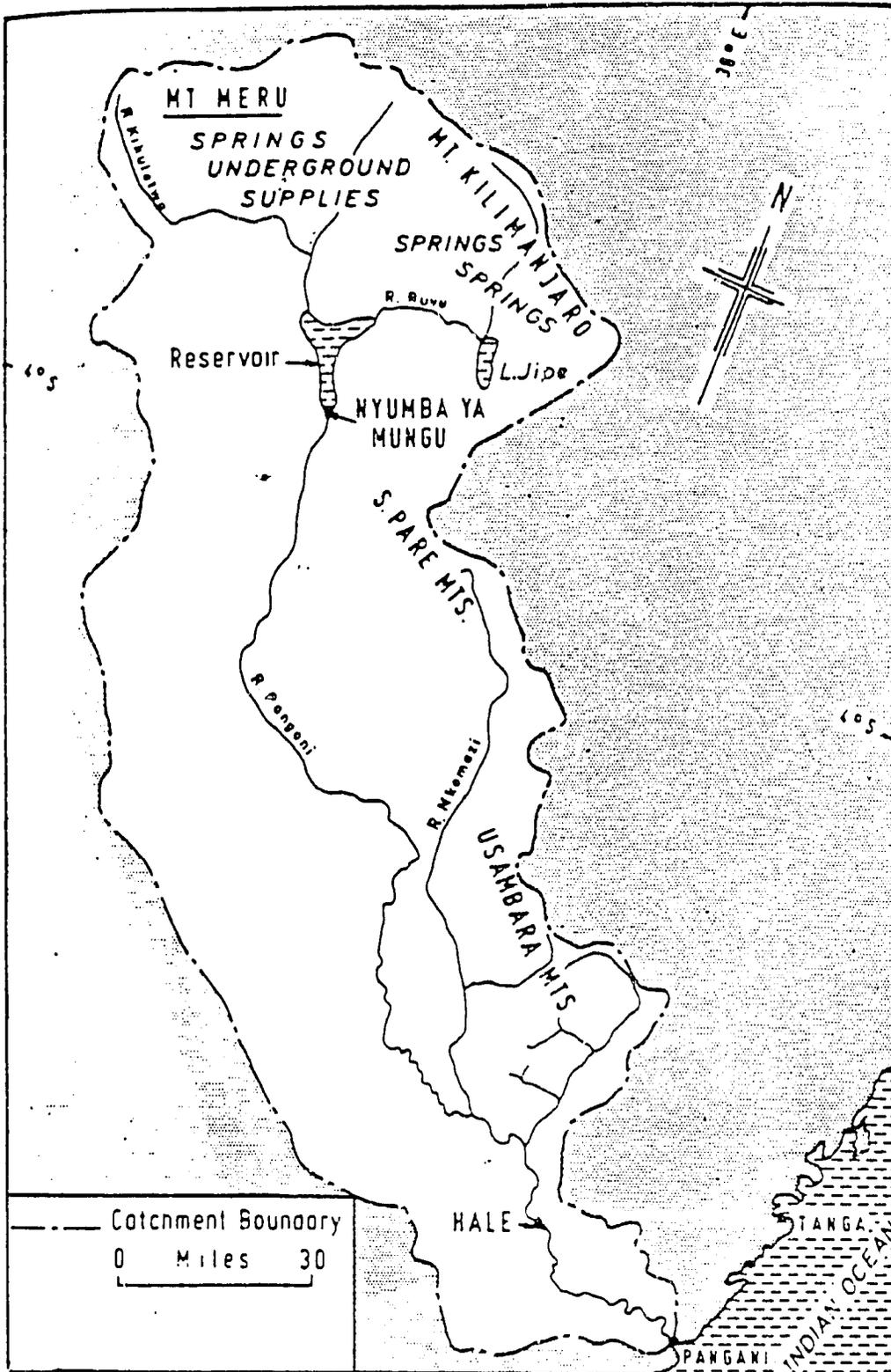
In contrast, much of the central part of the basin receives less than 500 mm a year and yields little run-off to the river in most years. Although the rainfall on the coast reaches 1,300 mm, the narrow catchment at this point again reduces the impact. The influence of coastal rains on the river flow is small. Rainfall in all parts of the basin is seasonal, a main rainy period in March and May and a shorter more variable rainy season in November and December. The hydrology of the basin reflects these topographic and meteorological conditions.

Map 1 (from Kaduma 1977) illustrates the main pattern of the hydrology. In its natural state, the base river flow in the catchment above Nyumba ya Mungu comes from ground water and springs, and about three-fourths of the flow at Hale at low water levels comes from the rivers Kikiletwa and Ruvu, both mostly spring fed streams.

The upper catchment, about a quarter of the total basin, contributes 90 percent of the water flowing to the sea. This is a reflection of the higher rainfall (average 1,000 mm) and the yield from ground water. The middle catchment, about two-thirds of the drainage basin, is a zone of little water addition to the river, and there are generally heavy water losses through overbank flooding and evapotranspiration in the rainy season. The Nyumba ya Mungu Dam partly alleviates these losses. The lower catchment has a relatively small contribution to total flow.

During the rainy season, considerable but unmeasured quantities of water were lost to downstream flow as the upper Pangani overflowed its banks into wide surrounding basins. In the central section of the river, flood stage

THE PANGANI RIVER BASIN



Source: Kaduma 1977

gains a heavy contribution from flows generated by the South Pare and Usambara mountains. Both the Kikiletwa River, flowing Meru and Kilimanjaro, and the Mombo River, from the Usambara/Pare, are characterized by high silt loads during the rainy season.

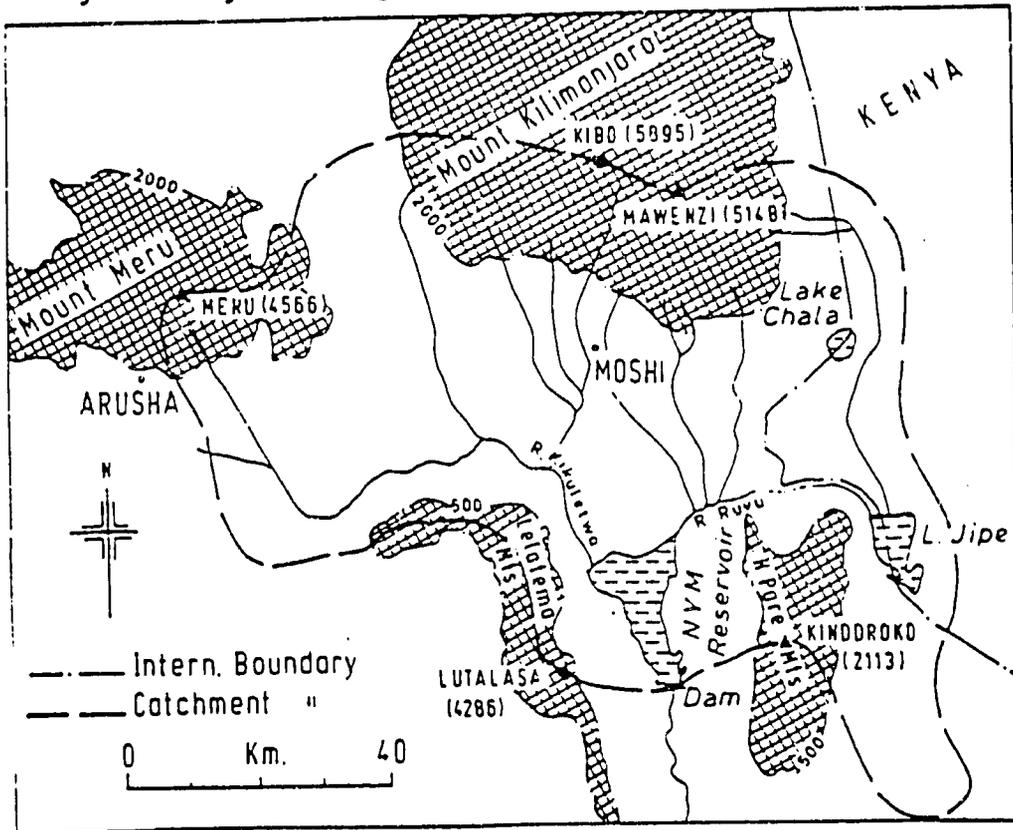
The most detailed recent analysis of the hydrology has been made in relation to the Nyumba ya Mungu Dam (Kaduma 1977, GOT hydrological data). Map 2 illustrates the catchment above the dam and defines the upper, semi-independent basin. River flow at stations above the reservoir rises monthly with peaks in April and May. Peak flow is three-to four-times low flow, and even in drought years a substantial (15 million m³) run-off occurs. Figure 1 illustrates the pattern of flow below the dam before construction.

The People and Land Use

The population of the Pangani Basin is concentrated in the upland and foothill areas of the basin and along the coast. The lower slopes of Kilimanjaro and Meru mountains are devoted to mixed farming dominantly coffee/banana/cattle raising, with very high population densities. The drier upper basin away from the mountain is characterized by maize/millet cultivation where rainfall is sufficient or cattle grazing in the lower rainfall areas. A similar pattern exists on the Pare and Usambara mountains with banana/maize and some coffee and tea on the upland areas and maize and sisal plantations in the drier zone away from the mountains. A good part of dry middle basins was traditionally used only for low density grazing. The coastal margin is a coconut/maize zone with sisal estates occupying a large part of the hinterland. Towns in the basin include: Tanga (80,000), a port and regional center; Moshi (60,000), a coffee marketing and regional center; and Arusha (150,000), a

MAP 2

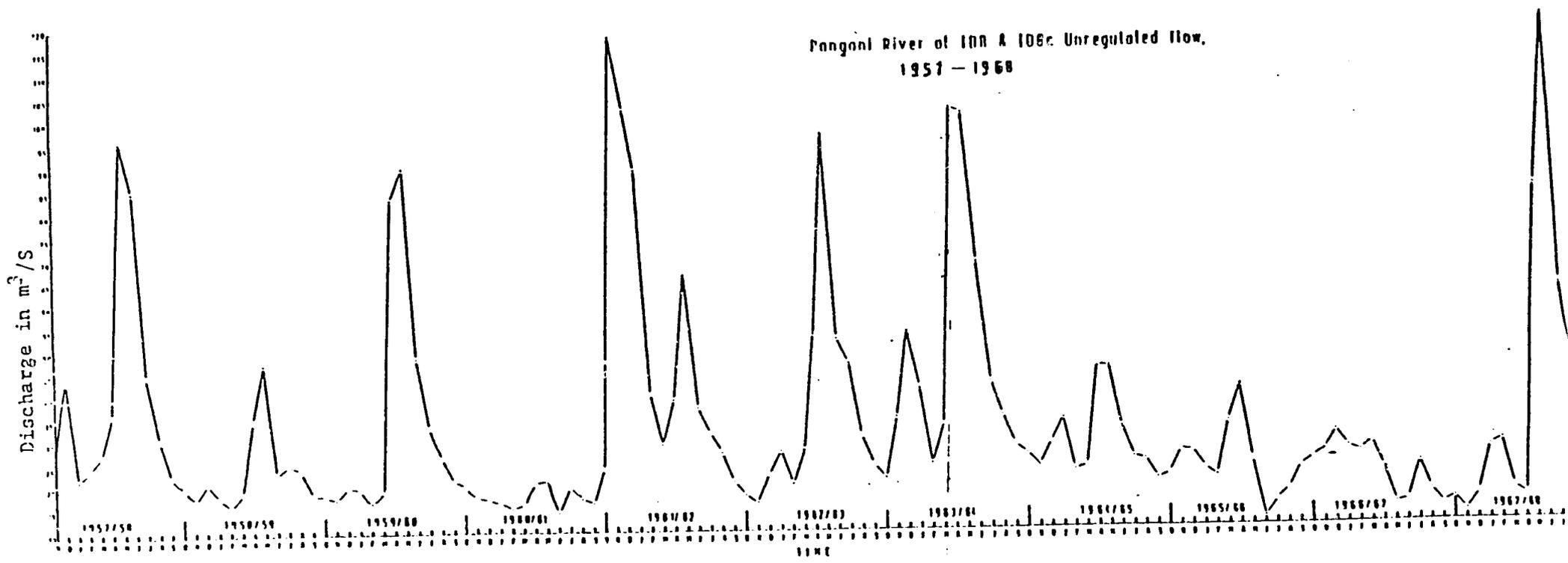
Nyumba ya Mungu Reservoir Catchment.



Source: Kaduma 1977

FIGURE 1

Pattern of Stream Before Dam Construction



Source: Kaduma 1977

coffee marketing, tourist, and regional center. The basin falls almost entirely within Arusha, Kilimanjaro, and Tanga regions, though these regions also include areas outside the basin.

C. Development

Kilimanjaro and Arusha regions have traditionally been among the most prosperous in Tanzania. Coffee production, begun in the 1920s, sparked a growth in small farmer prosperity and the Coffee Co-operative at Moshi was one of the first in Africa and, for a long period, one of the most successful. The small farm economy in the upper basin was complemented by a number of larger commercially owned farms under either European individuals or company management. Initially, coffee was the main product, though later, wheat and sugar cane also became important, the latter under irrigation on a large farm south of Moshi. The large and small farm sectors combined to produce significant export crops which were mostly marketed through Arusha and Moshi and helped in the initial growth of these centers. The tourist attractions of the East African Highlands and the services brought by the larger farms and European residents also helped this growth.

In the lower part of the basin where Pare and Usambara were quite prosperous, there was a much smaller production of externally marketed crops except for the sisal which was initially processed locally and exported through Tanga. While rural prosperity in Pare and Usambara was lower than in Kilimanjaro and Arusha, the four upland areas shared many social characteristics, including a much higher percentage of children in school, higher adult literacy, and better health facilities than much of the rest of rural Tanzania up to the time of independence.

INSTITUTIONAL STRUCTURE IN TANZANIA AND IN THE PANGANI BASIN

Two sets of institutions dominate in Tanzania, though they mix and interact in many different ways. One set is those locally based institutions which have grown up in association with traditional ethnic and local groups and their modern counterparts. These include, for example, the basic farm household, the clan or subgroup structure, the tribe or large ethnic/cultural group, traditional water user associations typical of Kilimanjaro and Paie, and the Moshi coffee growers cooperative society.

The other institutional set arises from the central government structure, first in the colonial period (including both German and British influences) and later in modification of those structures in post-independence Tanzania. During the colonial period, the centralized ministerial structure familiar to all English-speaking African countries was counterbalanced by the regional and district administrations where a small group of mostly expatriate technical and civil administrative people coordinated services and provided "law and order" in the local area. In Tanzania, given the problem of distance and communication, this local administration, though tightly controlled from Dar es Salaam in some respects, also had a good deal of freedom in the detailed administrative and later development styles in the region and district. Decentralized authority has long been something of a tradition in Tanzania.

After independence, the administration structure has been associated with a political structure in which there is a hierarchy of units, from the ten-cell unit combining households to the party chairman. The party is, at least in theory, present at all levels in the administrative chain at local, district, regional, and central levels.

In addition to those two reasonably complex subsets, Tanzania, like many other African countries, has also set up a plethora of parastatal organizations linked in closer and less direct ways with the ministerial structure but separate from it in personnel, financial, and administrative ways. Parastatals include units concerned with production (sometimes taking over the functions of commercial farms), marketing, and services such as banking.

Last but not least, there are a number of basically international institutions which became important at the regional and river basin level. These include in some areas the church (though many local churches have little international connection) and a multitude of national donor organizations who create a network of their own in many developing countries, including private assistance groups such as Oxfam and Catholic Relief. All too often there is little coordination between these donor groups.

The whole range of these different institutional structures operate in the Pangani Basin. In the basin, local ethnic traditions are strong though they have often been quite readily adapted to current situations. Pare, Usambara, Chagga, and Warusha ethnic identities are strongly defined, the local water user associations in Kilimanjaro and Pare are unique in Tanzania, the cooperative movement history is a strong one, and there is a strong skepticism about the wisdom of central government. The Catholic Church is important in all of the upland areas, much less so in the central basin where Muslim and local Christian influences are much stronger. Donor organizations include FAO, Japanese, Swedish, British, U.S., and other interests. The central government has a strong presence through some of the best regional organizations in the country, and the parastatals involved include TANESCO, concerned with energy,

and NAFCO, PADECO, and KNCU, all involved with cooperative and marketing efforts.

THE DEVELOPMENT OF THE PANGANI BASIN

Table 1 sets out the sequence of events in terms of the main physical constructions in the Pangani Basin. Furrow irrigation has been a feature of the Kilimanjaro and Pare foothills for a long period of time, and there are well established local construction and maintenance systems for these furrows. Essentially, they lead water from upper offtakes to cropped areas lower down-slope and away from stream margins. This is necessary as many streams are deeply incised in gorges and direct water offtake is difficult.

The second hundred-foot-drop over a series of falls and rapids in the lower Pangani attracted early attention from Tanganyika government officials, particularly as there were no identified sources of coal or oil near any of the coastal towns. The Tanzanian Electrical Supply Company (TANESCO) established a power station at Pangani Falls as early as 1932, and the year before (1931) it presented legislation that gave the company priority water rights on the base flow of the river in its lower reaches. This power source was upgraded at the end of the thirties and thereafter supplied an important component of the electrical energy to the Dar es Salaam and Tanga areas.

The Pangani Basin, along with others in Tanzania, attracted the attention of FAO in the immediate pre-independence period and was the focus of a number of surveys which addressed the irrigation potential of the area. Somewhat separately, TANESCO through the Halcrow Engineering Company was examining ways of increasing power output from the lower falls regions.

TABLE 1

PROJECT DEVELOPMENT IN THE PANGANI BASIN

Year	Project
Pre 1930	Furrow Irrigation Kilimanjaro and Pare
1930	Tanganyika Planting Company Irrigation Project
1932	TANESCO begins operating Pangani Falls hydropower
1964	Hale Power Station begins operation
1962-66	Mombo Irrigation Scheme established (200 ha)
1968	Nyumba ya Mungu Dam completed
1968	Kahe Estate Irrigation Scheme essentially completed (6,500 ha)
1987	Ndungu Irrigation Scheme complete (700 ha)

The needs of the power company and the prospect of water irrigation came together in the construction of two structures in the 1960s. The first was a small dam and reservoir at Hale which served a power station with an installed capacity of 47.5 MW (including the 8.5 MW of the earlier Pangani Falls station). Until the Kidatu hydropower station on the Rubiji River in central Tanzania came fully on stream in 1975, this was the country's major hydropower system supply. As demand has grown rapidly in the last fifteen years, it now supplies about 25 percent of total demand but still meets most of the needs of the whole northeast section of the country. The 1960s saw the construction of the Nyumba ya Mungu Dam in the central sections of the valley. The stated purpose was twofold: to provide a more even flow of water to the Hale area, reducing water losses in the central part of the valley (these had totaled 30 percent of flow), and secondly, to provide water for some irrigation below the

dam. In addition, the reservoir became for a number of years a major fishing ground at levels beyond expectations and attracted a large number of fishermen and their families around its shores (Kaduma 1977). As this flush of fish receded and as a series of dry years lowered reservoir levels, this fishing industry has lessened in importance.

As part of the same surge of energy and attention in the immediate post-independence period, the Kahe irrigation scheme was established in the area above the Nyumba ya Mungu Dam but for a number of years in the 1970s little government action was taken on irrigation in the Pangani Basin and the Kahe project did not prosper. During this time, it appears a significant number of small locally initiated irrigation activities were started in the Pare foothills and on the margin of the middle Pangani Basin. Also in the late 1970s and early 1980s, as the reliance on the Hale power system grew less critical maintenance and repairs fell behind schedule, silting of the intake occurred, and the generated capacity fell steadily.

The last few years have seen a renewed interest in the area. Japanese aid to Tanzania became focused in part on the Kilimanjaro Region, and after participating in the production of a plan of action for the region the Japanese aid authority invested in a significant irrigation scheme of some 6,500 ha. This and some smaller projects, together with the planned rehabilitation of the Hale power station, form the current focus of activity in the basin. The TPC estate functioning since 1930 and the Lower Moshi project form the largest irrigated areas in Tanzania. Both appear in good shape compared with the Kahe project, where poor soils and indifferent management have resulted in a doubtful future for this enterprise.

Table 2 sets out some of the key legislative acts controlling Pangani river development. The implications of these will be discussed as we review the institutional issues in the basin.

TABLE 2
SOME KEY LEGISLATIONS IN THE DEVELOPMENT OF THE PANGANI RIVER

Year	Legislation
1931	Legislative authority to TANESCO to develop hydropower
1949	Water Works Ordinance, 1949 Provided for individual water rights and payment of individual water rights under the ordinance
1974	Water Utilization Act Provided for rules concerning granting of rights. <u>More importantly</u> , it provided for the establishment of a National Water Advisory Board and Regional Advisory Water Boards. In the latter case, each region was supposed to have a Regional Water Board as advisory board to the Regional Water Officer, to be appointed by the Regional Commissioner. In 1975, the Regional Water Engineer (RWE) was designated as the Regional Water Officer. Nevertheless, LMI was not coordinated by the RWE and the powers of the RWE are still vaguely understood even by the RWE himself.
1981	Regional Water Boards were changed to Basin Water Boards.

The Organization of Irrigation in Tanzania

Irrigation in Tanzania has a long tradition, but one which is confined to a few areas. Irrigation was practiced west of Kilimanjaro before the seventeenth century where over 2,000 ha were irrigated in a late iron age community. The Wachagga and the Wapare later developed extensive furrow systems that continue to be used to the present day.

The government direct and organizational involvement with irrigation can be traced back to the 1953 Royal Commission for East Africa which identified better water use as a key to long-run development in the region. In the mid-1950s, the Water Development Department grew into WD & ID (Water Development and Irrigation Department), all as part of a Ministry of Agriculture. Change was slow, although allocation of £ 100,000 for irrigation was not inconsiderable in the budgets of those days.

In 1960, the IBRD mission recommended to the attention of the "about to be independent" government the need to pay special attention to irrigation. In a country of many rivers and little intensively cultivated land, this was thought to be important. However, the irrigation envisaged was that of larger impoundments and estate agriculture, little notice was taken of the already extensive local scale irrigation. The mission recommended that 25,000 acres (10,000 ha) should be added annually by the end of the 1970s, beginning with a target of 7,500 ha per year in 1965.

In 1969, FAO assisted the GOT in an assessment of irrigation networks which recorded four types; traditional, village irrigation schemes, medium- to large-scale state farms, and privately owned estates. In all, there were about 145,000 ha under these categories; ranging from Kilimanjaro, where one-third of all agricultural land was irrigated to other regions with almost no irrigated land.

In general, in the period 1965-1977, irrigation was not stressed much in Tanzania development, but the drought of 1974/75 again brought the issue into focus. Part of the problem had been separating irrigation from the Ministry of Agriculture to the Ministry of Water, Power, and Energy where the emphasis on energy and water supply was much stronger than that on food production. In the

mid-1970s, the Ministry of Agriculture and Livestock became the focal point for irrigation, and as a National Food Strategy became important with the renewed drought of the early 1980s, plans became better focused. Zonal irrigation units based in Morogoro, Mbeya, Tabora, and Moshi and a strengthened headquarters in Dar es Salaam provided some better organizational framework, and there was a better linking of water control and agronomic issues. There is still insufficient attention being given to the social and institutional aspects of the proposed irrigation expansion.

Plans in the National Food Study envisaged a growth from 145,000 ha in the early 1980s to 380,000 ha by the year 2,000. This is ambitious, and the Pangani Valley experience will be important in assessing how, as well as whether, this goal is achievable.

Irrigation in the Pangani Basin

Irrigation in the Pangani Basin is a large part of irrigation in Tanzania (Table 3). In 1980, about 50 percent of traditional smallholder irrigation was in Arusha and Kilimanjaro regions, and about 33 percent of large-scale irrigation was also in these regions. This section outlines the character of those irrigation systems and the role they have played in the utilization of water resources in the Pangani Basin.

Traditional Irrigation

The slopes of Kilimanjaro and the foothills of the Pare Mountains in Tanzania have been the site of most traditional irrigation in the country. The Kilimanjaro irrigation systems have been studied by Pike and Ramsay (TNR 1965) and the Pare systems by Yoshida (1985).

The Pare Mountains appear to have been settled at least 600 years ago (Kimambo 1969), and there is evidence from oral tradition that irrigation with extensive canals was practiced several hundred years ago (Kimambo 1969). In 1931, the total population of Pare District was about 56,000, but since that time it has roughly quadrupled to reach 208,000 in 1978. The South Pare irrigation systems are the most concentrated and colonial records indicate that the canals have been present in much their current form over most of this century. In the 1980s (Yoshida 1985), most farms were about 3/4 ha in size with maize, beans, and paddy being the most important crops. Apart from irrigation, little other modern technology is used; fertilizer use is, for example, not high.

In Yoshida's survey, it was clear that most furrows had been constructed in their present form over a hundred years ago, and in most cases the construction and use had been based on the clan structures, though individuals who had played a key role in the construction were commemorated in furrow names. Possible links with irrigation in the Taita Hills of Kenya were also revealed. A number of the traditional furrows were modified and new ones constructed during the early part of the German colonial period.

Besides the typical furrows (1/2 to 1 m wide x 1/2 to 3/4 m deep: up to 10 km long), water is also stored behind small earthen dams in the foothills of the mountain. The storage ponds, roughly 5 to 10 m in dimension, hold water in the dry season to provide water flow in the furrows during that period.

Both furrows and ponds are managed by water managers, usually an old respected man who "allocates water and calls villagers for maintenance" (Yoshida, 52).

TABLE 3

IRRIGATION BY REGION AND MODE 1980

Region	Traditional Smallholder Irrigation (ha)	Large-Scale Govt.	Private
Kilimanjaro	38,390	6,710	
Mbeya	17,500	3,240	
Arusha	15,347	-	
Ruvuma	14,580	-	
Coast	-	800	
Morogoro	-	9,622	
Others	20,377	-	
Total	106,184	20,372	700

Source: Ministry of Agriculture and Livestock/FAO, Tanzania National Food Strategy (1984)

Traditional furrow use is mainly to extend the growing period at the end of each of the main rainy periods. It is most important at the end of the short (Veli) rains (October to December/January), and cropping would not often be possible without the supplemental watering. Irrigation also seems to have stimulated rice growing, greatly extending the area where it can be successfully cultivated.

Institutional Arrangements for Water Management in Pare

Traditional institutional arrangements for water management and furrow construction have already been alluded to. The clan was the unit responsible for both construction and management and the individual water manager was usually a respected clan member. Over time, clan boundaries became more blurred; some nonclan newcomers were allocated rights and even some water managers were not traditional clan elders. This evolution was made more rapid

with the Ujamma village program and by legislation in 1975 registered Ujamma villagers were authorized to assume water management roles.

Yoshida in his study shows that in the mid-1980s the villages take major responsibility for water control. A subcommittee of one of the five village-based elected committees is designated to take control of all irrigation affairs. The Kameti dogo ya umwagiriaji (irrigation subcommittee) is made up of one or two representatives for each of the furrows in the village. In many cases, it seems the same people are in charge of the furrows; they are now linked at the village level.

Each water user is given an allocation by the furrow manager usually for a six hour irrigation period, though the allocated period will depend on the size of the farm. Penalties are enacted for water use at unauthorized times.

Ssenyonga (1983) has classified five major maintenance tasks:

1. Routine inspection
2. Monitoring and regulating water flow
3. Opening and closing diversion points
4. Cleaning the furrows
5. Major repair work

Items 1, 2, and 3 are normally carried out by the water managers, the others need special attention. Furrow cleaning is usually done by communal labor organized by the water managers and there are community penalties for not working on this task.

If major works are needed, a range of options have been used. In some cases, the district paid workers to extend canal systems and it has become a function of the District Irrigation Office to undertake this work. Other agencies, including PVOs, have also played such a role.

Again, as Yoshida points out, there is a need for interfurrow and inter-village water use coordination and some villages have made such arrangements. The major cases of conflict have been between upstream and downstream villages in times of short supply. A traditional division is that upstream villages use water in the morning and downstream villages at night. But given the greater role of village and divisional administration, new arrangements are necessary. These are as yet only in place in a few cases. However, in South Pare, the basic institutions and the history of negotiation and rationalization of allocation are a good base on which to build.

The Kilimanjaro area shares a similar pattern of water supply and use. While no recent study of the system has been made, Ramsey (1965) writes as follows:

The whole area is a network of irrigation channels and furrows, taking off from the streams and ingeniously led around precipitous ledges, across Korongos, and under boulders for distances of up to ten miles. Rough estimates give over one thousand furrows of varying lengths and capacities. Pipelines for domestic and industrial use (coffee pulperies, etc.) take off high up in the streams as they emerge from the forest to give the cleanest and surest supplies, and dams have been built to supplement the domestic and agricultural needs (TNR 1965, 94).

Pike (TNR 1965) describes some of the history of the furrows noting in 1884 that there was scarcely a ridge which did not have a furrow. "These chagga furrows . . . became rigidly controlled, so that each had its fair share of water, and every use of that furrow had his fair share for his own use" (TNR 1965, p.96). It is clear that the pattern of furrow use and development in Pare also occurred in Kilimanjaro and that the higher ground, the Pangani Basin, saw advanced forms of organization of water use long before the advent of modern ideas of irrigation and river basin development.

Modern Irrigation

Table 1 and earlier comments have already set out some parameters of large-scale irrigation in the Pangani. Individual projects in the basin are summarized by Msangi in Annex 1 of this report. The earliest project was a private initiative for sugar production, in which the Tanganyika Planting Company irrigated over 6,000 ha from groundwater springs. This still remains the largest single project.

The Kahe project in the same area was initiated much later (1968) in an attempt to produce kenaf using spring irrigation. This has not been an economic success. In the 1970s, a series of four schemes was planned in a lower Moshi irrigation project with a total of 6,320 ha to be irrigated. This was funded by Japanese capital and is a traditional irrigation activity aimed at rice and maize production. Apart from these three large projects, Annex 1 describes eleven small irrigation initiatives, under way or planned for the near future in the middle and lower basin. After years of hesitation and little action on irrigation in the basin, it has once again become a significant focus of development in the area with a much greater emphasis on the production of food crops than at any time in the past.

INSTITUTIONS AND THE UTILIZATION OF THE PANGANI BASIN

Annex II sets out in matrix form the main institutional history of the Pangani Basin. The Diagram deals first with the large-scale institutions, then the small-scale with a column for the all important linking institutions.

Unlike most examples of river basin development in Africa, the Pangani River Basin has never been under the control of a special basin authority, although the idea has been raised several times over the past thirty years.

This section of the report outlines some of the circumstances that may have influenced river basin development without a central authority. The section reviews the pattern of development, emphasizing the advantages and disadvantages which appear to have accompanied this type of institutional development.

As noted earlier, the Pangani gained early attention from the colonial government because of its potential for easy development of hydropower. At that time, in the early 1930s, no competition from planned irrigation was foreseen in the lower Pangani but TANESCO, the national power company, was given legislative authority and acquired preferential rights for electric power generation and supply in the valley, the government agreed:

- (i) not to issue water rights to reduce the river flow at the beginning of the Grand Pangani Falls (the power site) to less than 450 cubic feet per second.
- (ii) provided a preferential license to develop hydropower in three reserved areas of the middle and lower Pangani.

The existence of the Tanganyika Packers Irrigation scheme in the upper-middle river valley was not considered a handicap to these arrangements as it used mostly ground water, and the upper-middle course was separated from the hydropower sites by flat swampy areas where much water was lost anyway.

The institutional arrangement, as it evolved in the period before World War II and immediately after it, involved three types of institutions each with separate spheres of action:

- (i) TANESCO producing hydroelectricity from the lower river
- (ii) Tanganyika Packers Corporation (TPC), a private company irrigating 6,000 acres in the upper-middle river
- (iii) Indigenous water users developing furrow irrigation on the lower slopes of the Kilimanjaro and Pare mountains.

In the 1960s, as Tanganyika was becoming independent, development in general, and river basin development in particular, became a focus of national

and international authorities and the Food and Agriculture Organization surveyed opportunities for hydropower, irrigation, and fisheries development in the Pangani-Wami basins and in the Rufiji Basin. A number of reports followed (FAO 1961, 1962; Berry 1970). For the Pangani Basin, this was the first attempt to review multipurpose development, and now in a situation where access to land and water resources for steadily growing numbers of people was important.

In addition, by the late 1960s, Tanzania was going through a transformation in its political philosophy. The Arusha declaration in 1968 set the way for a defined villagization policy, a concern for rural development generally, and the beginnings of decentralization of authority to regional levels. This was also accompanied by a wave of creation of parastatal production and marketing bodies, a process which continued through the 1970s.

In the 1960s, TANESCO used its legislative authority in the basin to initiate the creation of two new structures, the Hale Power Station, completed in 1964, and the Nyumba ya Mungo Dam, finished in 1965. The completion of the dam removed the danger of frequent flooding in the central plains and improved the regulating of flow to the two power stations. It also initially made available over 200,000 acre feet of water for irrigation upstream of the Hale Power Station. This was the first multipurpose structure in the basin and the lake also soon became an important fishing resource.

By the 1960s and early 1970s, the institutional situation had become more complicated, but still without major conflicts. It could be summarized as follows:

- (i) TANESCO producing hydroelectricity from two sites in the lower river.
- (ii) TPC and a new project Kahe using large-scale irrigation in the upper-middle basin (total 10,000 acres).

- (iii) Traditional water user associations now incorporated at least in part into the Ujamma village hierarchy and beginning to use water from main tributaries and the main river.
- (iv) Stronger regional and district authorities exercising control over many small-scale water issues.
- (v) Growing numbers of marketing and other parastatals reporting directly to central government.
- (vi) An initial flush of lake margin settlement related to fishing, later reduced as the fish catch became smaller.

In the late 1970s and early 1980s, Tanzania went through a series of difficult years. The impact of a national drought was magnified by the war with Uganda and the closure of the Kenya-Tanzania border. In addition, the national importance of Pangani River hydropower was reduced with the installation of much larger power stations in central Tanzania. At the same time, population was growing rapidly and the northern part of the country was showing faster growth than most other areas. The emphasis in Pangani thus gradually switched from power production to food production and the government, particularly towards the mid-1980s, began to focus more directly on irrigation.

Its hard to tell which was cause and which effect, but during this time responsibility for irrigation was transferred from the Water and Irrigation Department to the Ministry of Agriculture.

An additional factor at work in this period was the influence of outside donors. The Japanese aid authority had taken on the responsibility of assisting in the plans of the Kilimanjaro Region and their interest in irrigation reinforced ongoing Tanzanian trends. However, this also produced the complication of another, external, key decision maker in Pangani.

The institutional situation in the 1980s is certainly more complicated than at any time in the past. Five main factors have led to this increased level of complication; the establishment of the Lower Moshi project with

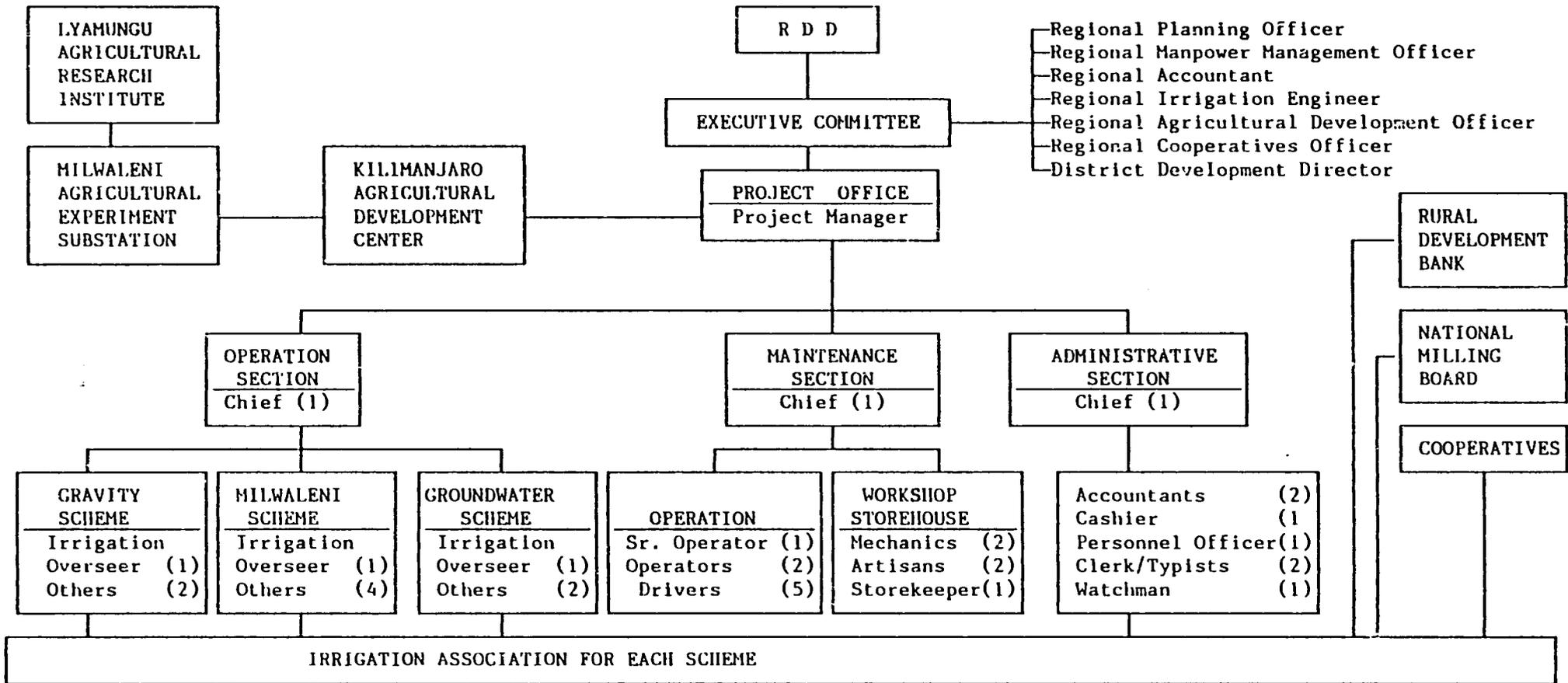
Japanese assistance, the drive for irrigated agriculture in the middle and lower Pangani, the role of the national marketing boards, the substantial increase in population and the lack of clarity in the role of national versus regional decision making.

The organization and functions of the lower Mushi project are set out in Figures 2 and 3. This project, as the diagrammatic summary suggests, was implemented after 1981 and was put in somewhat out of the context of previous work and, to a large extent, without reference to water user rights of local peoples or institutions. Conflicts occurred over water rights both with the regional water engineers and local people.

As Annex I shows, a number of small irrigation projects are planned or beginning to be operative in the middle and lower Pangani, these reflect the increased emphasis on food production in the government and the growing pressure on land and water resources in the region. In addition, the role of the state monitoring boards which grew in importance in the 1970s and 1980s was to stifle the incentives for many small producers. It probably resulted in an increase in illegal marketing much of it to Kenya, and some drop in production. Complicating the solution to the overlaps and conflicts was the lack of consistency in decision making between central government in Dar es Salaam and strong regional authority in the regions.

In summary, by the 1980s the need for mediating institutions had become very apparent. The situation would have been more acute had it not been for the decreased importance of hydropower. In many cases, the regional institutions in Arusha have played an important role, but they do not have the authority to deal with the whole basin. The region has been able to deal with many issues affecting village level institutions and in project development, it

FIGURE 2
 LOWER MOSHI IRRIGATION PROJECT (IMI)
 ORGANIZATION CHART AT O & M STAGE

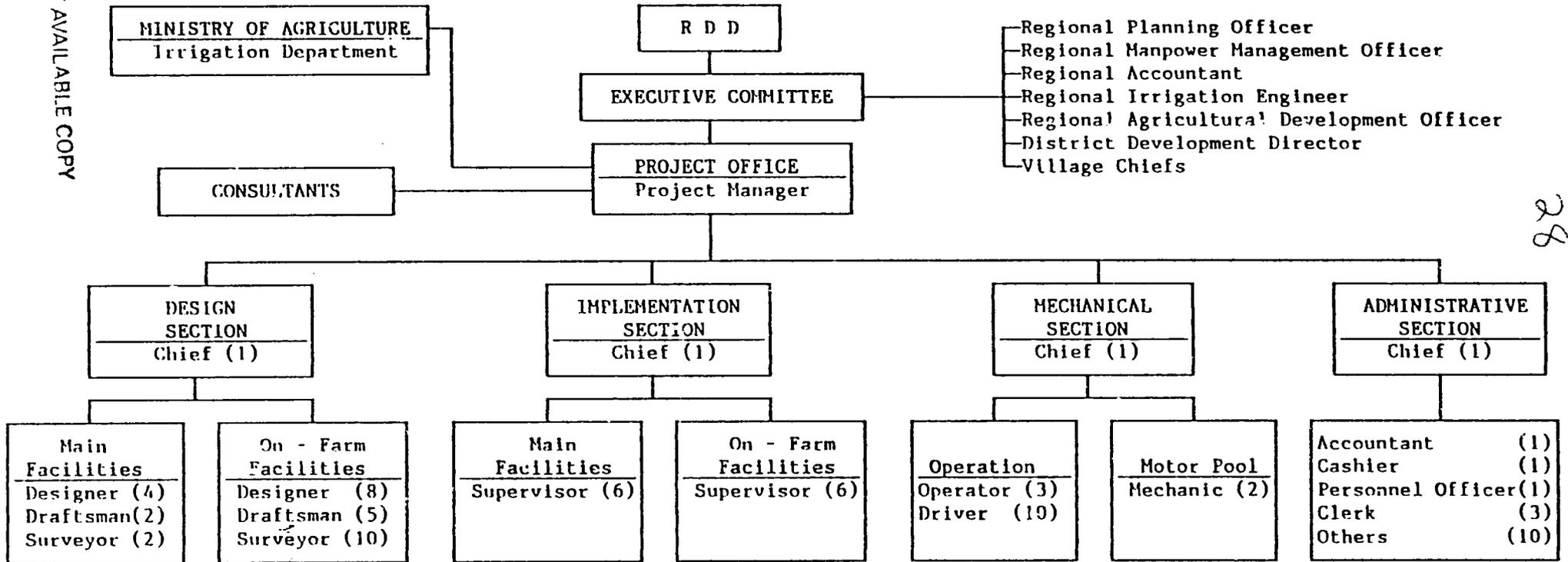


27

FIGURE 3

LOWER MOSHI IRRIGATION PROJECT (LMI)
 ORGANIZATION CHART AT IMPLEMENTATION STAGE

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28

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cannot deal with the basin on a whole and there is not an appropriate national institution to work on this problem. It may be that a zoned authority involving the regional administration of the basin may be appropriate in this area.

The four annexes provide details of the range of institutions working in the region. Annex I summarizes a wide range of institutions directly working on river basin development in the Pangani Basin. Annex II provides a summary of the stages in growth and character of both large and smaller scale institutions and Annexes III and IV summarize the specific institutional issues involved in the construction of the lower Moshi project and the Nyumba ya Mungu Dam. Dr. Msangi and Dr. O. Mascarenhas of the University of Dar es Salaam provided much of the field input for this analysis.

In conclusion, the Pangani Basin has survived and even managed well up to this decade without a centralized authority for river basin development. However, the pressure on resources has now reached the point where new mediatory and planning institutions or arrangements are likely to be needed. If it is possible, these should be built on the firm foundation of the regional authorities in this area. Issues that need to be addressed include:

- rehabilitation of the hydropower stations.
- planning of water use to maximize use for irrigation and hydropower.
- improved coordination of small-scale irrigation with other forms of water use.
- the process of involvement of donors in new scheme development.
- the role of regional and national authorities.
- improved marketing systems.

This is a major agenda suggesting not only a list of problems but a continuing set of opportunities.

ANNEX I

ANNEX INOTES ON INSTITUTIONAL ARRANGEMENTS IN RIVER BASIN MANAGEMENT IN AFRICA
PANGANI RIVER BASIN: TANZANIA

Institutions involved in the management of Pangani River Basin projects in Kilimanjaro Region include:

1. Kilimanjaro Regional Office under the chairmanship of a Regional Commissioner. The Regional Development Director is overall in charge of development projects in the region. The Regional Planning Officer is the overall coordinator of all projects.
2. Kilimanjaro Regional Water Engineer's office which is in charge of all water allocation in the region. The office constructs and maintains all structures, controls illegal abstraction and pollution of water resources.
3. Northern Zone Irrigation Office taking care of Kilimanjaro, Arusha, and Tanga regions under the leadership of the Zonal Irrigation Officer.
4. Regional Irrigation Office under the leadership of a subject matter specialist (regional irrigation engineer) part of KILIMO - Ministry of Agriculture and Livestock Development.
5. Lower Moshi Irrigation Project which draws water from Rau River, a small tributary of the Pangani. Lower Moshi Project Manager in charge of project.
6. NAFCO which takes care of Kahe project. Project directed by a Manager who is directly answerable to NAFCO headquarters in Dar es Salaam.
7. Tanganyika Planting Company (TPC) in charge of the Arusha Chini Sugar estate. An autonomous body answerable to SUDECO in Dar es Salaam.
8. TANESCO with regional officer in charge of all electricity production and distribution in the region. This officer is directly answerable to the TANESCO headquarters in Dar es Salaam. Controls Nyumba ya Mungu and Kiyungi Power Stations.
9. The Kilimanjaro Agricultural Development Centre in charge of agricultural extension services.
10. The Kilimanjaro Industrial Centre in charge of all industrial activities in the region as a whole.
11. Regional Fisheries Office controlling fishing activities in the region including those at Nyumba ya Mungu Reservoir and Lake Jipe.

12. PADECO involving itself with developing cooperative ventures in same district.
13. KNCU involving itself with developing cooperative ventures in Kilimanjaro districts. (Rombo, Moshi rural, Hai) especially crop marketing and farm implements acquisition and distribution to peasants and farmers.

Individual Projects in Kilimanjaro Region

1. LOWER MOSHI IRRIGATION PROJECT:

Administration of Project - Project Manager

- Resident Engineer
- Team Leader of the construction company
- Regional Administrative Representative

History of Project

Conceived during the 1970s during RIDEP preparation for Kilimanjaro region. The aim of the project is to solve the problem of semi-aridity in the lower areas so as to absorb the overpopulation in the higher zones.

1979/80 - A Feasibility study by Japanese International Cooperation Agency carried out in collaboration with the regional administration, regional development director, Ministry of Water and Ministry of Works. Four schemes were identified totaling 6,320 hectares. Lower Moshi project, dependent on the Rau River, area to be irrigated being 2,300 hectares, being one of the four schemes. The others are Miwaleni Springs (2,000 ha), Himo river system - (2,000 ha) and Ground water scheme (1,020 ha). The Lower Moshi project was chosen as a starting scheme due to its higher projected economic rate of return.

1982 June - Overseas Economic Cooperation Fund of Japan issued a loan for the construction of the scheme. Nippon Koei consulting firm started designs

for the scheme. Designs completed by April 1983. Tenders for the construction were called in December 1983 and in May 1984 construction work commenced.

1986 January - construction works for irrigating 950 hectares completed and irrigation started. 1986 December - 85 percent construction works completed and 1987 April full works to be completed and irrigation of whole are to be possible.

By December 1986, there had been three rice croppings (1st crop - August 1985, 2nd crop - January 1986 3rd crop - July 1986). January 1987 peasants were preparing for 4th crop of rice. The first crop of maize planted during the rainy season of 1986.

CONSTRUCTION

Equipment provided by KONOIKE company of Japan. Materials like diesel, cement, gravel, and sand obtained locally. Labor also obtained locally. Finance covered by loan from Japan to the government of Tanzania. Tanzania government contributed about one-third of funds required. Total funds 5 billion yen. Other inputs required by the peasants like fertilizers and gunny bags are provided by Kilimanjaro Agricultural Development Corporation (KADC) which has godowns and supply stations in the project area. KNCU is in charge for marketing the outputs, i.e., rice and maize although the peasants can also sell to private traders or others if they so wish. KADC, a body established in 1979 as part of Regional Development Director's office is in charge of agricultural development in Kilimanjaro region.

At the project area, the peasants have formed a village committee, which takes part in KADCs meetings. The committee whose members are selected by the peasants themselves presents the peasants views and suggestions to KADC at the meetings. After the meetings the committee then reports back to the peasants.

Other problems of political nature handled by the Regional and District Commissioner's Offices as in the rest of Tanzania.

Other problems pertaining to the operation and maintenance of project to be handled using the by-laws which are currently being worked out. For link-ages, see chart.

Problems facing the project at present are mainly on the health side. Mosquitoes are said to be more plentiful now with the irrigation infrastructure than before. The diet is said to be poorer now because of restrictions to livestock keeping, fruit and vegetable growing in the project area. Before the project, peasants grew pulses, fruits, vegetables, and kept sheep, goats, and cattle, as well as chicken. Peasants now have to buy fruits, vegetables, milk, eggs, as well as mosquito nets from the profit they make from two crops per year. Bearing in mind that they also have to pay for water, tractors, fertilizers, and gunny bags, not much of the money made remains for other needs like fuel-wood, school fees, transport, and clothing.

Another minor problem cited by the peasants concerns varying yields. They argue that some parts of the project area yield less than others because of varying soils. Yet experts have worked out uniform rates of water and cultivation changes and uniform amounts of fertilizers to be applied as well as other inputs. So, some peasants lose while others make large profits.

Peasants have definite suggestions to solving problems facing them. Some of them include subsidized prices for fertilizers, mosquito nets, and medicine, as well as more detailed study of the soils and soil needs have been submitted to KADC for consideration. Also presented to KADC and the local government are suggestions for better houses for the peasants, increased rice prices and

allocation of land for fruits and vegetables as well as land for a firewood lot.

2. ARUSHA CHINI SUGAR ESTATE

HISTORY

Has been in operation for 57 years, and known as Tanganyika Planting Company. Original machines were provided by Denmark and ownership was Danish until 1980, when the Treasury (Tanzania government) acquired all assets. SUDECO is the mother parastatal and plays the role of overall overseer, but TPC is an independent entity. In 1987 the factory machines were to be rehabilitated through a loan obtained from the Africa Development Bank (ADB).

OWNERSHIP -

Currently 100 percent local

MANAGEMENT

Both local and foreign. Finance Administration and Hospital services managers as well as the executing chairman are Tanzanians. The General Manager, agricultural, and irrigation (cultivation) managers are Danish.

The company is directed by a Board of Directors composed of representatives from the offices of SUDECO, Regional Development Director, District Development Director, JUWATA (Tanzania Workers Association) Ministry of Agriculture and Livestock, Treasury, the National Bank of Commerce and the national political party.

MARKETING

SUDECO markets all sugar produced by the company. This is a government requirement. However, the company expressed a preference for marketing its own produce.

PRODUCTION

Large-scale. Has a labor force of 4,800 employees. Produces an average of 40,000 tons/year of processed sugar. Yield to be increased to 60,000 tons/year after rehabilitation.

LINKAGES

Factory has positive advantages over other sugar factories in Tanzania, especially on production and management issues, on machine spare parts and repairs. Management meetings of all sugar estates in Tanzania chaired by SUDECO are held regularly. These meetings work out solutions to problems facing the sugar industry. However, the decisions reached in this meeting are not effective until the company's Board of Directors has approved them.

The company maintains positive relationships with other projects in the Pangani Basin like TANESCO regional office, Tanzania Railway Corporation (for transport within the estate and for access to the nearest railway station at Kahe). TPC also relates positively with KIBO Match factory with whom she shares water from Karanga/Ruvu River. The company maintains very good relationships with the nearby villagers who use water from the estate's water supply system for irrigation and domestic usage. The company constructed two boreholes for the villagers and keeps its health facilities open to them.

MISCELLANEOUS

The company provides housing, transportation, clean water, health facilities as well as schools for the employees and their families. The company also cultivate maize for employees and sunflower for oil extraction - for the employees. Sugar supply is also guaranteed for the employees.

3. TANESCO

Has a power station at Nyumba ya Mungu which has a maximum capacity to produce 7.6 MW of power. Rate of production depends on the reservoir level which in turn depends on rainfall rates in the catchment area and other abstractions upstream.

Has another power station at Kikuletwa with a capacity of 0.3 MW phase I, phase II is proposed to be built in three years time (1990).

Hale Power Station and Pangani Falls Power Station are in Tanga Region. Both have capacity to produce 38.5 MW of power but because of siltation problems at Hale weir, the capacity has been reduced to 27.0 MW.

Moshi/Arusha areas require a total of 32 MW a day so that Nyumba ya Mungu and Kikuletwa alone cannot meet this demand. Demand is, therefore, met by supply from the interconnected grid.

TANESCO, like TPC, maintains good relations with the regional authorities and other power consuming institutions. The regional manager sits in the Kilimanjaro regional development committee meetings as well as in the Regional Governing Committee (Halmashauri Kuu ya Mkoa). TANESCO is always consulted before any major installations requiring power are approved.

TANESCO experiences no major conflicts in water usage for power production. However, minor conflicts are experienced when smallholder irrigators divert water leading to reduced inflow into Hale. Otherwise, there are no conflicts upstream of Nyumba ya Mungu reservoir.

4. GOVERNMENT INSTITUTIONS

Regional Water Engineer

Role: In charge of all water (activities) in the region. Construct and maintains structures. His responsibility to control illegal

abstraction of water, e.g., traditional furrows; only resolves such conflicts if serious problems develop. However, the RWE was not involved with the planning of the Lower Moshi Project and likewise the KADC has no connection with the regional water engineer. The RWE was involved in a resolution of a 1986 conflict between the Lower Moshi project and the urban authorities. Water flow from the Rau River was not sufficient for the purposes and urban supplies were given priority.

The quality of water discharged from industries was not properly assessed because of lack of guidelines though usually Ministry of Water - (RC) is informed if pollution is detected.

The RWE cannot sue anybody, but now forms are circulated to industries requiring them to treat effluents before discharging them into a water body. The regional water engineer maintains close relationships with the regional administration (RDD). This office has a positive relationship also with other institutions like TPC, but not so positive with the irrigation department. Others like Health and KCMC hospital examine water samples instead of sending them to Ubungu in Dar es Salaam.

Regional Irrigation Office

The regional irrigation officer is directly answerable to the Ministry of Agriculture. Therefore, the division implements the ministry's decisions and follows policy issues. The 1983 Agricultural policy led to the establishment of a zonal office which has taken over the Regional Agricultural Development Office. The Zonal office operating in Tanga, Kilimanjaro, and Arusha regions is said to have the muscle to execute projects (especially on operation and maintenance aspects) because funds for fuel and manpower are now allocated to

the zonal office so that the regional irrigation engineer finds himself powerless.

The zonal office takes care of several irrigation projects in the Pangani Basin. The office provides technical personnel. These projects are:

- (1) Kahe irrigation scheme under NAFCO and dependent on Miwaleni springs. The scheme currently grows lucerne, maize, and keeps dairy cows.
- (2) Mombo Irrigation Scheme in Tanga Region which was started during the 1960s by WD as a village irrigation scheme has an irrigated area of 220 hectares and is comprised of small plots of 0.5 ha allocated to individuals. The scheme depends on the Soni River. The scheme came to a standstill for several years until 1976 when it was revived as an agricultural cooperative known as Mombo Irrigation Cooperative Society registered in 1979. TRIDEP in collaboration with the Ministry of Agriculture rehabilitated the scheme so that today it forms a model of village controlled irrigation schemes.

The scheme's manager is answerable to the zonal office on technical matters but administratively he is answerable to the district commissioner. The manager's role is to assist the peasants in obtaining inputs. The day to day operation matters are decided upon by an irrigation committee which controls, among other things, furrow gates. The scheme manager is a member of the irrigation committee.

- (3) Mkomazi irrigation scheme - the zonal office has not yet obtained detailed information on this scheme which grows rice.
- (4) Naururu Irrigation Scheme - also known as Ruvu Mferejini. The scheme located east of same town, depends on the main Pangani River. Here

peasants grow mostly maize. However, the scheme's intake requires rehabilitation.

- (5) Kirya Irrigation Scheme which is also in the same location as Naururu has been abandoned because of salinity problems.
- (6) Gunge Irrigation Scheme located in the Hedaru area also needs rehabilitation; crops grown are maize and cotton.
- (7) Ndungu Irrigation Scheme covering an area of 700 hectares is proposed to take off in 1987. The scheme which is to grow rice, will use Kalimawe Dam as water source. The dam was built by WD & ID during the 1960s to provide flood control.
- (8) Bendera Irrigation Scheme - crop grown is rice. There are proposals for the rehaulitation of the intake.
- (9) Manga-Mikocheni Irrigation SCHEME located on the eastern side of the south Pare mountains is also in the list of those proposed for improvement. Grows rice and maize.
- (10) Kwamazandu Irrigation Scheme (located near Korogwe) had an intake constructed by TRIDEP during the 1985/86 financial year.
- (11) Kambi ya Tanga, Shango/Mbuguni Scheme is dependent on Kikuletwa River. It has an uncontrolled intake which is proposed to be rehabilitated under FAO/UNDP proposals.
- (12) Kitivo Irrigation Project located on the eastern side of the Usambara mountains. Will draw water from Uмба River. Crop to be grown is rice. Constructed during the 1960s, the intake requires rehabilitation, so does the scheme itself. An UNCDF/ADB grant and loan is to meet rehabilitation costs.

Apart from the above schemes, there is a considerable area irrigated using the river Pangani. Smallholder traditional irrigators scattered all over the three regions abstract water from the Pangani river system. These traditional irrigators are not at all controlled by the regional or zonal office. Even the water law does not touch them because they fall under occupiers of land who have, according to the law, the right to abstract and use water freely. So far, they have not caused any major conflicts with the other water users like Lower Moshi Project or TANESCO.

However, these small-scale irrigators experience various inconveniences because of uncontrolled intakes as well as poorly designed drainage furrows. As such, their fields get flooded, some, as in the case of Kirya, are ruined through salts accumulation and some do not get enough water as in the case of Lemkuna located a few kilometers downstream of Nyumba ya Mungu Dam.

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February 1987

ANNEX II

AFRICAN RIVER BASIN DEVELOPMENT: INSTITUTIONAL ANALYSIS: (Large Scale) PANAGANI/T

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems Arising	Unanticipated Events	Linking Institutions*
Pre-Indepen.	Brit. Colonial Gov. TPC TANESCO Halcrow Engineers	Provide 50% sugar needs Hydropower for Dar es Salaam		6,000 ac. planted Pangani Falls Power Sta. 1932 Engineering Surveys 1950			
1961 - 1964	Tanganyika Inde. Gov. TPC TANESCO FAO	Provide 50% sugar needs Hydropower/Irrig.	Planning Teams	Reports Publ.			
1964 - 1972	Tanzania Government TPC TANESCO FAO Regional Dev. Comm. WD-ID PADECO	Provide 50% sugar needs Hydropower/Irrig. Planning Irrigation Coordinated Reg. Devopment Planning Irrigation District Developmt.		Hale Power Sta. (1964) Nyumba Ya Mungo Dam (1965)			
1973 - 1981	Tanzanian Government TANESCO Regional Dev. Comm. Water Board PADECO NAFCO(+TPC+Kahe Est.)	Provide 50% sugar needs Electric Power Gen. National Grid Coor. Water Use District Developmt. National Food Prod.				PADECO disbanded WD-Hydrological Interest only TPC taken over by NAFCO	

45

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems Arising	Unanticipated Events	Linking Institutions*
Post 1981	Tananian Government TANESCO Regional Dev. Comm. Water Board NAFCO Japanese Donors	Provide 50% sugar needs Electric Power Gen. Coor. Water Use National Food Prod. Food Security/ Reduce Imports			Rice Proj.	Water shortage - drought	

* Linking institutions can include those without local offices but with functional role.

46

AFRICAN RIVER BASIN DEVELOPMENT: INSTITUTIONAL ANALYSIS: (Small Scale Local)

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems Arising	Unplanned Events	Linking Institutions*
Pre-dam (Before 1964) 1932	Households (Farm) Pastoralists Regional/District Govt. Offices TANESCO Pangani Falls Power Station (no dam)	Risk aversion Food Security		Pangani Falls Power Station			District-Regional Offices Tanu
1964-72 1970 1970 1972	Households TPC Sugar Estate/ Kahe Project/ TANESCO Water Board WD - ID PADECO	Food Security Commercial Hydro Power Welfare Resolution of Water Dev. of Irriga. Fish Marketing	Govt. Fisheries AG 1970	Hale Power Stn 1964 Nyumba Ya Mungo Dam 1965 Dispensaries Schools		Fishermen from Lake Areas come in - 26 villages Formed (25,000pp) Fish Processing Marketing Introd. Private Enterprize	District-Regional Offices Tanu Mobile Health Units Transport Companys Fish to Moshi
1973-81 1975	Households TANESCO Water Board WD - ID PADECO NAFCO (inc. TPC) - Kahe Estates) NCCO UJAMA	Food Security Fishing Profits			Salinity Problems at Kahe Fishing declines	Villages Abandonned	Districts-Regional Offices Tanu

47

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems Arising	Unplanned Events	Linking Institutions*
Post 1981	Households TANESCO Water Board WD - ID NAFCO NCCO Japanese Aid Donors	Rehabilitation of Power Facilities National Food Production	Rice Production Food Security - Reduce Imports	Rice Project	Japanese ignore water rights Kahe likely to fold		District-Regional Office National Milling Co. Tanu

Institutions are any significant bodies that make decisions and take actions (i.e., households, irrigation authorities). Local institutions include Local in Origin plus local representatives of larger institutions (e.g., district offices, local TANESCO offices).

* Linking institutions can include those without local offices but with functional roles.

94

ANNEX III

INSTITUTIONAL DEVELOPMENT LEADING UP TO LOWER MOSHI IRRIGATION PROJECT (LMI)

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Pre-1964	Households	Food Security Cash Income	(1) Individual household prod. using family labor. (2) Govt. prescribes crops and production targets for districts.	(1) Households adopt a diversified crop and livestock production strategy. (2) Govt. assists with research particularly for cash crops, e.g., cotton, oil seeds	Drought; Seasonal flooding	Overpopulation in Kilimanjaro highlands forces migration to plains	Local govt. adminis.- colonial and newly independent from 1961 Moshi Town for sale of products and purchase of essentials local traders visiting villages to buy and sell.
	Tanganyika Planting Company (1930)	To produce sugar on a commercial basis		Gravity irrigation system and furrow irrigation on Kikuletwa/ Kikafu rivers (tributaries of Pangani)			

50

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
1964-72	Households (1) resident farmers (2) nonresident farmers	Food security Cash Income Dev. Goals (Personal)	(1) Individual Production and Consumption Strategies (2) Government increases its role in rural production (3) Legislation (a) 1967 Socialism and Rural Devel. (b) Mandatory Communal farming (c) 1972 Decentralization Act.	(1) Communal farming (2) Individual farming strategies (3) Government assists with simple irrigation weirs (4) Government sets up Marketing Boards and Parastatals, e.g., NNC and Cotton Authority	Drought; Seasonal flooding National and food shortages; Low yields and technology; Irrigation systems are inadequate.		Regional and District Administration NNC, Cotton Authority -- for marketing TRDB -- credit Agr. Dev. Office -- extension Agr. Res. Station, i.e., Lyamungu - Agr. research Moshi Town for unofficial marketing.
	Villages	Soc. econ. development of rural peoples control of productive activities. Foster socialism.	(1) Formal village organizations prescribed by gov (2) Village governments empowered to demand communal labor from households	(1) Villagization speeded up from 1960s; (2) Setting up of new land use patterns, e.g., (a) communal farm	Shortage of funds. materials to effect projects; Lack of adequate skills and technology	Unmet expectations of infrastructure and services	As Above

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
			(3) Village governments take over land	(b) block farm (c) individual (3) Intensification of infrastructure build-up.			
1964-72	Kahe Estate	Produce Kenaf on commercial basis on 4000 ha using irrigation	(1) Highly capitalized state farm set up (2) Allocated water rights of 108 cu/sec to be extracted at Miwani Springs	Construction of irrigation canals and drainage; General Manager and Board set up to run the project	Locally produced Kenaf not competitive with other fibers; not able to meet target in cultivation (only 1430 ha	Socio-econ problems; Bilharzia; Underutilization of water rights cultivated mismanagement	NAFCO Moshi Town Moshi District Authorities
	Tanganyika Planting Co. (TPC)	To grow sugar cane on commercial basis	Nationalized in 1967 but external management retained	Gravily irrigation system reinforced by large scale sprinkler irrigation using deep wells			

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
	Pangani River Users Committee	To resolve water conflict between Arusha, Kilimanjaro and Tanga Regions.		Meets regularly			
1973-81 1979 Survey	Households (9300 non-resident, 8700 resident)	Food security Cash Income Personal development goals	(1) III as unit of operation; (2) Cooperation with other III for irrigation. Govt. emphasis on food self-sufficiency particularly in maize, rice wheat. Rural development plans for next 10 years. Emphasis on irrigation to avoid climatic vagaries.	Diversified crop production. (1) upland-food (maize, beans) and cash crops (vegetables, oil-seeds and cotton); (2) paddy on low-lying fields; (3) livestock on open grazing land.	As Before		As in 2 above

53

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
1973-81	Villages	Rural development; Meet national goals in food production and cash crops.	(1) 1977 Villagization Act formalizing village decision making powers; (2) District crop targets being allocated among villages.				
	Kahe Estate	Produce Kenaf on 4000 ha	Change of crops recommended	1400 ha of maize and pasture	As before (in 2)	(As before in 2 above)	
	Tanganyika Planting Co. (Arusha Ghini)	Produce sugar on commercial basis	1980 taken over by Treasury by run Ministry of Agriculture	Cult. 6000 ha of sugar cane and can produce 40,000 tons of sugar.	Water use conflict with Kibo Hatch factory	Provides villages with canals for paddy irrigation;	SUDECO directly other institutions through board meetings, e.g., Kilimo Treasury RDD District Party NBC.

54

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
				Employs 4800 permanent employees. Irrigation System uses underground (boreholes and sprinklers) and surface (furrow) sources of the Pangani Basin - Karanga/Ruvu rivers.		Hospital services; Informal market; wells with handpumps	Other estates (sugar) through meetings with general managers. REGIONAL ADM. to resolve water conflicts with KIBO Match factory
	Pangani water Users Committee (1975)	To resolve Nyumba Ya Mungu Conflict	Revived, i.e., Committee is revived to resolve conflict.				
	Regional Water Engineer	To regulate all water activities except irrigation					

55

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
1973-81	Regional Irrigation Division	To develop regional irrigation projects					Regional Development Director - policy, planning and finance Kilimo - for technical staff.
	Japanese Aid Donors (Japanaid)	Prepare Ridep (Rural Integrated Dev. Plan) for Kilimanjaro	Japan aid requested to prepare irrigation projects to help dry areas by Tanzania Govt.	Feasibility study of LMI in 1979/80 by Japan International Agency.			RDD Ministry of Works
1979	KADC						

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Post 1981	Households 9300 nonresident 8700 resident	Food Security Cash	(1) farms arranged into irrigation blocks; (2) water users groups organized per block; (3) representatives from user groups organized as Irrigation Committee for each canal; (4) Irrigation Committees meet with KADC every 1st of month to get instructions about canal/ditch. Maintenance, loans, etc.	Grow rice and maize; Prepare fields etc., and maintain canals and irrigation works according to KADC instructions conveyed through extension officers Group crops, maintain irrigation works and practices	(1)Some fields are smaller than original plots; (2)Choice of crops are limited; (3)Yields are uneven because of differing soils As before		KADC; Lower Moshi Project Office; Konieke Construction Company; Irrigation Division of RDD (Until 1983); Zonal Irrigation Office (after 1983); District and Regional Administration KCMC - for marketing of crops. As before

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Post 1981	Konieke Const. Co.	Construct LMI project works		Leveling of fields; Construction of irrigation intakes, canals and drainage system; Construction of flood protection dykes; Farm road network; Project Offices Labs, workshops and staff houses.		Flooding of villages just outside the project area through construction of dyke.	LMI Project

58

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Post 1981	Lower Moshi Irrigation Project (LMI)	<p>Production of staple food crops and oil-seeds through modernized Irrigation on 6320 ha</p> <p>Raise farmers' standard of living through increased farm production and incomes.</p> <p>Incomes to be raised from Tx.Sh. 1930/-per hh to 4275/-for paddy growers 4320/- for oil-seed growers</p>	<p>Setting up of Project Office under RDD;</p> <p>Setting up of the Executive Committee to assist the Project Office</p> <p>Employment of engineering consultant firm by Project Office to supervise construction of LMI irrigation works.</p>	<p>(1) Persuading farmers to surrender their land for leveling and irrigation;</p> <p>(2) Supervising the implementation of the project</p> <p>- construction</p> <p>- operation</p> <p>- maintenance;</p> <p>(3) Preparing operation and maintenance manuals;</p> <p>(4) Giving advice about O & M.</p>	Conflict over water rights with Regional Water Engineer (1986)	Greater Influx of nonresident farmers	<p>KADC</p> <p>Lyamungu Agric. Research Station</p> <p>Rural Development Bank - Credit</p> <p>NMC - marketing</p> <p>Cooperatives - marketing;</p> <p>RDD</p> <p>WD 7 ID of Ministry of Agriculture through Zonal Irrigation Office</p>

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Post 1981	KADC	Coordinate and assist the LMI Project in operation and maintenance	Setting up of facilities for training of extension workers and strengthening extension services	Construction Work			Ministry of Agriculture RDD Japanese Govt - finance and technical assistance
	Credit organizations Tanzania Rural Development Bank.	Provide agricultural inputs (fertilizers, seed, etc.) for maize.		Provides credit to a few farmers	Not available to all farmers		Households

69

ANNEX IV

NYUMBA YA MUNGU (Pre-existing Institutions)

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Pre-1964	TANESCO (contd)	Provide hydro-electric power	The Hale Ordinance created conflict between use of Pangani for electricity and for irrigation	Feasibility Studies to ensure sufficient flow of water for Hale and, at the same time, to accommodate irrigation	Conflict with irrigation		Mainly Tanganyika Govt.
	Water Development and Irrigation Division	Assist in Irrigation Projects		Between 1954-1956 and in 1961 engaged consultants to (1) conduct soil surveys (2) assess water needs (3) advise government on how to accommodate power and irrigation			Mainly Tanganyika Govt.

62

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Pre-1964	Households a) pastoral Masai b) agricultur- alists	Food security through cattle rearing. Food security. Cash Income		Prod. of food and cash crops -some like those in Naururu practiced traditional irrigation.			
1964- 1972	TANESCO	Provide hydro- electric power		1968 Nyumba ya Mungu Dam is built ensuring adequate water for Hale; additional hydro-power and water for irrigation.	Socioeconomic a)poor housing b)inadequate health ser- vices c) con- gestion. Two dispensaries were built i., 1971-72.	Influx of immi- grants around the newly formed dam	

103

Time Sequence	Institutions	Mandates/ Goals	Actions Organizational	Actions Operational	Problems	Unplanned Events	Linking Institutions
Pre-1964	TANESCO	Provide hydro-electric power	Regulations about use of Pangani waters 1957-Govt. granted TANESCO the right of $12.74\text{m}^3/\text{s}$ for generation of power at Hale. 1961-Hale Ordinance specifically forbade any activities that would reduce the river flow to less than $12.74\text{m}^3/\text{s}$.	1938 Pangani Falls constructed. 1964 Hale Hydro-electric project.			

64

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