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FLEXIBILITY, COORDINATION AND CHOICE IN WATER RESOURCE PLANNING.

THE UTILITY OF RECENT PLANNING INNOVATIONS FOR WATER DEVELOPMENT IN TANZANIA

by

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and criteria of social choice are well known. And the opportunities for socialist planning and choice in Tanzania make unnecessary some of the peculiar games water resource planners play when they try to plan social investment by the rules and standard of the private enterprise capitalist system. But what does appear relevant are some of the experience and innovations related to three apparently universal problems of longer-term comprehensive regional planning exercises; problems of flexibility, coordination, and choice. This paper identifies these problems from the viewpoint of one knowledgeable about water and planning in Tanzania but lacking the intimate knowledge of those with day-to-day responsibility in this field. The paper then suggests some adaptations of new techniques that could be realistically applied in the Tanzanian context to help meet these problems.

Problems of Longer-Term Comprehensive Water Resource Planning

To plan is to anticipate and to guide change. Independent Tanzania is ten years old, the master plan is for a period twice that life. Reflect on the tremendeous changes of the past ten years and try to project those twice that distance into the future. How can that unusual vision be incorporated into the master plans? And at the same time how can the flexibility to provide for unforseen changes be made part of the plan?

To plan is to coordinate, but how will the master plans, each a regional study carried out by teams of differing national origin and make-up, be coordinated? How will they relate to the ongoing economic and social effort and the growing need and capability for regional and district planning and development?

And finally "to plan is to choose", but consultant reports should not pre-empt the choices to be made by Tanzanians as to how, where and when their critical water resource developments should take place. And over twenty years, choices made now, should not pre-empt

choices required in the future under differing conditions and needs. How can the master plans present in understandable, non-technical form information for such critical choices?

The problems, although posed in the Tanzanian context, are universal and a variety of techniques and innovations, many still under development, have been evolved to deal with them. To guide and anticipate change, the use of data banks, perspective planning, computer modeling and simulation, and the neo-science of futurology, has been advanced. To provide for coordination, water planners increasingly use standard techniques, assumptions, and projections. These are frequently prepared by specialist agencies with advanced knowledge of economic and demographic trends or by such specialists who are part of interdisciplinary or interministerial teams. To provide for choice, programme budgeting, cost-effectiveness and multiple-objective-cost-benefit techniques have been developed. At the same time simpler, more readily understood modes of public presentation and discussion have been sought.

On reflection, this armory of techniques and innovations appears to be a mixture of tools and toys, science and fad, complexity prompted by necessity and complexity designed to conceal the critical choices of post-industrial societies. What, if any, of these techniques might be useful in the Tanzanian context and how should they be applied?

The Development of a Set of National Perspectives

Over twenty years very significant changes will or could take place in Tanzania affecting the planning of water development and the provision of improved rural water supply. Changes over twenty years in income and population distribution, available investment, social and political needs and organization, technological change and industrial development, as well as changes in the standards of what are considered improved water supplies; will seriously affect plans designed

over the next two to four years.

To chart such changes it has been found useful to develop a set of perspectives, broad statements of direction and possibility, as contrasted to more specific projections of future trends. In the present context they are needed as a framework within which to fit the regional master plans. And such perspectives need not be fuzzy extensions of present direction. Rather, for a planned society, they should include visions of what ought to occur, what is needed, and what is socially desirable.

Consider some examples of perspective changes and the questions these pose: Among the initial master plans, will be studies of Dodoma and Shinyanga Regions, areas of highly contrasting patterns of population and water availability. Yet by the end of the plan period, Dodoma district is likely to have a population density equivalent to that found today in Shinyanga district, and Shinyanga, a population density equivalent to such densely-populated districts as Arusha/or Iushoto. Should the approaches to water supply adopted in these regions be expected to markedly change by the end of the plan period?

Present allocations of regional development funds is on the basis of parity for all regions; the allocation of water development funds is proportional to the regional human and cattle population; more recently Devplan has suggested for discussion the desirability of adopting a compensatory formula - more aid for the lesser-developed regions. What assumption as to regional investment capability should govern the programming of projects?

The number of Ujamaa villages has about doubled each year since the end of 1968. The impact of such villages on water development is considerable as they lead to great concentration of population and they are given preference in the development of water supplies. But such a growth rate as a yearly doubling

obviously cannot be maintained. What perspective as to the rate of growth, distribution and character of the Ujamaa Village Programme should govern the master plans?

The next twenty years will contain major advances in technology related to water development, can any of these be expected to alter the present practices for providing rural water supply? For example, would a low-cost plastic material with the durability characteristics of butyl rubber shift the cost-curve away from pumps and gravity schemes in favour of the now, relatively high-cost, rain catchments and charcos schemes? Or would low-cost power associated with major hydro-electric schemes make feasible rural electrification in selected areas and make available low-cost, low-maintenance electric pumps, tube-wells and sprinkler systems?

Water planners assume a rising level of water demand over the plan period, an assumption well in accord with most experience. But not only will total water demand change over twenty years but the standards of quality and delivery will change as well. By the end of the planning period, will supplies without chlorination and filtration be as acceptable as they are today? And will a distance of 400 metres to a water point be adequate as a measure of improvement? Will a movement develop in more favoured economic and climatic areas for household self-supply by roof cisterns, hand pumps and wells, or house connection from piped supplies?

Not all perspectives deal with external factors of population or technology that affect plans for water development, there are important "backward" linkages as well. For example:

A twenty year plan opens up fresh possibilities for a specialized internal market for industrial goods. Bought as they are now in small quantities on an annual or project basis, they are with few exceptions (plastic pipe, concrete products) the products of foreign manufacture. But if one

considers the entire plan period, a base market on which to build local industry can be assured. Providing water for 20,000,0000 people might require 50,000,0000 feet of plastic pipe, 100,000 taps, 50,000 hand pumps and 5,000 diesel pump sets. Indeed, even water supply techniques might change to accommodate industrial development possibilities, as for example, if butly rubber could be produced cheaply in a petro-chemical complex. Water development commands between six and twelve percent of development spending, how can crucial supporting linkages to other sectors of the economy be identified and strengthened?

National perspectives of long-term trends and desired direction, such as the foregoing, can be developed by a study group or seminar representing the various ministries, their planning units, the University and other locally available experts. These national perspectives, in turn, can serve as a basis for the preparation of region-by-region projections to guide the master plans.

Consistency Between Regions: Projections, Areas and Design Standards

Some common problems of coordination are found in systematic water planning. The areal unit favoured by water planners, frequently river basins, do not coincide with either the administrative regions or the economic regions employed in development planning. Seldom is the water plan well-coordinated with the overall planning effort, and the comparability between regions or river basins is difficult to insure especially when the planning teams vary in background and skills. Various stratagems have been developed to minimize these problems. Increasingly, the river basin, an area of water supply, have given way to areas of water demand, these service areas conforming more readily

to administrative and economic considerations. Liaison with the overall development planners to prepare the specific projections of expected and desired growth and development that serve as the basis for deriving water demand. And comparability between plans has been enhanced when the terms-of-reference suggest a standard set of sub-regional units, when major economic and demographic projections are centrally provided, and when a common set of design standards and assumptions are adopted. Building-in consistency this way seems more effective than the use of coordinating or liaison committees which in practice seldom seem to function well.

In the Tanzanian context, consistency between regional plans, coordination with development planning, and with the regional and district administration can be enhanced in similar ways. A set of sub-regional areal units are now available for over half the country. These agro-economic zones, being prepared by BRALUP for general planning use, conform to district, regional and census enumeration area boundary lines, are relatively homogeneous with respect to agriculture, ecology and economy, and include a basic set of prepared data. An example of these data for the zone of Eastern Kahama, is given in Appendix A along with a map of the zones for Sukumaland. If these zones were adopted for water planning a master plan for Shinyanga region would contain fifteen sub-regional units.

A standard set of regional projections can be prepared for each region in a consistent manner by a specialist group such as the Regional Planning Division of Devplan. This group, with Regional Economic Secretaries and District Planning Assistants in most regions, could construct the set of regional projections that should serve as a basis for deriving water demand. Ten and twenty year projections might include:

Regional population and its distribution

Regional Income

Available investment trends

Major economic activity

Urban growth and emphasis

Requirements for social, educational and health services.

These projections will probably be required for regional planning purposes in any event and can be prepared region-by-region on a rolling basis as arrangements for master plan studies are made. Preparing these projections externally would free the master plan team to concentrate on its major field of expertise - water development. It would also use the existing knowledge of social and economic conditions currently available and provide automatic liason with Devplan and the regional planners.

New standards for design and assumptions of water demand are, from current reports, apparently being developed. The responsibility for providing comparable assumptions and standards for each master plan would seem to rest best with the ministry, perhaps with the forthcoming planning unit. In all, a healthy division of labour can envisaged with the Regional Planning Division of Devplan providing specific regional projections of major demographic and economic variables, BRALUP providing a set of viable sub-regional planning units, and the Ministry offering guidelines as to water demand assumptions and design standards. These, if followed by the master plan teams, would encourage a considerable standard of comparability for a minimum effort of central control.

Information for Choice

That "to plan is to choose" has been widely recognized, that the planners should not necessarily be the choosers is also well-known, but that the planned - for people themselves might help to make choices, has only received belated recognition. Nonetheless, under a wide spectrum of social systems, planners are seeking to find ways of public participation in the planning process, some seeking meaningful ways, while others unfortunately seek to erect only the facade of participation.

One critical problem is how to provide information on projects in such form that the choosers, whether they are planners, designers, representatives of the people, or the people themselves, can make judgments. The problem has been compounded by the fact that experts and professionals of all types frequently make judgements by experience, skill, intuition or even prejudice, without specifying to themselves or others the basis for the judgement. In most cases this may be adequate, for one goes to a doctor precisely to obtain his judgement. But in the case of water development, the critical choices may well be non-technical, such as a decision to favour Ujamaa villages in providing water supply. Thus it is now increasingly realized that projects serve many purposes and have many possible scales. Emphasizing one purpose or scale may mean foregoing others. Ways, hopefully understandable, should be devised to make such comparisons possible. The need to formally set out such information is not obviated by the master plans, for most of those who prepare or approve the master plans today will not participate in the many revisions and updating of the plans that the future will require.

In one current effort seeking to specify the varying objectives and trade-offs between these objectives the effects of each project on national economic growth, regional economic growth, and environmental quality are estimated. In another proposed system, a fourth broad factor would be added, the well-being of people. In such exercises, a specific project, for example a hydro-electric dam, is seen to have varying impacts from each point of view and even though these impacts are not fully quantifiable or even known, they do provide a sounder basis for choice than that of ignorance.

These criteria, of course, are not sensibly applicable in the Tanzanian context. Criteria of choice in Tanzania should be related to the actual choices being made. Apart from the important

choices of engineering design, most projects of a specific scale and phasing have three critical aspects: the project has some service potential - to provide health and convenience for people; some development potential - to increase the productivity of the population; and a differing cost structure - money, time, supervision, and other scarce resources. To balance these qualities of service, development, and cost, is desirable - more service for less cost, service with development where possible, etc. But the possibilities are not always intuitively obvious. For example, the service potential of a given project can vary with the degree of population density, but this need not be taken as given but can be changed as through the Ujamaa Village Programme. Or the development potential can vary greatly depending whether ancillary investment, planning, and coordination takes place as has been shown in studies of North-East Nzega. The cost-effectiveness of a project differs not only in total and unit cost, but in requirement for foreign exchange, mechanical equipment, technical supervision or the potential to employ self-help.

Can these many possibilities be evaluated in a sensible and comparable way? Tables 1 and 2 set out such an analysis for a project which has received study roughly comparable to that of the master plan. The format can be used in the design process to analyse different alternatives, scales and phasing of the same project or to display the qualities of preferred or recommended projects. Simple indicators are used to measure service potential: population served by distance zones, potential consumption, reliability, water quality, and the number of facilities served. Indicators of development potential include: Ujamaa villages, cultivable land made accessible, irrigated land, livestock watered, fishponds, and rural industry. Cost-effectiveness indicators include: money, time, and the various constrants of scarce resources.

The example given in Tables 1a, b, c, 2a, b, c, the Ipango Water Supply Project, illustrates one use of these indicators. The project is in two phases and Table 1a, b, c, presents data on Phase I to be compared with Table 2a, b, c, which gives similar information for the two phases combined. One possible comparison, therefore, is between building the project only to the scale of Phase 1 as against building the entire project (Phase 1 plus 2).

From the Tables we learn that the smaller project is considerably cheaper. Its total cost is but a third of the combined project, and the capital cost per capita or per liter is two-thirds that of the larger project. Furthermore, the operating costs of the smaller scale project are much smaller; while the demands on scarce resources are only slightly more modest.

In service potential, the larger project will serve from two to three times as many people with similar quality and reliability. More facilities will be served by the larger project. And in development potential the larger project will have considerable scope as it apparently provides water to those areas most in the need for new facilities and with greater potential for development.

What should be the choice between these projects? There is, of course, no simple answer as it depends on the available resources, other alternatives, regional and national priorities at the time the choice needs to be made. But the decision will not be made in total ignorance of the consequences if these indicators are readily available.

PROJECT TITLE: MPANGO WATER SUPPLY . PHASE 1

DESCRIPTION: Water Intake on perennial stream: gravity main 30 km., 35 km. distribution line, domestic outlets in valleys

REGIONAL/DISTRICT DEVELOPMENT PRIORITY: very high priority

A. COST/EFFECTIVENESS

1. CAPITAL COST

TOTAL COST:	AFTER CONSTRUCTION	2,200,000	SHS.
	5 YEARS	-	SHS.
	10 YEARS	-	SHS.
	20 YEARS	-	SHS.

		PER CAPITA	PER M^3	PER L */DAY
2. AVERAGE:	AFTER CONSTRUCTION	52 Shs.	Shs.	1.7 shs.
	10 YEARS	-	-	-
	20 YEARS		-	-

3. OPERATION & MAINTENANCE: ANNUAL 14,000 SHS.

4. CAPITAL COST CONTENT:

%FOREIGN EXCHANGE	25%
MECHANICAL EQUIPMENT CONSTRUCTION	68
TECHNICAL SUPERVISION CONSTRUCTION	10
SELF-HELP LABOUR POTENTIAL	10

5. ESTIMATED TIME FOR COMPLETION: 1½ YEARS

*LITER

PROJECT TITLE: MPANGO WATER SUPPLY PHASE 1

SERVICE POTENTIAL: SERVICE AREA 1 KM^2

	BEFORE CONSTRUCTION		AFTER CONSTRUCTION		AFTER 20 YEARS
	WET SEASON	DRY SEASON		AFTER 10 YEARS	
1. ESTIMATED POPULATION					
IN SERVICE AREA	11,200	11,200	15,000	25,200	42,000
SERVICE POPULATION					
BY DISTANCE: 400 METRES	10%	- %	20%	20%	20%
800 METRES	25	5	25	25	25
1600 METRES	20	4	20	20	20
1600 METRES	45	91	35	35	35
2. POTENTIAL CONSUMPTION					
AVAILABLE L/DAY/CAPITA	40 l	20 l	40 l	35 l	30 l
ACTUAL OR ANTICIPATED:					
% 10 l/day	10%	18%	10%	5%	-%
10-20 l/day	45	42	50	50	55
3. RELIABILITY					
% OF YEARS SUPPLY ASSURED					
MAJOR TRADITIONAL SOURCE	99%	95%	x %	x%	x %
NEW IMPROVED SOURCE	x	x	90	94	91
4. QUALITY					
% OF SERVICE POPULATION WITH:					
TRADITIONAL SOURCE	80%	88%	8%	8%	8%
TRADITIONAL SOURCE HIGH RISK	6	3	2	2	2
IMPROVED SOURCE	14	9	10	10	10
IMPROVED SOURCE	-	-	-	-	-
TREATED SOURCE	-	-	80	80	80
5. FACILITIES					
SCHOOLS		2	2	3	3
DISPENSARIES		1	2	2	2
GOVT CENTRES		0	0	0	0
OTHER SERVICE CENTRES		2	3	3	3

TABLE 1c.

PROJECT TITLE: IPANGO WATER SUPPLY PHASE 1

DEVELOPMENT POTENTIAL

TYPE	WITHOUT ADDITIONAL INVESTMENT NUMBER	WITH ADDITIONAL INVESTMENT PLANNING OR COORDINATION NUMBER	TYPE OF INVESTMENT	ESTIMATED COST OF ADD'L INVESTMENT
1. UJAMAA VILLAGES NUMBER	5	0	0	0 Shs.
POPULATION	4000	0		
2. RELEASED LABOUR HOURS/ADULT/DAY	0.7			
3. CULTIVABLE LAND TOTAL-SERVICE AREA (ha.)	12,080			
CULTIVABLE, NOW UNCULTIVATED (ha.)	10,900			Shs.
UNCULTIVATED UNITS	38,000			
4. IRRIGABLE LAND POTENTIAL (ha.)	0	0	0	0 Shs.
5. PRODUCE MARKET CO-OP BUYING POINTS	0	0	0	0 Shs.
LOCAL MARKETS	0	0	0	0 Shs.
6. LIVESTOCK ANIMALS WATERED	0	0	0	0 SHS.
NPS	0	0	0	0 Shs.
MARKETS	0	0	0	0 Shs.
FISH PONDS SURFACE AREA	0	0	0	0 Shs.
8. RURAL INDUSTRY EMPLOYEES	0	0	0	0 Shs.

PROJECT TITLE: MPANGO WATER SUPPLY PHASE 1 AND 2

DESCRIPTION: Water intake on perennial stream, gravity main 30km., pump and rising main 35 km., earth dam reservoir 75 km. distribution line, domestic taps and cattle troughs

REGIONAL/DISTRICT DEVELOPMENT PRIORITY very high priority

A. COST/EFFECTIVENESS

1. CAPITAL COST:

TOTAL COST:	AFTER CONSTRUCTION	7,000,000 SHS.
	5 YEARS	- SHS.
	10 YEARS	- SHS.
	20 YEARS	- SHS.

		PER CAPITA	PER M^3	PER LITER/DAY
2. AVERAGE:	AFTER CONSTRUCTION	78Shs.	Shs.	2.6 Shs.
	10 YEARS	-		-
	20 YEARS	-		-

3. OPERATION AND MAINTENANCE: ANNUAL 90,000 SHS.

4. CAPITAL COST CONTENT:

% FOREIGN EXCHANGE	27%
MECHANICAL EQUIPMENT CONSTRUCTION	12
TECHNICAL SUPERVISION CONSTRUCTION	8
SELF-HELP LABOUR POTENTIAL	10

5. ESTIMATED TIME FOR COMPLETION: 2½ YEARS

Table 2b

PROJECT TITLE: MPANGO WATER SUPPLY PHASE 1 AND 2

SERVICE POTENTIAL: SERVICE AREA 500 KM^2

	BEFORE CONSTRUCTION WEST SEASON	BEFORE CONSTRUCTION DRY SEASON	AFTER CONSTRUCTION	AFTER 10 YEARS	AFTER 20 YEARS
1. ESTIMATED POPULATION IN SERVICE AREA	31,700	31,700	34,300	59,00	89,000
SERVICE POPULATION BY DISTANCE: 400 METRES	5%	%	15%	15%	15%
800 METRES	20	4	20	20	20
1600 METRES	25	9	25	25	25
1600 METRES	50	87	40	40	40
2. POTENTIAL CONSUMPTION					
AVAILABLE l/DAY/CAPITA:	40 l	20 l	40 l	35 l	30 l
ACTUAL OR ANTICIPATED					
% 10 l/day	10%	18%	10%	5%	- %
10-20 l/day	45	42	50	50	55
20 l/day	45	40	40	45	45
3. RELIABILITY					
% OF YEAR SUPPLY ASSURED					
MAJOR TRADITIONAL SOURCE	99%	94%	95%	99%	97%
NEW IMPROVED SOURCE	x	x	x	x	x
4. QUALITY					
% OF SERVICE POPULATION WITH:					
TRADITIONAL SOURCE	80%	88%	8%	8%	8%
TRADITIONAL SOURCE-HIGH RISK	6	3	2	2	2
IMPROVED SOURCE	14	9	10	10	10
IMPROVED SOURCE HIGH RISK	-	-	-	-	-
TREATED SOURCE	-	-	80	80	80
5. FACILITIES					
SCHOOLS	6	6	7	8	
DISPENSARIES	4	6	6	8	
GOV'T CENTERS	0	0	0	0	
OTHER SERVICE CENTERS	6	7	8	8	

Table 2c

PROJECT TITLE: MPANGO WATER SUPPLY PHASE 1 AND 2

DEVELOPMENT POTENTIAL

TYPE	WITHOUT ADDITIONAL INVESTMENT NUMBER	NUMBER	WITH ADDITIONAL INVESTMENT PLANNING OR COORDINATION TYPE OF INVESTMENT	ESTIMATED COST OF ADD'L INVESTMENT
1. UJAMAA VILLAGES NUMBER	16	0	0	0 Shs.
POPULATION	11,000	0		
2. RELEASED LABOUR HOURS/ADULT/DAY	0.7			
3. CULTIVABLE LAND TOTAL -SERVICE AREA (ha.)	42,500			Shs.
CULTIVABLE, NOW UNCULTIVATED UNITS	142,000			
4. IRRIGABLE LAND POTENTIAL (ha.)	0	0	0	0 Shs
5. PRODUCE MARKET				
CO-OP BUYING POINTS	0	2	small godowns	50,000
LOCAL MARKETS	2	0	0	0
6. LIVESTOCK ANIMALS WATERED				Shs
NPS	0	4	cattle dips	60,000
MARKETS	0	0	0	0
7. FISH PONDS SURFACE AREA	0	0	0	0Shs
8. RURAL INDUSTRY EMPLOYEES	0	20	saw mill	125,00

The indicators based in the analysis might be expected to improve as our understanding of the dynamics of rural water development increases. For the present, we do not know whether released labour is in practice productively-used or to what degree is disease reduced by increased water use. Thus we can only state the possibilities and speculate on the affects. But current research now underway promises to strengthen our knowledge of these effects.

Mastering the Master Plan

A master plan is a document, planning is a continuing process. Increasingly, the concern of planners is shifting from the production of documents to the provision of planning services. In the context of Tanzanian resources, consultant assistance in preparing the plans seem necessary. But long after the master plan teams depart, the planning unit of the ministry will be called upon to revise, update, and reschedule the programmed effort. Will the volumes of plans, many of them attractively printed and illustrated, lend themselves to this treatment? If the usual experience with such reports holds in the future, it is indeed unlikely. Even as good and competent a report as "Tanzania Rural Water Supply Development" does not lend itself easily to reprogramming its suggested twenty year programme for rural water supply. It should seem reasonable to demand of each master plan the quality of easy revision and review. The use of consistent projections, unit areas, and design standards will encourage these qualities but the format of presentation needs to be scrutinized as well with the view that the plans strengthen and reinforce the future planning capability of the ministry's own unit.

Conclusion

An essential skill in short supply in developing countries is the ability to wisely use, guide, and direct consultants. Unfortunately, this skill is not included in most formal education, rather it is acquired by experience, some of it painful, it is furthed by a comparative

and current knowledge of the applicable techniques of analysis, and it is maintained by the constant strengthening of the nation's own internal planning and technical services.

The deeply - held desire of Tanzanians to provide improved water for all deserves the very best of consultant works. And the high costs of such work, comparable to building major dams or constructing irrigation works, argue for exercising the same care in the design of consultant effort as in the design of a major engineering structure. A small effort now by the existing planning and technical services can insure that the water master plans are flexible to meet the changes of the future, are consistent with development policy, and are helpful in making needed and sometimes difficult choices.

KAHAMA DISTRICT (131) Zone 131.1: Eastern Kahama

A. LOCATION :

The zone includes all of Kahama Division, Ngongwa Sub-Division of Msalala Division and the north-eastern part of Dakama Division.

B. GENERAL FEATURES

This is a flat to undulating zone with large areas of mbuga, especially in the east. It is an area of fairly long Nyamwezi settlement and the density of population (which is medium[1]) is much higher than in any other part of the district. Most people live in the west and central parts of the zone, while the mbuga areas are used mainly for grazing. Paddy, which is becoming increasingly important, is the main cash crop, followed by cotton. Other important crops include maize, cassava, groundnuts and other legumes. As in all parts of the district, ridging is the normal form of tilling but, in this area, many farmers use ox-ploughs. There are more livestock than in the western zones but less than in Zone 2. Unlike most of Sukumaland, livestock owners use manure for cultivation.

C. PHYSICAL RESOURCES

The area is flat to undulating with a few granite outcrops and, especially in the eastern part, large areas of mbuga. On the slopes the soils are well drained, dark red loams and sandy clay loams while in the valleys and the flatter areas poorly drained, dark brown or very dark grey to black sandy clays and clays predominate. The average annual rainfall is probably 950-1000 mms.

D. CROP PRODUCTION

1. Land availability and tenure: Most land suitable for cultivation is already in use but land shortage is not a problem as in much of Sukumaland. Land rights are held on an individual basis and the normal means of obtaining land is by inheritance; land is occasionally sold but not normally rented or loaned.

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[1] See Introduction for scale of population density used throughout this report.

2. Farm size: The average area cultivated per household is medium[1], although there are some very large farms. On the smaller farms most of the land claimed is cultivated every year but those who own a large area may leave much of it fallow. In most farms the plots are scattered.

3. Crops: Paddy, the main cash crop, is grown by most farmers and is becoming increasingly important. It is grown in the valleys and other low-lying areas. Cotton is also a major cash crop but it is less important than in zones 2 and 3. Maize and cassava are the main food crops while other crops include groundnuts, chick peas and other legumes, millet, sorghum and sweet potatoes.

4. Planting: Most crops except paddy and cotton are interplanted or planted in succession. The times of planting and harvesting the major crops are as follows:-

	planting	harvesting
paddy	Dec - Mar.	May - Aug.
cotton	Nov. - Dec.	June - Aug.
maize	Nov. - Jan.	Apr. - June.
groundnuts	Nov. - Dec.	March -
millet/sorghum	Nov - Dec.	June - July

5. Tillage: Ridges are normally used for all crops except paddy and chick-peas.

6. Seed: Improved seed is used for cotton (supplied free by the Lint and Seed Marketing Board and distributed through the Cooperatives) and occasionally for maize.

7. Soil erosion and conservation: There is some soil erosion but it is not serious as in many parts of Sukumaland. Conservation measures (other than ridging) are seldom practised, although sisal hedges are ocassionally planted.

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[1] See introduction for scale of farm size used throughout this report.

8. Soil fertility: Since this area has been cultivated for a long period of time measures to restore soil fertility are required. Those farmers with livestock use manure, particularly for maize and cotton, and a number of people use artificial fertilizers. Other measures include intercropping (practised throughout Sukumaland)ridging and, where enough land is available, the use of fallow.

9. Water control: Apart from the construction of bunds in paddy fields to conserve water, there is usually no form of water control

10. Mechanization: Most cultivation is probably done by hand but a considerable number of farmers use ox-ploughs.

11. Crop protection: The uprooting and burning of cotton plants after harvesting as a precaution against disease is compulsory and most of those people who use artificial fertilizers also use insecticides. The other main means of protection is individual or group scaring and hunting of birds and animals.

12. Labour: Hired labour is not widely used but co-operative labour between neighbours is very common. It is used for many agricultural operations and other activities and payment is in the form of food, beer or reciprocal labour.

13. Marketing: All cotton and much of the marketed rice, maize and groundnuts are sold through the Co-operatives. Other produce is sold on local markets (including black marketing).

E. ANIMAL HUSBANDRY

1. Cattle: The proportion of farmers owning cattle is medium/low.[1] The average herd is fairly small (probably under 20 head) but there are some large ones of several hundred head. Cattle are an important indicator of wealth and are used for dowry, milk, manure and work but are seldom sold unless cash is urgently required. They are Bebus and there are no improved stock.

2. Small stock: The number of households owning goats and sheep is somewhat less than those with cattle. They are used mainly for meat and for religious purposes.

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[1] See Introduction for scale of cattle ownership used throughout this report.

3. Donkeys: A few farmers keep donkeys for transport purposes.

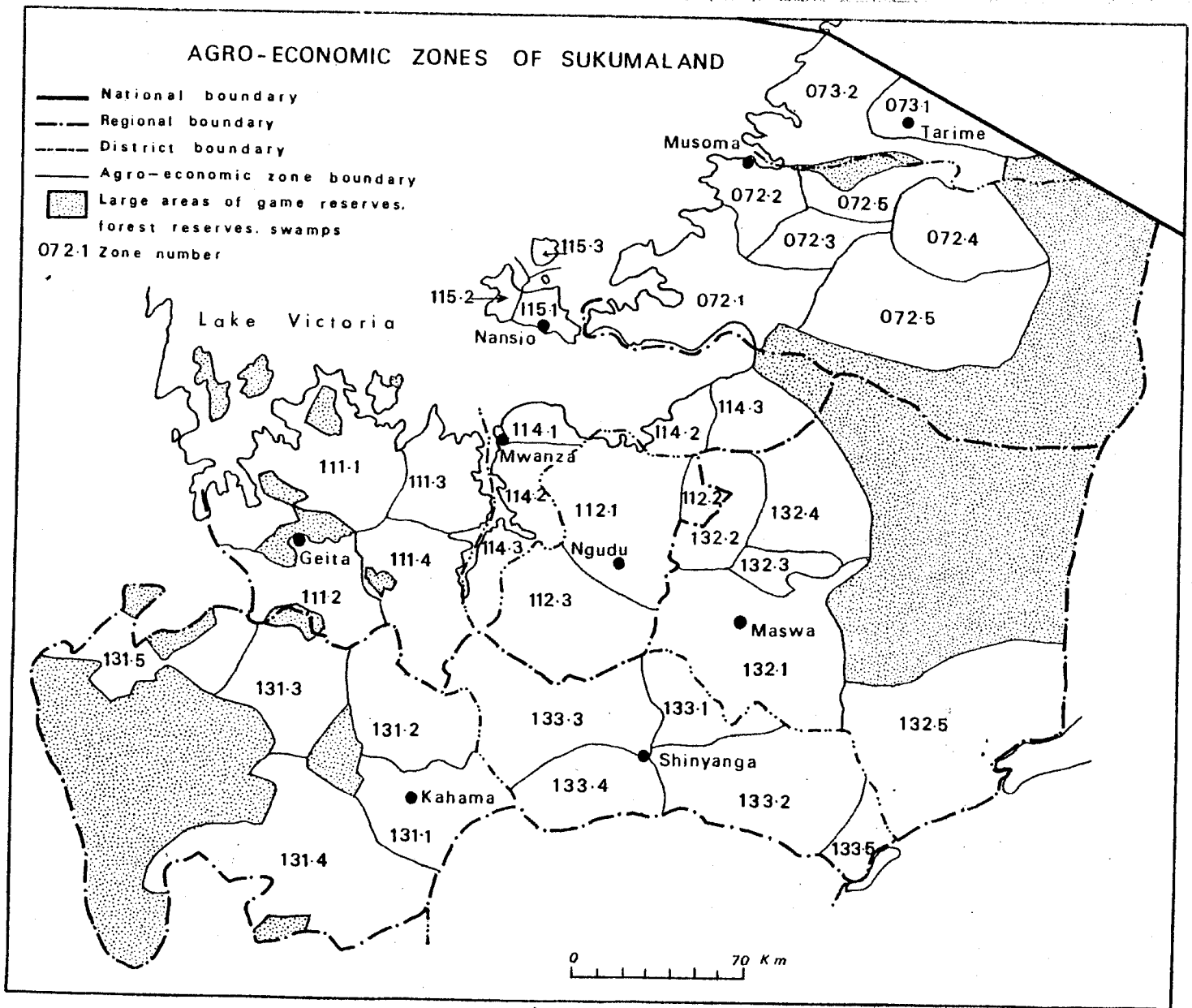
4. Poultry: Almost everyone has a number of poultry, used for meat and eggs.

5. Husbandry: When there are no crops in the fields livestock are grazed anywhere, irrespective of ownership of the fields. At other times they are grazed on permanent pasture (land unsuitable for cultivation) or fallow land. The low lying, poorly drained areas (particularly in the eastern part of the zone) are used mainly in the dry season and there is considerable seasonal migration, especially of larger herds. Permanent pasture is owned communally and animals are often herded communally among neighbours, tended by youths and men. Herders are not hired but the tending of cattle owned by others in return for milk, manure or the use of oxen is common.

F. POPULATION AND SETTLEMENT

1. People: The main in the zone are the Nyamwezi, but there are also a number of Sukuma, Tusi and Sumbwa.

2. Settlement: Most settlement is in the form of clusters of homesteads (household units) scattered through the zone, although larger nucleated settlements form a long road or around features such as shops and Co-operative buying posts. A homestead consists of one or more buildings, often surrounded by a fence or hedge. The whole area is divided into "villages" but a "village" is a unit for administrative and identification purposes rather than a nucleated settlement.


AGRO-ECONOMIC ZONES OF SUKUMALAND
National boundary
Regional boundary
District boundary
Agro-economic zone boundary
Large areas of game reserves, forest reserves, swamps
072·1 Zone number
Lake Victoria
Musoma
Tarime
Nansio
Mwanza
Geita
Ngudu
Maswa
Shinyanga
Kahama
073·2
073·1
072·2
072·6
072·3
072·4
072·1
072·5
115·3
115·2
115·1
114·1
114·2
114·3
111·1
111·3
111·4
112·1
112·2
112·3
132·4
132·2
132·3
111·2
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