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THE ECONOMICS OF RURAL WATER SUPPLY IN TANZANIA

by

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I. Introduction.

Last year, at the start of the Second Five Year Plan, Tanzania set itself the task of ensuring that the entire rural population of the country is provided with adequate water supplies within a period of forty years. To achieve the goal, Government has estimated that it must provide water to an average of 250,000 persons per year at an annual expenditure of Shs. 50 million. The enormity of this task can be well appreciated when one realizes that ninety percent of the rural population, or over ten million people, are considered to have inadequate supplies and that an annual expenditure of Shs. 50 million represents about 7.5 percent of the average annual development investment anticipated during the Second Plan. In response to this challenge, Government has budgeted Shs.406 million for new rural water development over the Second Plan period and is in the process of completely re-evaluating the present organizational approach to the development of Tanzanian water resources.

The actual course of Tanzanian water development soon will be decided, as decisions are about to be made that will largely determine whether or not the above forty-year goal or some other goal is pursued. The success of future Government efforts greatly depends upon the overall programmes and resulting projects set up to achieve its desired objectives. With large amounts of investment likely to continue for a considerable number of years in Tanzania, it is worthwhile to inquire into the economic bases upon which rural water programmes are planned and specific projects are selected. This is especially important in the case of finance for rural water development, which has been mostly supported by Swedish Credits over the past several years. The future availability of Swedish or other foreign aid and the ability of Government to achieve its anticipated investment levels will be directly affected by the economic aspects of the situation.

Because the provision of rural water supplies is a major issue not only in Tanzania but also in Kenya and Uganda, this paper is an attempt to set out some of the basic economic aspects of rural water development and to indicate how they can be used to assist in programme planning. The economic aspects, by themselves, cannot completely control decision-making and plan formulation, because rural water supply is not looked upon as an economic investment in Tanzania, but rather as a social input with some economic consequences. This view of the social role of rural water is amply supported by the essentially non-economic selection criteria and organizational procedures which largely determine the distribution of rural water investment between villages and Regions. Indeed, the problems of equity and the very credibility of Government often become the key factors in the allocation of rural water projects. Nevertheless, since the development of rural water supplies involves the use of scarce resources that have opportunity costs in terms of other development activities foregone, the economic aspects cannot be ignored if Tanzania is to make efficient use of its available resources. With this proviso in mind, the paper can be seen as an attempt to present a bit of the economic picture of this type of rural development activity - a picture that has not received sufficient consideration to date.

II. The Present Situation

II (1) Populations Within Urban Water and Rural Water Service Areas.

In Tanzania, water supplies are classified as either rural or urban. Rural water supply development is the responsibility of the Water Development and Irrigation Division (W.D.& I.D.) of the Ministry of Agriculture, Food and Co-operatives. The emphasis is

on the provision of communal standpipes, termed domestic water points, although a few private house connections are sometimes allowed. The capital costs of construction and the recurrent operation and maintenance costs of the completed projects are financed completely by the Ministry. W.D. & I. D. obtains no revenue of any significance, as water taken from domestic points is free to the consumers. Urban water supply development is the responsibility of the Water and Drainage Division (W.D.D.) of the Ministry of Lands, Housing and Urban Development. The emphasis is on the provision of private house connections, although communal kiosks are constructed occasionally in low income areas. The Ministry initially finances the capital costs of construction, but after completion of the projects the users having private connections are charged a water rate sufficient to amortize the capital costs and to pay the recurrent operation and maintenance costs. W.D.D. sets the water rates so that its overall costs are balanced by revenues. A total of 94 urban water supplies are operated by W.D.D. ranging from Dar es Salaam down to individual prison farms and aerodromes, but only about ten of the largest towns operate at a profit; the remainder operate at a loss.

Using the above definitions of rural and urban water supplies, an estimate can be made of the portion of the population of mainland Tanzania to be served by each Ministry. Although only the population within urban water supply service areas can be directly estimated from available data, the rural water supply population can be taken as the difference between total and urban populations. Table 1 shows the growth of urban water supply population since 1951.

Table 1. Populations Served with Urban Water Supply by the Water and Drainage Division of the Ministry of Lands, Housing and Urban Development and Its Predecessors (selected years).

Year	Total Number of Private connections	Total Number of Kiosks	Total Population Served
1951	7,228	120	200,004
1954	11,288	180	185,990
1957	17,413	284	265,541
1960	24,466	328	441,638
1962	29,446	370	442,896
1965	36,999	*	*
1967	41,000 (est.)	*	*
1969	45,000 (est.)	*	650,000 (est.)

*data unavailable

Sources: Data for 1951-62: Tanganyika/Tanzania, Public Works Department, Annual Reports 1951-62, Dar es Salaam, Government Printer.

Data for 1964: United Republic of Tanzania, Central Statistical Bureau, Ministry of Economic Affairs and Development Planning, Statistical Abstract 1966, Dar es Salaam, Government Printer, 1968.

Date for 1967-69: Private Communication, Director, Water and Drainage Division, Ministry of Lands, Housing and Urban Development, 18th February, 1970.

Since Independence, the population receiving urban water supplies has increased by 5.7% per year. This is slightly less than the recorded 6.4% annual rate of growth for urban areas between 1957 and 1967, At the time of the 1967 census, Tanzania had an urban population of 677,780 within the fifteen administratively defined townships and the nineteen former townships. This population did not include any surrounding "town planning areas" although W.D.D. includes these outer areas in its water supply service network. Thus, the W.D.D. definition of urban population is much larger than that of the 1967 census. For the purposes of water supply planning, therefore, urban population will mean all of the present population served by W.D.D at their 94 locations as well as the population in all associated areas that W.D.D. intends to supply eventually.

An estimate of the overall population in urban water supply areas can be obtained by separating the areas into Dar es Salaam and vicinity on the one hand and all other areas on the other. As shown in Table 2, Dar es Salaam proper had a population of about 327,000 in 1967. Adjacent suburban areas within the master planning zone for the city contained an additional 54,000 people. At an assumed growth rate of 8.0% this planning zone had an estimated population of 387,000 in 1969, of which about 300,000 were supplied with water by W.D.D. The present Dar es Salaam water supply area for W.D.D. extends from Kunduchi north of the city down to Kigamboni south of the ferry and will extend soon to Mjimwema. Regular supplies are provided as far west as Manzese, but numerous villages and Government installations are served along the 45 mile supplying pipeline which draws water from the Ruvu River. Thus, the population supplied with water by the Dar es Salaam Water Supply exceeds that of Dar es Salaam itself.

Table 2. Population Estimates for Urban Water Supply Areas.

Urban Area	Population Served with Urban Water Supply 1969[1]	Population in Urban Water Supply Areas		
		1967	Assumed Rate of Growth	1969(est)
Dar es Salaam and Vicinity	300,000	327,000[2]	8.0%[3]	387,000
Outside Dar es Salaam Area	350,000	*	*	700,000
Total Mainland Tanzania	650,000	*	6.4%[4]	1,087,000

*Data unavailable
Sources: See below

For the other 93 W.D.D. water locations, the populations receiving W.D.D. water varies between 30% and 70% of the existing populations in the eventual service areas. Table 2 shows the total population currently receiving W.D.D. water in these 93 locations to be 350,000. Therefore, by assuming an average population served of 50%, the overall population within the planned urban areas is about 700,000. This results in an overall population of 1,087,000 people living in planned urban water supply areas on mainland Tanzania in 1969. If the estimated total population of mainland Tanzania during mid-1969 is taken as 12,557,000 people,[5] then the corresponding portion of this total living in the rural areas at the start of the Second Five Year Plan was 11,470,000.

Sources: 1. Personal Communication, Director, Water and Drainage Division, Ministry of Lands, Housing and Urban Development, 18-19 February, 1970.

2. Dar es Salaam city (272,300 plus suburban area (54,000): Town Planning Division, Ministry of Land Settlement and Water Development, Dar es Salaam Sub Region: Physical Subregional Survey and Plan, Dar es Salaam, August 1968, p. 52f.

3. Ibid, p. 83.

4. Tanzania, Central Statistical Bureau, Ministry of Economic Affairs and Development Planning, Recorded Population Changes 1948-67: Tanzania, Dar es Salaam, August 1968, p. 13.

5. Central Statistical Bureau, Ministry of Economic Affairs and Development Planning, Provisional Estimates of Fertility, Mortality and Population Growth for Tanzania, Dar es Salaam, December, 1968, p. 17.

II (2) The Nature of Adequate Water Supplies.

It probably is true to say that most people in rural Tanzania draw their water from a source that has undergone some improvement as a result of human efforts. Because Tanzania is not well endowed with a good distribution of lakes, ponds, springs, and permanently flowing streams and rivers, most people find it necessary, or at least desirable, to improve the reliability, distribution, or quality of their water sources. The improvements may range from a large storage dam with miles of distribution piping on the one hand to a shallow seepage hole dug in a dry stream bed on the other. All are improvements on the natural source of water, but not all can be considered as adequate for the purposes of development in Tanzania. What is adequate in one area or in one stage of development may not be adequate in another. Government does not clearly define what is meant by adequate water other than that is a "necessity for the achievement of a better quality of rural life".[1] At the present time most W.D.& I.D. expenditures for rural water supply development are weighted heavily in favour of piped supplies, whether pumped (including boreholes)or gravity, which terminate in communal standpipes. However, W.D.& I.D. officials point out that piped supplies are by no means the only type of system capable of providing adequate water supplies in rural areas and that simpler, less expensive methods also are acceptable. For example, properly constructed small reservoirs or hand dug wells may be considered to be adequate sources of water supplies in some sparsely populated areas having seasonal streamflows or a high groundwater table.

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[1] United Republic of Tanzania, Second Five Year Plan for Economic and Social Development, 1st July, 1969 - 30th June, 1974, Vol. I, Dar es Salaam, Government Printer, p.40.

On the basis of discussions with W.D.& I.D. officials, an informal definition of what is currently considered to be an adequate water supply can be stated as follows: (1) the source of water is protected from the more gross forms of pollution; (2) the people expend less effort obtaining this water than they would from other, traditional sources, and (3) no better water supply can be developed for the same level of expenditure. The pollution aspects are the responsibility of the Government Chemist in Dar es Salaam who must certify that the water quality of a proposed W.D. & I.D project is safe for human consumption before construction can begin. Unfortunately, water samples are tested for chemical pollutants only, as the Government Chemist does not have testing facilities for the more important bacteriological pollutants.[1] It must be pointed out that the above definition is subject to a wide range of interpretation. Because of the lack of specificity in the definition, its applicability to rigorous project or programme planning is severely limited.

II (3) Rural Water Supply Development to 1969.

In general, rural water supply projects can be classified into piped and nonpiped categories. The piped projects further subdivide into pumped and gravity schemes. Pumped schemes involve taking water from rivers, lakes, reservoirs, wells, and boreholes and then pumping it to some other location. Gravity schemes can involve streams, springs, and reservoirs wherever topographic conditions provide sufficient pressure to allow unaided flow in pipes. The unpiped projects include dams, wells, springs, and boreholes that have no facilities for distribution of the water to other locations. During the 1950's a large number of dams were constructed

[1] P.J. Madati, "Water Quality Standards in Tanzania", Dennis Water,(ed.), Rural Water Supply in East Africa, BRALUP Research Paper 11, University College, Dar es Salaam, May, 1970, pp. 88-9.

in the drier parts of the country. These projects were supposed to include at least a short outlet pipe leading to a cattle watering trough below the dam, but many dams were built without these facilities, forcing both people and livestock to wade into the reservoirs for water. According to the criteria for adequate water supplies presented earlier, these unprotected sources of water are subject to serious pollution hazard and, thus, are not acceptable at the present time. Current W.D.& I.D. policy requires the construction of new dams to be followed by the installation of piped distribution systems. On some of the larger projects provisions for filtration and simple chlorination treatment also are included. Similarly, current construction of charcos, which are small excavated earth tanks situated so as to collect rainfall runoff from small catchment areas, includes the protective fencing of the charco and the installation of a simple draw-off well for the use of the local people. Very few unprotected water supplies are built by W.D.& I.D. at the present time, but this general policy has been effective for only the past few years and a larger, although undetermined, number of unprotected supplies were constructed during the early years of the Division. Table 3 gives a rough picture of the types of projects completed by W.D.& I.D. through 1968.

As summed up in Table 3, a total of 295 earth dams and other storage reservoirs were constructed, as well as 597 gravity and pumped schemes and 521 successful boreholes. These categories are not mutually exclusive, because numerous dams are utilized in gravity and pumped schemes and most of the successful boreholes are utilized in pumped schemes as well. The table does not give a clear breakdown between piped and non-piped projects, nor between the protected and non-protected projects. Furthermore, the table does not provide any idea of the number of people utilizing the water supplies from these projects.

Table 3. Water Supply Projects Completed by W.D.& I.D., 1946-68.

Year	Earth Dams Catchment Tanks and Charcos (min.20 ac-ft)	Gravity Pipe-lines and Pumped Supplies	Boreholes Successfully Completed (min.400 gal/hr
1946	7	1	6
1947	12	1	10
1948	5	9	8
1949	10	11	13
1950	7	13	26
1951	5	18	19
1952	3	22	21
1953	9	41	32
1954	19	52	29
1955	18	22	22
1956	20	5	24
1957	29	15	30
1958	18	20	23
1959	19	30	19
1960	33	29	23
1961	13	44	26
1962	9	21	17
1963	8	21	13
1964	18	23	20
1965	9	20	35
1966	5	18	18
1967	6	71	28
1968	13	90	59
1969	*	*	*
Totals	295	597	521

* Not available.

Sources: Tanganyika/Tanzania, Water Development and Irrigation Division, Annual Reports, 1946-68, Dar es Salaam, Government Printer.

II (4) Populations Provided With Improved Rural Water Supplies.

It is difficult to determine the number of present users of improved rural water supplies directly from available records. Because of differing methods of describing projects and of costing the various water development activities over the years, it is difficult to compare water supply projects from different periods of time. Before 1945, Government did little in the way of actual rural water supply development.[1] The Public Works Department (P.W.D.) built some supplies for townships, outstations, minor settlements, and trading centres, but in almost all cases these were administrative locations where European officials were stationed. A few water supplies were constructed by the Department of Agriculture for local cattle watering purposes, and some supplies were built by P.W.D. at the request and with the funds of other Government departments, mission installations, and large estates. For example, the Water Boring Section, which originally was a part of the Public Works Department, drilled 88 boreholes on prepayment between 1932 and 1948. A total of 81 of these boreholes were for sisal estates. Official approval for the formation of a Department of Water Development, along with the transfer of a nucleus of staff from Public Works Department, was granted on 1st July, 1945, although it did not start operating as an independent organization until the beginning of 1946. From the first, W.D.& I.D.[2] was intended to provide both professional advice and material and financial assistance to the Native Authorities in the development of water supplies. W.D.& I.D. also took over all responsibility for the construction of new water supplies in outstations and minor settlements that were not included in the group of major towns serviced by P.W.D.

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[1] Department of Water Development and Irrigation, A Short History of Water Development and Irrigation in Tanganyika, Dar es Salaam, 7th September, 1961.

[2] The abbreviation W.D.& I.D. will be used to designate the present Water Development and Irrigation Division as well as all of its direct predecessors.

There were two main types of projects constructed by W.D.& I.D. The first type included water supplies for outstatiions and minor settlements. These projects were financed soley with Central Government Funds and were placed on a self-supporting basis whereby all users, whether from private connections or communal kiosks, paid a water rate. The second type included water supplies constructed for the local Native Authorities, or Rural Local Authorities as they came to be called after Independence. A proportion of the capital cost of these projects was paid by the local authority, while the operation and maintenance was mainly the responsibility of the local authority with some assistance on extraordinary maintenance problems by W.D.& I.D. The effect of this requirement for cost sharing between W.D.& I.D. and the local authority was that the majority of rural water supply projects tended to be built in the wealthier districts while the poorer districts remained essentially unchanged. There was a third type of project built by W.D.& I.D. in the instances when an outside organization or individual was willing to pay the entire cost of the construction. These prepayment projects, as before, were requested by other Government departments, missions, and estates, but in addition the richer Native Authorities began to utilize the contractor services of W.D.& I.D., thus unbalancing the distribution of projects even further.

During the 1950's responsibility for the operation and expansion of the water supply systems in most of the outstations was transferred to the Public Works Department. These supplies are considered as urban in character, and they are now under the control of the Water and Drainage Division of the Ministry of Lands, Housing and Urban Development. The few minor settlement supplies that were constructed generally remained under W.D.& I.D. control and, therefore, are still considered to be rural at the present time.

Exact figures for population served by improved rural water supplies are unavailable because of the difficulty in interpreting the records, as described above. In practice, Government often estimates populations provided with water from the expenditure totals involved. Since W.D.& I.D. currently has a general project expenditure guideline which limits capital costs to a maximum of Shs.200 per person served, a limiting cost figure is sometimes used to determine annual totals of population served. In this manner the Ministry of Economic Affairs and Development Planning used the per capita cost factor of Shs. 200 plus a W.D.& I.D. estimate that Shs. 60 million were expended on rural water supply projects from 1964 to 1969 to conclude that 300,000 people were provided with water during the First Plan.[1] The National Water Resources Council accepts this figure and assumes that 800,000 and 300,000 people were provided with improved water supplies before and during the period of the First Plan, respectively.[2] A somewhat larger total was stated by W.D.& I.D., which claimed that water supplies have been constructed for 1,250,000 rural people through the end of 1968.[3] This figure was estimated to be 11.5 percent of the rural population of eleven million.

Because of the problems of interpreting the project reports, this same method of utilizing expenditure totals to estimate populations will be used in this paper. Table 4 shows calendar-year

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[1] The Second Plan actually stated 60,000 families per year but this is taken as an error: United Republic of Tanzania, Tanzania Second Five Year Plan for Economic and Social Development, Vol.I, Op.Cit., p.40.

[2] National Water Resources Council Secretariat, Tentative, Long-Term Projections on Investment for Rural Water Supply, January, 1970,(mimeo).

[3] Water Development and Irrigation Division, Ministry of Lands Settlement and Water Development, Annual Report, 1968, Op. Cit., p.8.

expenditures by W.D.& I.D. on water supply development for the period 1946 to 1969. Only the figures for actual water supply project construction and for investigations of future projects are included in the table. No figures are given for expenditures on capital equipment or on P.E.F., which is the Professional Emollument factor, or the proportion of total projects costs allocated to salaries and expenses of the permanent W.D.& I.D. staff. Also shown is the total expenditure of the Division for the calendar year.

According to current W.D.& I.D. procedures, project costs are considered to be the capital construction costs, the hire and renewals cost for equipment, and P.E.F., which is taken to be 20% of the sum of the other two items. Because of the changes in cost accounting, the construction costs of regular water supply projects are given in columns 2, 4, and 5 of Table 4. In addition to these regular project expenditures, there are separate amounts shown for the Masai Development Plan of 1952-57, contributions from Native Treasuries 1946-50, and expenditure on prepayment projects 1957-68. The Masai Development Plan had the main objective of improving cattle water supplies; the Native Treasury contributions were the local portion of water supply project costs for those years, while prepayment projects included water supplies for estates, missions, other Government divisions, and additional supplies for local authorities.

Not all of the expenditure totals in Table 4 were for actual water supply projects and, therefore, should not be included in a determination of populations provided with improved water. The problems of determining the correct total are illustrated by one W.D.& I.D. report which stated that by the end of 1952 it had built 225 Native Authority water supplies having a capital value of £ 200,000[1], but by the end of 1953 the cumulative number of such

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[1] Tanganyika, Department of Water Development, Annual Report, 1952, Op. Cit., p.4.

Table 4: W.D.& I.D. Expenditures for Rural Water Supply Development in Millions of Shillings.

Year (1)	Surveys and Investigations (2)	General Water Development (3)	Water Supply Development (4)	Native Authority or Rural Local Authority Water Supplies (5)	Prepayment Projects (6)	Native Treasury Contribution 1946-50 Masai Development Plan 1952-57 (7)	Total Expenditures for Dept/Div. (8)
1946		0.18				0.02	1.41
1947		0.63				0.22	1.95
1948		1.44				0.04	2.94
1949		1.36				0.03	3.38
1950		2.11				0.04	5.37
1951		1.78				Masai	4.71
1952		2.20				0.56	7.05
1953		2.02				1.14	7.45
1954		2.54*				1.02*	7.92*
1955		3.57				0.46	12.92
1956		3.91				0.23	15.58*
1957	0.95			1.36	2.10	0.05	15.58
1958	1.09			2.25	1.72		16.71
1959	0.88			3.08	2.03		14.64
1960	0.98			2.66	2.01		12.81
1961	1.66			5.07	0.74		18.04
1962	0.62			2.64	0.34		13.05
1963	1.53			4.32	0.27		16.36
1964	1.72			1.99	0.43		23.92
1965	1.19		1.99		0.49		24.34
1966	0.80		4.63		1.23		28.55
1967	3.45		5.57		0.48		25.12
1968	7.05		13.23		3.69		41.80
1969	5.87*		21.30*		**		**
Totals	27.82	21.88	46.30	23.36	15.52	N.T. = 0.36 Masai = 3.45	--

*Estimates

** Not available.

Sources: Tanganyika/Tanzania, Water Development and Irrigation Division, Annual Reports, 1946-68 Dar es Salaam, Government Printer, Figures for 1969 estimated from Tanzania, Estimates of Development Expenditure, 1st July, 1968-30th June, 1969 and 1st July, 1969-30th June, 1960, Dar es Salaam, Government Printer.

supplies was claimed to be only 133 and the total capital value of £ 215,000.[1] In any event, the actual expenditures for Native Authority supplies over the period 1946-56 appears to be about one-half of the development expenditures charged to water supplies. The other half was used for surveys and investigations, outstation water supplies, irrigation, flood control, etc. Similarly, the expenditures for prepayment projects between 1957 and 1968 included an unknown amount of works on activities other than rural water supplies. For this reason, with the exception of the 1968 expenditures, only half of the prepayment expenditures will be taken as part of rural water supply capital costs. The 1968 prepayment expenditures were mainly for the Nyumba ya Mungu Dam power station; therefore, the entire figure for that year has been rejected. The resulting total capital expenditures on rural water supply projects between 1946 and 1969 are shown to be Shs.89,336,000 in Table 5.

Table 5. W.D.& I.D. Expenditures for Rural Water Supply Construction.

Table 4 Column Number	Type of Expenditure	Total Expenditure (mil.Shs)	Estimated Percent for Rural Water Supplies	Expenditure on Rural Water Supplies (mil. Shs.)
2	Surveys & Investigations, 1957-69	27.82	0%	-
3	Water Development, 1946-56	21.88	50%	10.94
4	Water Supply Project Development, 1957-69	46.30	100%	23.15
5	Native Authority/ Rural Local Authority, 1957-64	23.36	100%	11.68
6	Prepayment Projects 1957-67	11.84	50%	5.92
7	Masai Development Plan, 1952-57	3.45	100%	1.72
7	Native Treasury Contribution, 1946-50	0.36	100%	0.36
			Total =	89.34

Source: Table 4.

[1] Ibid., Annual Report, 1953, p.4.

Rather than use the limiting capital cost figure of Shs. 200 per person served by a water project as an estimator of population totals, a more realistic set of cost figures will be proposed for the 24 years of record. Last year W.D.& I.D. made an analysis of all major rural water supply projects completed during the 1968-69 financial year and determined that the average capital cost, including P.E.F., was Shs. 170 per person served.[1] Since P.E.F. currently is charged at 20% of all other project costs, the average capital cost, excluding P.E.F., for these 39 analysed projects was Shs. 142 per person. This is the figure that should be used with the annual capital expenditure totals, because projects costs shown in Tables 4 and 5 do not include P.E.F. charges. It also is assumed that per capita project costs during the early years of W.D.& I.D. operations were lower than at present. Consequently, per capita expenditures are assumed to have been Shs.142 only for 1968-69 and are estimated to have been Shs. 130 for 1965-67 and Shs. 100 for 1946-64. There is no firm evidence to support these figures other than the argument that they seem reasonable. They probably are at least as reliable as the totals for capital expenditures on actual rural water supply projects. If anything, these figures probably result in an overly-optimistic number for the total present rural population provided with improved water supplies. This is because no allowance has been made for unrepaired or abandoned projects, as all schemes are assumed to be operating. Table 6 presents these figures and concludes that the total number of people served by W.D.& I.D. since 1946 equals about 760,000.

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[1] Water Development and Irrigation Division, Ministry of Agriculture, Food and Co-operatives, Rural Water Supplies: Aspects on Costs for the Implementation of the Programme in the Second Five Year Plan, Dar es Salaam, 29th August, 1969, (mimeo).

Table 6. Rural Populations Provided with Water by W.D.& I.D.

Period	Capital Expenditure (mil. Shs)	Per Capita Expenditure (Shs)	Total Population Served
1946-64	41.50	100*	415,000
1965-67	13.29	130*	102,000
1968-69	34.54	142	243,000
1946-69	89.34		760,000

*Estimates by author.

There are several other organizations which develop, or have developed in the past, rural water supplies. One major improved rural supply was built by the Makonde Water Corporation in the 1950's to supply the people living on the Makonde Plateau, which now has an overall population of 300,000. The project eventually was turned over to the Public Works Department, but on 1st January, 1970, the project was placed under the control of W.D.& I.D. It is estimated that about 200,000 people utilize the 43 water kiosks in the Makonde supply. Other organizations which have current programmes for rural water supply development include the Community Development Trust Fund, the Kibaha Health Centre, and Salawe Mission. All of these organizations emphasize the construction of dug wells with handpumps. As shown in Table 7, the total rural population in mainland Tanzania receiving improved water supplies as of mid-1969, the start of the Second Five Year Plan, can be estimated at just over 1,100,000 people. This is about 9.8 per cent of the rural population of 11,470,000 which was calculated in section II (1). Thus, out of an overall 1969 population of 12,557,000, about 8.9 per cent of the people were served with improved rural supplies and about 5.2 percent (650,000) were using improved urban supplies.

Table 7. Rural Population Provided with Water at Start of Second Five Year Plan, 1969.

Organization	Number of Wells Constructed	Average Population per well	Total Population Served
W.D.& I.D.	-	-	760,000
Makonde Water Supply	-	-	200,000
Community Development Trust Fund	750	200	150,000
Kibaha Health Centre	45	150	6,750
Salawe Mission	40	100	4,000

Sources: Makonde: Water and Drainage Division estimates.
CDTF, Kibaha, and Salawe: Dennis Warner, Programmes for Rural Water Supply Development in Tanzania and Kenya, BRALUP Research Notes No.5d, University of Dar es Salaam, (forthcoming).

There are undoubtedly other organizations which have provided large numbers of people with water. These would include sisal and sugar estates, missions, and the former Ruvuma Development Association. However, no data is available for these organizations, and the total shown in Table 7 is thought to be sufficiently optimistic to more than compensate for the omission of other large rural supplies. In fact, it is the opinion of the author that the actual number of improved supplies that are considered adequate by both Government and the local users and that do not required immediate replacement serve a population considerably less than one million people. This opinion is reinforced by the fact that a significant, but unknown, proportion of rural water supply development was made on behalf of livestock, but the preceding tables assume all expenditures were made for human beings.

III. Finance

III (1) Capital Expenditures on Rural Water Supply Projects.

Capital expenditures for new plant and construction equipment used by W.D.& I.D. have always been the responsibility of Government, although various charges for renewals (amortization) of equipment have been included within project costs over the years. Before 1965, capital expenditures incurred by W.D. & I.D. for new water supply projects were divided into three major classifications, depending upon the repayment provisions involved. These three major classifications were (1) Government outstations and minor settlement water supplies, (2) Native Authority or Rural Local Authority water supplies, and (3) prepayment water supplies.

Water supplies for Government outstations and minor settlements were financed and owned completely by Government, and water rates were charged to recover capital, operation, and maintenance costs. These supplies were owned completely by Government, and in almost all cases they were sited in administrative centres having some European settlement. Most of these locations are present day District capitals. For the purposes of rural water supply planning, these areas now are considered to be urban in character and are not included within rural water programmes.

Water supplies for Native Authorities, or Rural Local Authorities as they later came to be known, initially were financed by a cost sharing arrangement between the local authority and W.D.& I.D. From 1946 to 1953 the local authorities were required to contribute 33 percent of the capital costs of construction, with W.D.& I.D. providing the remainder. During the following two to three years the local authorities were forced to pay the entire costs, but around 1956 this requirement was reduced to 50 percent. Two years later, the local share was reduced still further to 25 percent, and in 1965 it was eliminated altogether. The result of these earlier

cost sharing requirements was that development tended to be concentrated in the richer Districts, with Kilimanjaro and the East and West Lake areas especially favoured with projects.

The third classification, prepayment water supplies, included projects built by W.D.& I.D. on a contractor basis for, and with the requirement of full repayment by, other departments, local authorities, missions, and estates. Prepayment of all capital costs was required, and upon completion, the projects were turned over to the payee for complete ownership and control. In Districts where funds were available, the local authorities frequently financed the entire cost of small water supply projects for which they wanted immediate action.

The advent of Swedish aid in 1965 brought significant changes in the financing of local authority water supplies, which constitute the vast majority of recent W.D.& I.D. activity. In 1965, Government assumed all capital costs of all regular rural water supply development. The result of this policy was that projects began to be allocated throughout the country on the basis of local need and the works capacity of W.D.& I.D. in the different Regions. Prepayment projects continue to be built, but the majority of current expenditures for such works are derived from the Regional Development Fund allocated to each Region.

III (2) Recurrent Expenditures for Operation, Maintenance, and Renewals.

Recurrent expenditures for plant, equipment, and salaries likewise are financed by W.D.& I.D. and are partially reimbursed through various charges added to project costs. Capital, operation, and maintenance costs for Government outstations and minor settlements were and continue to be recovered through water rates levied on the consumers. In the early years of W.D.& I.D. activities, outstation supplies occasionally were both built and operated by W.D.& I.D., but more often the responsibility for running the

project fell upon the District Commissioner, who was allocated Public Works funds for this purpose. From about 1954 onwards, the tendency was to transfer responsibility for the daily operation of these supplies to the Public Works Department. At the present time most of these supplies are under the control of the Water and Drainage Division of the Ministry of Lands, Housing and Urban Development.

Projects built by W.D. & I.D. for local authorities before 1970 were owned and operated by the appropriate local council. Operation and normal running costs were locally financed from the beginning; however, methods of paying for maintenance and renewals costs have varied over the years. Initially, the Native Authorities were completely responsible for all maintenance expenses. Because of the poor standards of maintenance that resulted, W.D.& I.D. during the 1950's attempted to provide regular maintenance services as well as replacement renewals of equipment. The local authorities were requested to pay an annual sum of equal to 2.5 percent of the capital value of all projects in the District in return for this service. The results were not entirely satisfactory, partly because actual costs tended to exceed 2.5 percent, partly because W.D. & I.D. did not have the facilities to adequately maintain an increasingly dispersed network of projects, and partly because some local authorities either were unable or preferred not to participate in the maintenance programme. In 1960, the programme was terminated, and local authorities again became responsible for maintenance. W.D.& I.D. continued to provide requested maintenance on prepayment as it had always done, but such requests were too few for proper maintenance. A new approach was attempted in 1965 when Government assumed all capital costs of project development. Under this approach District Councils retained responsibility for normal operational costs of water supplies, but W.D. & I.D. assumed responsibility for maintenance and repairs in return for an annual

deposit of one percent of total project capital costs. If maintenance costs exceed one percent of capital costs, W.D.& I.D. carried out further repairs on a prepayment basis. No renewals charges were levied, because Government has assumed all development costs. The allocation of new projects was influenced by the record of the District Council in supplying W.D.& I.D, with the necessary maintenance funds or in providing an adequate maintenance service of their own. Despite these provisions, District Councils continued to have difficulty in supplying the required funds, and the termination of the head tax and produce cesses in 1969 removed the sources of revenues that Councils drew upon for such expenditures. As a result, on 1st January, 1970, Government took over the operation and maintenance of existing and future rural water projects, thereby becoming responsible for all capital and recurrent costs involved in rural water supply development.

Recurrent expenditures for prepayment and privately-built projects have always been the responsibility of the authority, department, or organization owning the project. In the case of projects financed by local authorities either with District Funds or through the Regional Development Fund, no firm policy has yet been decided by Government, but it is likely that W.D.& I.D. will assume all recurrent costs in the near future. Only supplies owned by missions, estates, and private and international organizations are operated and maintained outside of the Central Government.

III (3) Sources of Finance.

During the colonial period financial support of water supply development came from three main sources, which included Colonial Development and Welfare Committee grants, Territorial Funds, and prepayment projects. Capital equipment and development expenditures for overall W.D.& I.D. activities usually derived from the C.D.& W. grant, while recurrent expenses were financed from Territorial Funds.

Government outstations and minor settlements initially were financed with C.D.& W. funds, but after the first few years support came from Government Loan Funds, which had to be repaid from project water revenues. No additional Government outstation or minor settlement supplies were built after 1963.

C.D.& W. grants provided the Government portion of funds in the various cost sharing schemes for Native Authority projects. No repayment was required for C.D.& W. funds. The local portion of project costs was drawn from Native Treasury funds. Funds for water supplies of a prepayment nature, of course, came from the sponsors of the projects. After Independence in 1961, finance for outstation supplies and supplies for other Government departments continued to come from Government Loan Funds or from full prepayment. Funds for the construction of local authority water supplies under the 25% - 75% cost sharing arrangement came from District Council treasuries and from regular Central Government allocations, respectively. Although the lack of local authority funds was the usual reason for the limitation of project development, in 1964 and 1965 the main shortage occurred in the availability of Central Government funds. In 1963 financial grants from the Freedom from Hunger Committee in the United Kingdom provided Shs. 600,000 towards the local share of project costs in the famine stricken areas of Dodoma, Singida, and Arusha Regions.

A major breakthrough occurred in 1965 when the first of the three Swedish loans for rural water supply development was negotiated. The Swedish credits are provided for rural water supply development expenditures on equipment, surveys and investigations, and project construction only. They cannot be used for capital expenditures on other than rural water supply development, nor on any recurrent expenditures, although P.E.P. costs allocated to water supply projects are allowed. Furthermore, there are no restrictions limiting the use of Swedish credits to any particular

type of equipment or level of labour utilization. These aspects have been left to the discretion of W.D.& I.D., although all projects must receive the approval of a senior Swedish advisor before they can be included in the programme. Within each category of development expenditure, the Swedish credits are designed to cover 80 percent of the total, with the remaining 20 percent of expenditure supplied from internal Tanzanian sources. Each of the loans are repayable over 25 years, including an initial ten year grace period, at an annual interest rate of two percent on the principal.[1] The First Credit Agreement, Shs.11,635,532, was intended to finance development during the 1965-66 financial year. The Second Credit, which totalled Shs.41,422,200, was for the period 1966-69, while the Third Credit, Shs. 20,711,100, was for the financial year 1969-70. As of July, 1970, no additional foreign loans for rural water supply development had yet been negotiated.

IV. Project Allocation

IV (1) Financial Allocations Between Regions.

Before 1965, allocations of Government finance for the development of rural water supplies were based almost completely upon the ability of the local authority to raise its share of project costs. As a result, project development tended to be concentrated in the wealthier Districts. In 1965, Government assumed all capital costs of project development, thereby, in principal, allowing the distribution of subsequent projects to occur according to the needs of the people rather than their ability to pay. Such a distribution of projects did occur to some extent; however, the general pattern of subsequent development was that the bulk of project construction continued to occur in the Regions which contained a strong W.D.& I.D. administrative and field establishment. These were the Regions with the capacity to investigate, plan, design, and construct projects. Although W.D.& I.D. expanded its works capacity in the lesser developed Regions, the distribution of actual projects continued

1. J.M.Kaduma, "Foreign Aid and Rural Development in Tanzania," in I.Livingstone and C.Nyirabu eds., Foreign Aid and Rural Development: Proceedings of a Seminar, Economic Research Bureau, University College, Dar es Salaam, January, 1970, p.200.

to favour the better developed Regions. Those Regions having a large W.D.& I.D. works capacity included Kilimanjaro, Arusha, Mwanza, Tabora, and Dodoma, while Regions with a small W.D.& I.D. capacity for project development included Mara, Shinyanga, Singida, Kigoma, Mbeya, Mtwara, and Ruvuma.

A new system of allocating rural water supply finance to the Regions was formulated by WD&ID for the 1969-70 financial year, the start of the Second Plan. This system allocates water supply investment on the basis of regional population totals, livestock totals, livestock carrying capacity, and the past distribution of funds. All of those items were used to determine regional distribution factors, or the percentage of annual expenditures to be allocated to each Region. Table 8 outlines the derivation of these factors. In this table, the estimated cattle population requiring improved water supplies is expressed in terms of equivalent human beings, in which the daily water needs of two cattle are assumed to be equal to a single person. The resulting figure for equivalent persons is modified also by considerations of regional cattle carrying capacity and likely future cattle populations. As shown in the table, the current water supply needs of cattle in Tanzania are estimated by WD&ID to be equivalent to a human population of 2,223,000. The regional figure for equivalent people is added to the regional rural human population to determine the existing rural population in each Region. From this total is subtracted the total number of people who have received improved water supplies since 1948. The estimate of people served is based upon total development expenditures for 1948-69 divided by an assumed cost of Shs. 200 per person served. The resulting total of people and equivalent people still to be provided with improved water supplies in each Region then is converted directly into regional distribution factors.[1]

[1] Water Development and Irrigation Division, Tanzania Rural Water Supply Development Programme 1969-1974, 26th November, 1968, (mimeo).

Table 8. Derivation of WD&I[D] Regional Distribution Factors.

Region	People	Cattle			Past Development		Total Population to be served	Regional Distribution Factor (%)
	Rural Population 1968	Existing	Theoretical Carrying Capacity	Equivalent People	Rural Water Supplies 1948-69 (mil.shs)	Population Served		
Coast	508,752	70,000	150,000	35,000	3.46	17,300	526,400	4.1
Morogoro	657,798	80,000	250,000	50,000	4.13	20,650	687,100	5.3
Tanga	708,365	260,000	500,000	130,000	7.61	38,050	800,300	6.2
Kilimanjaro	623,564	210,000	200,000	100,000	16.40	82,000	641,600	5.0
Arusha	569,167	1,580,000	1,600,000	237,000	15.63	78,150	728,000	5.6
Mwanza	1,022,840	625,000	500,000	250,000	8.84	44,200	1,228,600	9.5
Mara	520,467	730,000	700,000	130,000	2.37	11,850	638,600	4.9
Shinyanga	888,209	2,690,000	2,000,000	300,000	5.24	26,200	1,162,000	9.0
West Lake	648,893	100,000	500,000	100,000	3.64	18,200	731,700	5.7
Tabora	531,345	640,000	1,000,000	133,000	13.44	67,200	597,100	4.6
Kigoma	449,404	50,000	250,000	50,000	1.10	5,500	493,900	3.8
Singida	454,749	620,000	620,000	114,000	5.72	28,600	540,100	4.2
Dodoma	684,853	1,150,000	1,000,000	171,000	11.63	58,150	797,700	6.2
Mbeya	963,422	580,000	750,000	233,000	3.30	16,500	1,159,900	9.0
Iringa	661,609	620,000	650,000	165,000	4.58	22,960	803,700	6.2
Mtwara	991,131	15,000	100,000	15,000	4.43	22,150	991,900	7.7
Ruvuma	392,812	10,000	100,000	10,000	2.19	10,950	391,800	3.0
Total	11,266,384	10,030,000	10,870,000	2,223,000	113.71	568,550	12,920,400	100.0

Source: Water Development and Irrigation Division, Tanzania Rural Water Supply Development Programme 1969-1974, 26th November, 1968 (mimeo).

Because of existing differentials in works capacity between WD&ID regional offices,[1] the regional allocation of development funds has not yet taken place strictly according to the distribution factors shown in Table 8. Nevertheless, these factors represent the financial distribution towards which WD&ID currently is rapidly moving in the allocation of regional funds and the expansion of works capacities. WD&ID, itself, emphasizes that the regional distribution factors are not necessarily a final solution to the allocation problem but should be seen only as part of a continuing effort to bring about a more equitable distribution of development.

Table 8 is based upon a mixture of both social and economic criteria, which reflect the dual nature attributed to rural water supplies by the Second Plan:

> The provision of adequate water supplies to rural areas is of high priority on both economic and social grounds. Economically, water is not only a critically important input into the agriculture and livestock industries, but the provision of better domestic water supplies will both release much labour currently consumed in carrying water for other productive purposes and allow a more efficient pattern of settlement. The provision of better rural domestic water supplies is also a necessity for the achievement of a better quality of rural life, both in health and convenience, which can provide a counter-attraction to the convenience of urban living.[2]

In Table 8, investments for human populations appear to be taken only as a social service, because regional allocations are made solely on the basis of the number of people requiring improved water supplies. No consideration is given to agricultural potential, labour utilization, or settlement patterns. On the other hand, investments for cattle populations are greatly affected by economic considerations. Such factors as the potential carrying capacity

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[1] In 1969, WD&ID had offices in 15 of the 17 Regions of mainland Tanzania. Kigoma Region is administered by the Regional Water Engineer in Tabora, and Ruvuma Region is administered through Mtwara.

[2] United Republic of Tanzania, Second Five-Year Plan for Economic and Social Development, Vol.I, Op. Cit., pp. 39-40.

of land, the number of cattle adequately served by natural water sources, and planned future cattle populations all influence the determination of the existing water needs of cattle in the Regions. Overall, cattle account for 17.2 percent of expenditures allocated by the Regional Distribution Factors in Table 8, or approximately one-sixth of the national total. However, the distribution of accepted cattle water needs tends to be concentrated in a few Regions, notably Arusha, Mwanza, Shinyanga, and Mbeya. As shown in Table 9, this concentration has the effect of reducing the allocation of rural water expenditures to Regions having small cattle populations. Morogoro, Mtwara, and Ruvuma Regions, for example, contain 18.7 percent of the total human population requiring improved supplies but, because their combined cattle water needs equal only 3.3 percent, the resulting expenditure allocation for these Regions is reduced to 14.8 percent. The distribution factor for Mtwara Region, alone, is reduced from 9.1 to 7.7 percent of the total by the inclusion of cattle in the analysis.

IV (2) Project Selection Within Regions.

Allocations of funds for most individual projects since 1965 have been based upon the decisions made by administrative and political officials within the Region concerned. In brief, project requests often originate at the village level, pass successively through the Village Development Committee (VDC), the District Development and Planning Committee (DDPC), and finally the Regional Development Committee (RDC), where they are given a priority ranking relative to all other approved projects in the Region. Occasionally, project requests are initiated by the Area Commissioner or the Regional Commissioner, who usually send their proposals directly to the Regional Development Committee for approval.

Table 9. Regional Distributions of Human and Cattle Populations Requiring Improved Water Supplies in 1968.

Region	WD&ID Regional Distribution Factor %	People		Cattle	
		Total	Percent	Total	Percent
Coast	4.1	491,500	4.6	70,000	1.6
Morogoro	5.3	637,100	6.0	100,000	2.2.
Tanga	6.2	670,300	6.3	260,000	5.9
Kilimanjaro	5.0	541,600	5.1	200,000	4.5
Arusha	5.6	491,000	4.6	474,000	10.7
Mwanza	9.5	978,600	9.1	500,000	11.2
Mara	4.9	508,600	4.7	260,000	5.9
Shinyanga	9.0	862,000	8.0	600,000	13.5
West Lake	5.7	630,700	5.9	200,000	4.5
Tabora	4.6	464,100	4.3	266,000	6.0
Kigoma	3.8	443,900	4.1	100,000	2.2
Singida	4.2	426,100	4.0	228,000	5.1
Dodoma	6.2	626,700	5.9	342,000	7.7
Mbeya	9.0	926,900	8.7	466,000	10.5
Iringa	6.2	638,600	6.0	330,000	7.4
Mtwara	7.7	977,000	9.1	30,000	0.7
Ruvuma	3.0	381,900	3.6	20,000	0.4
	100.0	10,696,600	100.0	4,446,000	100.0

Source: Derived from Table 8.

Project evaluation is introduced at several stages of the selection process. At the village level, project requests usually are forwarded by the VDC directly to the DDPC, which is composed of Central Government administrative officers, local government officials, and some elected councillors. Often, these requests do not propose an actual project but simply ask for a better water supply. The DDPC usually forwards these requests to the appropriate WD&ID Regional Water Engineer, who carries out a preliminary investigation of the project to determine the existing water situation, possible methods of improvement, and likely costs. These results are given to the DDPC, which with the approval of the District Council either forwards the request on to the RDC or informs the VDC that no action will be taken. Occasionally, a DDPC will draw up a District priority list for proposed water supply projects. If the project request is forwarded to the regional level, the Regional Development Subcommittee, composed of the Regional Commissioner and the heads of the Central Government regional level offices, considers the technical and economic merits of the project. Normally, the technical aspects and estimated costs of proposed projects are accepted by the RDC on the basis of the advice of the WD&ID Regional Water Engineer, who also is a member of the Committee. Final technical designs of projects funded by WD&ID, however, must be approved by the WD&ID head office in Dar es Salaam. The economic, social, and political aspects of proposed projects, are the responsibility of the entire RDC. During the past few years, the RDC has been required to consider the following issues in the selection of future water projects:

"(1) The urgency of the needs for new and improved water supplies for domestic purposes and for livestock.

(2) The economic benefit expected to result from improved water supplies, as compared to their estimated cost.

(3) The ability of the Government to support the establishment of a water project with other public services designed to promote economic development.

(4) The manner in which existing water supplies are maintained and utilized.

(5) The capacity of WD&ID to carry out the work itself or through other means."[1]

Projects that are accepted by the Subcommittee are brought before the full Regional Development Committee of elected officials, appointed members, and regional heads for final approval and priority determination. Although the entire Committee is empowered to act upon project proposals, in practice the degree of participation by the Regional Commissioner strongly influences the outcome. In some Regions, the recommendations for project acceptance and priority by the Regional Water Engineer are approved by the RDC without modification.

After the decision by the RDC and the approval of the preliminary investigation report by the WD&ID head office in Dar es Salaam, the Regional Water Engineer prepares an engineering design for the project. This design must be approved by the WD&ID

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[1] Water Development and Irrigation Division, Administrative Instructions, Regarding the Choice and Design of Rural Water Supply Projects, Ref. No. G.2/194, Dar es Salaam, 25th May, 1968, (mimeo).

head office, which then allocates funds for the project subject to the inter-regional allocation of funds for the year in question and the ranking of the project on the regional priority list. The actual implementation of projects during a given financial year usually follows the RDC priority list for that year. For the Second Five Year Plan, 1969-74, each Region was instructed to draw up lists of annual project priorities for the entire plan period. Although the process of project selection described above refers specifically to the overall regional water programme financed by Central Government, projects financed through the Regional Development Fund are selected in much the same manner. The major differences are that Regional Development Fund projects usually are relatively small and utilize some self-help labour and that technical approval of the WD&ID head office generally is not required unless WD&ID is hired to carry out the construction.

Despite the requirement for the economic evaluation of projects by the Regional Development Committee, little actual analysis is ever carried out on routine water supply schemes. This is partly due to a lack of knowledge concerning the economic benefits of improved domestic water supplies. In the case of livestock water supplies, better economic data is available, but regional officials within WD&ID and within the Veterinary Division of the ministry rarely work together on routine water projects. Another reason for the lack of economic evaluation is the shortage of economic expertise in the Regions. An attempt to rectify this situation was made by Government in 1968 with the posting of Regional Economic Secretaries to the Regions for the purpose of advising the RDC's on economic matters. However, the combination of heavy work loads and inadequate methods of project evaluation have prevented the Regional Economic Secretaries from having any significant beneficial effect upon the process of project

selection and implementation in the field of rural water supply. One of the most common deficiencies of project proposals is the lack of cost comparisons of alternative technical methods of providing water for given villages. Such cost-effectiveness analyses are rarely undertaken because Regional Water Engineers generally have neither the time nor the staff to carry out proper cost comparisons. As a result, they tend to produce project designs based upon personal judgments of the best available technical method without actually comparing the costs of different technical solutions.

Given the essential social nature of rural water supplies, at least as defined by Government, the present procedure of allowing local authorities to determine project priorities theoretically places decision-making in the hands of those most familiar with local conditions and needs. This decentralization of decision-making frees the Central Government of many of the problems of selecting and allocating projects from Dar es Salaam. However, the process of project selection by the Regional Development Committees is only as good as the selection criteria established for and utilized by the Committees. The generalized criteria shown above[1] set out major issues but do not provide specific operational guidlines. Consequently, the members of the RDC often are forced to rely on the recommendations of the Regional Water Engineer or the Regional Commissioner, although in most cases these recommendations are based more upon personal judgments than upon analytic comparisons.

There is nothing inherently wrong in utilizing personal judgment in project selection, as long as similar results can be obtained by others having access to the same information. It should be understood, however, that problems may occur if unstated values are implicitly assigned to various aspects of competing project proposals. Since only the decision-maker may know (or sense)

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[1] Ibid.

the relative weights of these values, his conclusions are likely to be difficult to verify or duplicate. In the absence of firm, operational criteria, there is no to evaluate the effectiveness of a selection procedure based heavily on implicit personal judgments. It is for this reason that the development of useful project selection criteria for Regional Development Committees is one of the major needs for future Tanzanian rural water development.

V. Project Economics

V (1) Project Costs and Implicit Economic Returns.

Project costs are the main factor determining the number of projects built, and ultimately populations served, for a given overall expenditure. The main determinant of project costs are the technical design criteria by which schemes are planned and constructed. Over the period of the First Five Year Plan and at the beginning of the Second Plan the following criteria were in effect:

(1) Project components were designed for either a five or ten year period representing a fifty percent or one hundred percent increase in project consumers, respectively. Generally, pumps and storage tanks were designed for the expected five year demand while rising mains and distribution piping were designed for the expected ten year demand.

(2) Storage tanks were designed to hold a 24 hour supply of the expected five year demand.

(3) Domestic water points served a maximum of two hundred people each.

(4) Project components usually were designed to provide ten gallons per person per day for the expected five or ten year population, whichever was applicable. Within project areas an attempt was made to limit water-carrying distances to a maximum of one-quarter mile.

(5) Most pumping installations, other than boreholes, were supplied with a spare engine and pump in order to maintain a stand-by capacity.

In addition to the above technical criteria, there was a financial restriction that projects normally should not cost more than Shs.200 per person of the existing population served.

In general, individual water supply projects serve populations varying between as few as one hundred people to as many as four thousand. A standard borehole with distribution, for example, will consist of the drilled and cased borehole, the engine, pump, and pump house, the attendant's quarter, the rising main, storage tank, gravity main, distribution piping, cattle trough, and several domestic water points.

Typical project costs for a sample of 89 projects approved for Swedish Credit during 1968 and 1969 are shown in Table 10. This sample represents about one-half of the total projects approved during that period. The table shows that current average project costs are considerably higher than the corresponding costs estimated by Government in 1964. Besides the inevitable price increases over time, the cost differentials are partly due to the fact that easy-to-develop sites are becoming scarcer and partly to the fact that Government is building larger projects in order to take advantage of economies of scale. For example, the borehole, gravity, and pumped projects included in Table 10 for 1968-69 have investment costs of Shs.18.0 to Shs.28.5 per gallon per day for a project capacity of 5,000 gallons per day but only Shs.5.0 to Shs. 8.0 for a project capacity of 50,000 gallons per day. On a per capita served basis, the borehole projects tend to have the highest unit costs, followed by the pumped and then the gravity projects. Most projects have unit costs ranging between Shs.120 and Shs.200 per person served. Projects which exceed this cost range generally tend to have small daily supply capacities.

Table 10. Cost of Typical Rural Water Supply Projects.

Type of Project	1964 Average Cost (1000 Shs)	1968 and 1969			
		Ave. Cost (1000 Shs)	No. of Projects Analysed	Cost Range (1000 Shs)	Average Capacity (1000 gal/day)
Borehole with headworks	60	-	-	-	-
Borehole with distribution	-	179	35	72 - 500	19
Gravity pipeline	60	221	18	22 - 500	35
Pumped Supplies	200	267	29	85-1,096	31
Charcos	20	64	6	38 - 124	10.5
Earth dams	100	146	1	-	17
Shallow wells with handpumps	10	-	-	-	-

Sources: 1964: The United Republic of Tanganyika and Zanzibar, Five-Year Plan for Economic and Social Development, 1st July, 1964 - 30th June, 1969, Vol.II, Dar es Salaam, Government Printer, 1964, p. 39.

1968-69: Recent estimates of Swedish Credit projects.

Using the above per capital project costs along with several assumptions with regard to project life, recurrent costs, and interest rates on capital, the implicit stream of benefits necessary to equalize the costs can be calculated. For this purpose, project life is assumed to be twenty years with a zero salvage value at the end of that period; annual operation and maintenance costs are estimated conservatively at five percent of capital costs, and the interest rate, or opportunity cost of capital, is taken at the commonly-used Government rate of eight percent per annum. It was stated above that most projects have unit costs ranging between Shs.120 and Shs.200 per person served. At the level of Shs.200 per capita, and with the

above assumptions in effect, the implicit stream of benefits must be equal to approximately Shs.30 per person per year. At the level of Shs.120, implicit annual benefits must equal about Shs.18.

These figures for implicit benefits do not imply that direct economic returns of the indicated amounts must occur. In the first place, direct economic benefits resulting from water supplies are difficult to measure, and, secondly, WD&ID is quick to point out that rural water supplies are "a social service not amenable to conventional cost-benefit analysis".[1] The figures for implicit annual returns do mean, however, that the resulting benefits, whether they be economic or social, tangible or intangible, must be equal to the discounted annual costs if the projects are to be considered worthwhile. The fact that Government builds projects which are largely social in nature without requiring explicit economic returns indicates that Government believes that the non-economic benefits resulting from the projects have an implicit value to the country at least equal to the monetary costs of the projects.

V (2) Labour Inputs.

Within WD&ID, routine rural water projects are divided into two groups, big projects and small projects, characterised by whether their construction costs exceed or are less than Shs.50,000, respectively. WD&ID has estimated that during the period 1966-69 ninety percent of all its rural water supply expenditures came from Central Government sources, and 95 percent of these expenditures were used in the big project category. Of the remaining ten percent, the sources of which were District Councils, missions, and private estates, only one-fourth were utilized for big projects.

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[1] Letter from the Director of Water Development and Irrigation Division, WD&ID Ref. No. W.291/17, 30th September, 1968.

Table 11 illustrates the distribution of expenditures between big and small projects for both Government and non-Central Government sources of finance for the period 1966-69. The table shows that projects built with funds from District Councils, missions, or private estates are much more likely to involve small projects than those built with regular WD&ID funds.

Table 11. Distribution of Rural Water Supply Expenditures According to Project Size 1966-69.

Source of Funds	Size of Project	Distribution of Expenditures (%)
Government	Big	85.5
	Small	4.5
Other	Big	2.5
	Small	7.5
		100.0

Source: Water Development and Irrigation Division, Ministry of Agriculture, Food and Co-operatives, Rural Water Supplies: Aspects on Costs for the Implementation of the Programme in the Second Five Year Plan, 28th August, 1969, (mimeo).

These facts are included in a recent WD&ID study which analyzed all 39 of the big projects which it completed during the 1968-69 financial year in order to obtain an estimate of the likely cost reductions with self-help labour.[1] At the present time WD&ID constructs almost all projects with paid labour. It was found that the projects had an average unit cost of Shs.170 (including P.E.F.) per person served with water.[2] Construction time was seen to be

[1] Water Development and Irrigation Division, Ministry of Agriculture Food and Co-operatives, Rural Water Supplies: Aspects on Costs for the Implementation of the Programme in the Second Five Year Plan, Op.Cit.

[2] Under the assumptions given in section V (2), the implicit stream of benefits necessary to reduce this capital cost to zero must have a value of Shs.26 per person per year.

a critical factor in the overall cost of projects. Because of heavy demands upon the scarce amount of construction equipment, professional supervision, and administrative services, increases or decreases in construction time affect the total number of projects undertaken during a given financial year. The opportunity cost of unskilled labour, on the other hand, is low, as there normally are few alternative employment opportunities available. Table 12 gives the WD&ID estimate of the contributing cost factors for these 39 projects as well as the proportion of each cost factor dependent upon construction time. The table shows that 32.5 percent of project costs were estimated to be directly dependent upon time; therefore, variations in project costs are related to deviations from the average project construction time in the ratio of 0.325 to 1. Using this figure, project costs would be reduced by a maximum of 32.5 percent if construction time could be reduced to zero.

Table 12. Cost Breakdown for Typical WD&ID Big Projects 1968-69.

Costs	Percent of Total	Proportion Dependent Upon Construction Time	
		Individual (%)	Cumulative (%)
Material	40	0	0
Labour: unskilled	8	0	0
Labour: skilled	12	50	6.0
Transport	10	20	2.0
Auxiliary equipment	5	90	4.5
Administration debited to project	5	80	4.0
P.E.F.	20	80	16.0
	100		32.5

Source: Ibid.

It was assumed in the WD&ID study that careful planning of big projects would reduce construction time by 30 percent but that the use of self-help labour would increase overall construction time by 30 percent also, thus cancelling out any time savings resulting from careful planning. Combinations of these situations, as given by WD&ID, are shown in Table 13. On the basis of these relationships, WD&ID stated that the use

Table 13. WD&ID Estimates of Relative Time and Cost Relationships for Various Combinations of Labour and Planning on Big Projects,

Labour	Careful Planning	Relative Time	Relative Time
Paid	Yes	1.0	1.0
Paid	No	1.43	1.14
Self-help	No	1.86	1.20
Self-help	Yes	1.0	0.92

Seource: Ibid.

of self-help labour for unskilled tasks reduces direct costs by eight percent but increases overall construction costs by about 20 percent. The study concluded that it was unreliable to attempt to reduce construction costs of routine rural water supply projects in the "big" category through the use of self-help labour. It estimated that careful planning of self-help efforts would reduce the cost of big projects by only three to four percent under actual conditions.

On small projects having capital costs under Shs.50,000, the WD&ID study claimed that skilled and unskilled labour account for 50 to 60 percent of total costs. The simpler technical aspects of small projects were not greatly affected by construction time; therefore, overall costs could be reduced 40 to 50 percent

with self-help labour. WD&ID favoured the use of self-help in small projects, but pointed out that only five percent of total Government rural water investment was used on such schemes. If self-help labour was to be employed on both big and small projects, the report estimated that the resulting cost savings would be five to six percent on Government-funded projects and about 35 percent for projects funded by other sources.[1]

Table 13 assumes that the combination of paid labour and careful planning is the base condition under which WD&ID presently operates. Cost increases or decreases are compared against this combination. It is highly debatable whether careful construction planning is the norm in WD&ID regional offices. For the purpose of cost comparisons, it would be more realistic to assume that the combination of paid labour and no careful planning exists at present. The relationship for determining the relative costs of the various combinations can be stated as

$$C_R = C_B \left[1 - 0.325 \ (1 - T_R)\right]$$

where C_B is the base cost for paid labour and no careful planning, C_R is the relative cost of a different combination, and T_R is the relative construction time factor. By using in the above equation the WD&ID figure of 32.5 percent of total project costs dependent upon construction time along with their assumptions of the effects of planning and self-help labour upon construction time, modified values of relative costs can be calculated. Base cost can be taken as 1.0 with paid labour and 0.92 with self-help labour. As shown in Table 14, self-help with careful planning does not reduce costs as much as paid labour with careful planning. Furthermore, self-help without careful planning does not reduce project costs at all. The conclusions of this exercise seem to be even less favourable to the use of self-help labour on high projects than that shown by WD&ID. However, before firm conclusions are drawn, it must be

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[1] Ibid.

Table 14. Modified Estimates of Relative Time and Costs Relationships for Various Combinations of Labour and Planning on Big Projects.

Labour	Careful Planning	Relative Time	Relative Cost
Paid	No	1.0	1.0
Paid	Yes	0.7	0.90
Self-help	No	1.3	1.01
Self-help	Yes	1.0	0.92

Sources: Tables 12 and 13.

recognized that the WD&ID estimates of the effects of labour and planning inputs upon construction time are assumptions that have not yet been verified by actual field data. This would appear to be a very useful area for further research investigations. The issue of self-help labour cannot be definitely resolved without a better understanding of the interrelationships between labour inputs and construction scheduling.

V (3) The Choice of Technique.

As mentioned in Section IV (2), cost comparisons of alternative technical methods of providing water to a given village are rarely carried out because of lack of time and qualified staff in the Regions. Another reason is that in many areas of Tanzania no obvious alternative methods are available to compare against the standard practices. For example, within the semi-arid plains stretching south from Arusha through Dodoma and west into Tabora Region, few natural surface water sources exist on a permanent basis and groundwater usually is found only at depths of one hundred metres or more. The standard practice for developing water supplies in these areas has been to drill boreholes and to install pumps with diesel engines. A number of dams and charcos have been developed in the areas also, but in general boreholes are preferred

because WD&ID has built up a relatively large works capacity for drilling operations in recent years.

While the choice of technique may be limited in some parts of the country, there is no shortage of alternative technical methods in many other areas, which include most of the densely-populated sections of Tanzania. In the high rainfall, mountainous areas of Usaramba, Upare, Kilimanjaro, Mbulu, Morogoro, and Rungwe, streams tend to flow throughout the year and the obvious choice is to construct gravity pipelines, although pumped schemes utilizing dams or boreholes are also possible. In the relatively well-watered coastal areas flanking the Indian Ocean and to the south and west of Lake Victoria, the groundwater table often is within easy reach of hand dug wells, allowing for the possibilities of shallow wells with either hand-powered or diesal powered pumps, as well as pumped schemes utilizing dams or boreholes. Cost comparisons of differing techniques may not be critical in areas of limited technical choice, but they are especially important where alternative methods are possible. Without such comparisons, there is no way to ensure that project costs are held to a minimum. It is true that methods of cost-benefit analysis are difficult to apply to rural water supply projects because of the problems involved in quantifying social benefits in monetary terms. However, it is a relatively simple task to compare the construction costs of alternative technical solutions for a given project. By assuming that all possible technical solutions in the project provide equal benefits, the solution with the lowest cost is the obvious choice from an economic standpoint. Such a cost-effectiveness analysis is within the capabilities of Regional Water Engineers, because they currently are responsible for estimating the costs of all projects brought before Regional Development Committees. The main constraints, as pointed out in section IV (2), are the limited time available for project evaluation and the shortage of professional staff in the WD&ID regional offices.

V (4) Foreign Exchange Considerations.

Another aspect of project economics involves the influence of programme implementation upon the foreign exchange reserves of the country. Imported equipment and materials used in project construction must be purchased with foreign exchange, and the expenditure of limited foreign exchange reserves on one type of development reduces the amount available for other types. Even labour and P.E.F. costs involve foreign exchange losses. The Ministry of Commerce and Industries uses the following percentages of foreign exchange components for labour costs in industrial development analyses:

unskilled and semi-skilled	= 10%
skilled	= 20%
managerial	= 40%
expatriate	= 60%

A rough survey of several rural water supply projects by the author showed that the foreign exchange component of typical gravity pipeline and borehole pumping projects ranged between 45 and 60 percent of total costs including P.E.F. The actual figure depends upon the amount of imported products used as opposed to alternative local materials. There are a number of alternative construction materials available. For example, imported pressed steel storage tanks can be replaced by concrete block tanks, or, better yet from a foreign exchange point of view, masonry tanks. The latter two are labour intensive also, which is an advantage from an employment standpoint. In addition, imported galvanized steel pipes usually can be replaced by locally manufactured (although the materials are imported) polythene or poly-vinyl chloride pipes. Unfortunately, there are no available alternative replacements for imported pumps and engines,

although some efforts have been made to fabricate low cost hand pumps from locally available materials.[1] It is fortunate that many of the locally manufactured construction materials tend to be more economical in both initial cost and in maintenance costs than the imported materials. Polythene pipes, being lighter, more flexible, and longer than steel pipe sections, are easier to handle and cheaper to use. Similarly, concrete block and masonry storage tanks have lower maintenance costs than pressed steel tanks, which often rust badly after a few years. Government, in particular, has responded to these advantages. In present WD&ID projects, galvanized steel pipes are used only where necessary around fittings and above-ground installations and the pressed steel storage tanks have been completely abandoned in favour of the concrete block and masonry types.

According to the above table, the foreign exchange component of expatriate salaries is taken to be fifty percent higher than that of comparable locally-staffed posts; i.e., 60 percent (expatriate) versus 40 percent (local). Most senior technical staff within WD&ID are expatriate. For example, of the fifteen currently established posts of Regional Water Engineer, only two are held by fully-qualified Tanzanians; all others are staffed with expatriate engineers. To a lesser degree, this same dominance of senior technical posts by expatriates also exists within the head office and in the specialized services of borehole drilling and geological investigations. All other posts related to rural water supply, including the main Dar es Salaam drawing office, Technical Assistants, the administrative staff, and field personnel are almost exclusively Tanzanian.

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[1] See: George Cotter, "The Shinyanga Lift Pump", pp.125-133, and R.W. Dawson, "Inertia Hand Pump," pp.134-36, in Dennis Warner (ed.), Rural Water Supply in East Africa, Op. Cit.

In general, the use of expatriates does not directly cost Tanzania greater salaries than that of local personnel. An expatriate salary normally consists of the official local salary, paid by Tanzania, plus some additional increment provided as a grant by a foreign government directly to the individual concerned. In some cases, the entire expatriate salary is funded abroad in the form of a non-repayable grant. The additional costs to Tanzania of using expatriates, therefore, occurs in the form of the expatriates' higher propensity to consume imported items and the possible opportunity costs of accepting foreign assistance in the form of technical personnel rather than some other type of aid.

VI. Programme Expenditures

VI (1) Proposed Expenditures Over the Second Five Year Plan, 1969-74.

During the planning period immediately preceding the Second Five Year Plan, WD&ID estimated that an average annual development expenditure of Shs.50 million would be required in order to successfully supply adequate water to everyone within forty years.[1] The Second Plan, however, allocated a total of only Shs.110.6 million over the plan period. Because this total was seen to be inadequate to meet the increasing needs and demands, especially those from Ujamaa villages, the approved expenditure was increased by Government in late 1969 to Shs.406 million, of which Shs.325 million were earmarked for actual project development. The pressures on existing works capacity that this large expansion entails will be partly relieved through the use of outside contractors on the larger projects. Over the period of the Second Plan, WD&ID estimates that up to forty percent of the expenditures on project development will be through outside contractors, while over the subsequent fifteen years contractors will receive up to one-third of the total project expenditures.

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[1] Water Development and Irrigation Division, Tanzania Rural Water Supply Development Programme 1969 - 1974, Op. Cit.

If Government is to fulfill its targeted expenditure of Shs. 325 million on new water projects during the Second Plan period, the present rate of development expenditure will have to be increased considerably. The authorized level of new development expenditure on projects during the first year of the Plan, 1969-70, was Shs.25 million, although only about Shs.15 million were actually spent. For 1970-71, a total of Shs.24.1 million has been authorized for rural water supply development.[1] These totals are exclusive of any expenditures devoted to surveys and investigations or the expansion of WD&ID facilities. As explained in section III (3), 80 percent of these expenditures are financed by Swedish credits and 20 percent by internal Tanzanian sources.

One of the major difficulties in achieving these planned expenditure goals is the limited works capacity of the WD&ID head office and the various WD&ID regional offices. For the most part, the head and regional offices currently are working at full capacity and little opportunity exists for expanding development activities with the available staff under the present workload. Officials of WD&ID have indicated that the most effective way of overcoming this capacity limitation would be both to improve planning procedures in order to reduce unit costs and to hire more engineers and middle-grade technical staff.[2] A slightly differing view is given the Annal Plan for 1970-71, which states that the implementation of in the rural water supply programme is satisfactory, but points out three difficulties which cause delays in implementation:[3]

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[1]The United Republic of Tanzania, The Economic Survey and Annual Plan, 1970-71, Dar es Salaam, Government Printer, 1970, p.56.

[2]Dennis Warner (ed.), Rural Water Supply in East Africa, Op.Cit., p. 29.

[3]The United Republic of Tanzania, The Economic Survey and Annual Plan, 1970-71, Op. Cit., p. 56.

(1) Procurement of materials is under strict regulations which do not allow for quick purchase and delivery. (At present, annual expenditures on pumps, engines, pipes, and other construction materials total about Shs.3.6 million.)

(2) Available plant and transport are insufficient to cope with the demands of the expanding construction programme. Funds for replacement are limited, and the delivery period is relatively long. A solution would be to allow WD&ID to use local contractors for transport when temporary needs occur.

(3) There is an increasingly scarce supply of skilled labour for the construction, operation, and maintenance of new projects. WD&ID is experiencing strong competition from private companies which offer better terms for the services of these individuals. As a result, measures are needed which will allow WD&ID to attract and retain skilled staff.

VI (2) Long-Range Projections of Finance Required for Overall Programme Success.

There are two major financial aspects to any development programme: one is the schedule of required investments and the other is the schedule of repayment of any loans used in the investments. Officials of the National Water Resources Council Secretariat have calculated several possible financial schedules in order to forecast the magnitude of investment required to supply the entire rural population with improved water supplies in the foreseeable future.[1] These schedules are based upon several assumptions concerning future population and economic growth rates, expenditure allocations, project costs, and external loan agreements. The assumptions can be summarized as follows:

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[1] National Water Resources Council Secretariat, Tentative, Long-Term Projects on Investment for Rural Water Supply, January, 1970, (mimeo).

(1) The rural population is equal to the difference between the total present mainland population, which increases at 3.1 percent per year, and the urban population, which increases at 6.4 percent per year.

(2) The annual growth rate in constant prices of Gross Domestic Product (GDP) is 5.0 percent in case of moderate growth and 6.5 percent in case of rapid growth.

(3) The total annual Central Government development expenditure is 7.6 percent of the Gross Domestic Product of that year. (Actual ratio in 1968-69).

(4) The annual expenditure for rural water supply development, excluding surveys and maintenance, is 11.0 percent of the total Central Government development expenditure. (Proposed ratio in the revised Second Plan.)

(5) The unit cost of supplying water to one person is Shs. 200.

(6) A total rural population of 1,100,000 people have been provided with improved water supplies by 1969.

(7) A loan is made every year to the amount of 80 percent of the planned expenditure for that year.

(8) All loans have an interest rate of 2.5 percent per annum.

(9) For each loan, repayment of principal is made in equal annual installments over a period of fifteen years, which follows an initial grace period of five years.

Using the first assumption, the Council predicted that the estimated 1969 urban and rural population of 0.77 million and 11.83 million, respectively, would increase by the year 2009 to 9.2 million and 33.5 million respectively. Table 15 presents the results of the Council's calculations for both a 5.0 percent and a 6.5 percent rate of national economic growth. The table indicates

that it is possible to supply the entire rural population with improved supplies in forty years at a 5.0 percent rate of growth in GDP and in 31 years at a 6.5 percent rate of growth in GDP, provided that the assumptions on investment expenditures are valid. The assumptions concerning loan repayment schedules were considered by the Council to be reasonable in light of recent experiences with Swedish aid. The most useful conclusions of the analysis were the likely magnitudes of the incoming loans and the outgoing debt repayments. Under the above assumptions, a maximum loan of Shs.293 million would occur in the financial year 2000-01 in the case of 5.0 percent growth rate and of Shs.265 million in the year 2005-06 in the case of a 6.5 percent rate. Similarly, the peak loan repayment would be either Shs.285 million in the year 2014-15 or Shs.265 million in the year 2005-06, depending upon whether a 5.0 or 6.5 percent growth rate is followed.[1]

The projections developed by the National Water Resources Council Secretariat, are useful as a point of departure in understanding the implications of the Government goal of providing all rural people with improved water supplies within forty years. However, they must be used with caution, for the expenditure totals presented in Table 15 do not indicate the magnitude of overall capital and recurrent costs of rural water supplies. Nothing is said about renewals (amortization) of projects at the end of their useful lives nor about operation and maintenance costs. If annual operation and maintenance costs are estimated to be a conservative five percent of cumulative capital costs, for example, then the recurrent expenditures in the year 2009 (in the case of a five percent growth in GDP) would total a staggering Shs.325 million. The magnitude of projected annual loan repayment also needs to be placed in perspective. When considering the loan

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[1] Ibid.

Table 15. National Water Resources Council Projections of Future Rural Water Investment Requirements, (millions of shillings and millions of people).

Annual GDP Growth		1969-74	1974-79	1979-84	1984-89	1989-94	1994-99	1999-04	2004-09
5.0%	Five Year Investment	296.5	378.5	482.5	615.0	785.3	1002.3	1279.0	1632.5
	Five Year Population Served	1.48	1.89	2.41	3.08	3.93	5.01	6.40	8.16
	Cumulative Population Served	2.58	4.47	6.88	9.96	13.89	18.90	25.30	33.46
6.5%	Five Year Investment	308.0	422.5	578.5	791.5	1085.5	1487.5	2034.5	2789.5
	Five Year Population Served	1.54	2.11	2.89	3.96	5.43	7.44	10.17	13.94
	Cumulative Population Served	2.64	4.75	7.64	11.60	17.03	24.47	34.64	—

Annual GDP Growth		1969	1974	1979	1984	1989	1994	1999	2004	2009	2014	2019	2024	2029
5.0%	Annual Loan	42	53	68	87	110	141	180	230	293	0	0	0	0
	Annual Repayment		4	22	50	85	108	138	175	223	285	213	120	0
6.5%	Annual Loan	42	57	78	107	146	201	275	0	0	0	0	0	0
	Annual Repayment		4	23	53	96	131	179	245	214	135	27	0	0
Estimated Rural Population		11.83	-	-	-	-	23.5	26.7	30.0	33.5				

Source: National Water Resources Council Secretariat, Tentative, Long-Term Projections on Investment for Rural Water Supply, January, 1970, (mimeo).

repayment of Shs.293 million in the year 2000-01 (again in the case of a 5.0 percent growth rate), it is sobering to realize that the overall servicing of foreign debt in Tanzania during the 1969-70 financial year totalled only Shs.32 million on all outstanding foreign loans. By the end of the Second Plan, it is estimated that external debt service will equal less than five percent of annual export earnings.[1] If this same ratio of debt servicing to export earnings is to occur in the year 2009, current export earnings will have to grow at the annual rate of about 13 percent in order to cover only the rural water loans projected by the Council. Furthermore, as of July, 1970, Tanzania had not yet negotiated any new rural water loans for 1970-71 or subsequent financial years.

Another reason for the use of caution is that the assumptions upon which Table 15 is based are probably unrealistic for such a long-term development programme. The Council assumed a per capita cost of Shs.200 for supplying improved water, but this value has been used by WD&ID only as a general guideline for the maximum allowable project cost and not as an average cost. Earlier, it was shown that the big WD&ID projects completed during 1968-69 had an average cost of Shs.170 per person served.[2] If Government was to make a serious attempt to fulfill the forty year programme, it is the opinion of the author that per capita costs of projects probably would be reduced below Shs.100 through a combination of new design criteria and more efficient implementation of projects. (The success of any attempts to reduce per capita costs, of course, would be influenced by the future price levels for material and labour.) Moreover, the assumption that the future expenditures for rural water supply development will continue to equal 11.0 percent of total

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[1] The United Republic of Tanzania, The Annual Economic Survey, 1968, Dar es Salaam, Government Printer, 1969, p. 95.

[2] Water Development and Irrigation Division, Rural Water Supplies: Aspects on Costs for the Implementation of the Programme in the Second Five Year Plan, Op. Cit.

Central Government development expenditures is highly questionable in view of the essential social nature of rural water supplies. Despite the economic emphasis given to rural water in the Second Plan, Government considers water supply basically as a social service having some economic ramifications.[1] Paradoxically, the same thing can be said of health or education, and yet the Second Plan allocates only 2.8 and 8.0 percent, respectively, of total Government development expenditures to them.[2] If the experience of Kenya and Uganda is any guide, it is likely that future demands for greater health and education investments will overshadow those for water supplies.

VII. Impending Decisions and Future Directions.

Entering the period of the Second Plan, Government found itself in a dilemma with respect to rural water supplies. Despite the fact that development expenditures on rural water in 1968 and 1969 had quadrupled over the previous two years, the natural population growth alone far outstripped the number of people served with improved supplies. A quarter million people received new water supplies during 1968-69, but the rural population of mainland Tanzania increased by over 600,000 in the same period. New rural water investment in the Second Plan had been budgeted at Shs.406 million, which is about twelve percent of planned Government development expenditures and a seven-fold increase in expenditures budgeted in the First Plan. However, under existing project costs and because of the anticipated three percent annual increase in population, even this level of investment was seen to be inadequate to achieve the stated goal of providing the entire rural population with adequate water supplies within forty years. In addition, there was the problem of obtaining the necessary finance for such development. Swedish Credits had supplied the bulk of finance

[1] Dennis Warner, (ed.), Rural Water Supply in East Africa, Op.Cit., p.29.

[2] The United Republic of Tanzania, Second Five Year Plan for Economic and Social Development, Vol. I., Op. Cit., pp.150-7, 175.

since 1965, but there was no commitment beyond 1970 and no assurance that future finance would be available to support a forty year investment programme.

Two policy constraints directly influenced the level of financial resources available for new development. The first was that water supplied through communal taps was free of any charge to the consumers. The second was that on 1st January, 1970, WD&ID assumed responsibility for the operation and maintenance of all rural water supplies. As a result, programmes could not be self-financing and project evaluation had to be based on something other than local willingness to support a scheme.

In late 1969, WD&ID engaged a firm of Swedish consultants to carry out a study of the rural water supply programme and the corresponding role of WD&ID in it. The consultants were requested to look into three major issues: (1) the scope of a future Water Master Plan and the distribution of responsibilities between Ministries, (2) programme planning for rural water development, especially project selection criteria and the implementation aspects of the Second Plan, and (3) the reorganization of WD&ID as concerns the expansions of works capacity, the reassessment of technical procedures, and the use of self-help labour. The consultants' report was submitted in April, 1970, and at the time of preparation of this report (July) was still under review by Government.

Government has not yet come to a final decision concerning the major recommendations of the consultants. However, it has instituted a number of recent changes in design criteria for the purpose of reducing the unit costs of supplying rural water. On 1st June, 1970, WD&ID began to utilize the following technical criteria in project design.[1]

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[1] Water Development and Irrigation Division, Administrative Instructions: Design Criteria for Rural Water Supply, Ref. No. G.2/II/8, 1st June, 1970, (mimeo).

(1) Project components consisting of intake, well, borehole, rising main, gravity main, and/or distribution main are to be designed for the estimated population in twenty years at the rate of 30 litres per capita per day. This twenty year estimate may not exceed the present population by more than one hundred percent. Project components consisting of domestic points, minor distribution piping, storage tanks, and/or pumps are to be designed for the present population at the rate of 45 litres per capita per day.

(2) Where appropriate, pumping installations are to be designed for two pumps working simultaneously for ten to twelve hours per day.

(3) Storage tanks are to be designed for peak flows without any emergency reserve.

VIII. The Unasked Questions.

Tanzania has undertaken a major task by its intention to ensure adequate water supplies for the entire rural population within forty years. This decision is a direct outgrowth of the conviction that rural water supplies are an essential factor in social and economic development. From the Government viewpoint, however, the critical problems occur mainly in implementing this decision within the given time period. Those problems include the need for a continuous high level of investment and a corresponding continuous availability of large amounts of finance, whether internal or external. The solutions, therefore, are seen for the most part to lie in the development of greater technical efficiency in order to reduce unit costs and the overall period of development. The questions asked are those relating to daily water consumption, walking distances, project design, field construction, and organizations for water supply development. Not asked are the questions dealing with development objectives, levels of water supply adequacy, investment alternatives, or methods of evaluation.

Technical efficiency is a condition worth promoting in Tanzania and especially so in the development of rural water supplies. However, technical efficiency is not the most important issue at the present time even though most considerations of future programmes emphasize this aspect. Little or no consideration is given to the impact of project implementation upon the local community or to methods in which rural water supply development can contribute to national social and economic objectives. The Second Plan sets out the following guiding principles for the provision of rural water:[1]

(1) Development of Ujamaa villages.

(2) Areas of acute scarcity of water.

(3) Areas of population concentration.

(4) Promotion of productive activities.

Although all of these principles are influential to some extent in current project planning and implementation,[2] they are not truly development objectives themselves but rather means by which Government hopes to achieve broad social welfare goals. Unfortunately, the critical relationships between means and ends, or goals, is not adequately understood. Therefore, this relationship is the most important current issue and one that is rarely raised. It involves the degree to which rural water development should contribute to the fulfillment of national aspirations and objectives.

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[1] The United Republic of Tanzania, Second Five Year Plan for Economic and Social Development, Vol.I, Op. Cit., p. 40.

[2] In early 1969, WD&ID regional offices were instructed to give priority for future development to Ujamaa villages. As a result of this emphasis, new project construction during the 1970-71 financial year will occur only in Ujamaa villages in at least two Regions.

There is little direct interaction between stated expectations and actual investment planning in the rural water field. According to the Second Plan, the benefits of rural water supply, as stated in section IV (1), are assumed to occur in the fields of agriculture, livestock, labour utilization, settlement, health, and convenience.[1] The manner in which these benefits are to occur is left unspecified, and the benefits themselves tend to be categorized as a unitary package of results:

> In the immediate future therefore there is a great need to ensure that the scarce resources available during the Plan period are used to maximum benefit. For this purpose the highest priority will go to low cost projects which provide benefits to maximum numbers of people, while more expensive projects bringing large benefits to relatively small numbers of people must command relatively lower priority, and must be implemented only after careful planning has demonstrated that the projects in question bring returns which justify the heavy costs involved. The maximum spread of benefits, therefore, will be achieved by an emphasis on inexpensive schemes, mobilizing self-help efforts of the local people.[2]

Despite such statements, actual programme and project planning are almost totally divorced from specific predictions of how rural water development will affect the agriculture and livestock industries, the availability of labour, settlement patterns, and convenience. Frequently, one or more of these aspects are mentioned in passing, but their magnitude is usually unspecified, and their occurrence is taken to be automatic. The general planning of rural water supplies in Tanzania has yet to be based on the requirement that programmes and projects contribute directly and explicitly to the fulfillment of specific national development objectives. Without such a requirement, the link between water planning and development results will remain one of assumptions, implicit beliefs, and catchy phrases.

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[1] The United Republic of Tanzania, Second Five Year Plan for Economic and Social Development, Vol. I., Op. Cit., p. 40.

[2] Ibid.

There are a number of specific questions that should be posed before decisions on long-term policy commitments are made. Some refer to the resulting impact of improved water upon the village community. What are the subsequent social and economic changes that occur? Are they favourable or unfavourable? How can the favourable changes be encouraged?[1] Many of these answers can be found only through long-term comparative studies of differing projects. Other questions deal with the Tanzanian ethic of self-reliance. All of these moves in the field of rural water development over the past several years have been away from local initiative in planning projects and away from local contributions to the implementation of projects (Section III). Government now plans, builds, operates, and maintains projects. The labour force is fully paid and the water is free to the consumers. How can local responsibility towards a water scheme be fostered if complete ownership and control remain outside the community? Recently, a promising approach has begun at a number of Ujamaa villages, whereby pump operators are no longer paid a salary by WD&ID, but instead assume their tasks as part of their contribution to village development.

Still other questions need to be asked concerning the use of self-help labour. The Second Plan puts great emphasis on self-help efforts; however, WD&ID rarely uses such labour inputs (Section V (2)). Many Regional Water Engineers claim that self-help is inefficient and undependable and cannot be integrated well into a tight construction schedule. Nevertheless, there is ample experience throughout East Africa to show that under certain conditions self-help labour can be used successfully in rural water projects.[2] This is especially true in small schemes where

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[1] Unfavourable, as well as favourable, social, economic, or political effects can occur as a result of a water project; See: Dennis Warner, A Preliminary Assessment of the Impact of Rural Water Supply Upon Households and Villages, Economic Research Bureau Paper 70.12, University of Dar es Salaam, 1970.

[2] Dennis Warner, (ed.), Rural Water Supply in East Africa, Op. Cit. pp.17-20.

the local people become fully involved in project planning and implementation. Furthermore, many rural areas of Tanzania have a continuing tradition of requiring all adult males to work a given day of the week on communal activities such as irrigation furrow maintenance, road repair, or school building. Compliance is variously enforced locally through the use of social pressures or sometimes through the fine of a chicken or a couple of shillings. The significance of these illustrations is that self-help labour and local contributions are workable concepts in Tanzania and should be given greater consideration in rural water investment.

There is a need for a clear definition of "adequate water supplies" that takes into consideration the development aspects of the particular area in which it is applied (Section II (2)). The minimum acceptable level of adequacy, especially from the viewpoint of the consumers, may vary from one part of the country to another. A shallow dug well with a hand pump may be acceptable in a sparsely-settled area, but a long-distance pipeline with numerous domestic points may be the minimum in a densely-settled area. Therefore, the definition might require some reference to water quality, quantity, the effort required to obtain the water, the density of settlement, and possibly the economic level of the area. It also would be worthwhile to know the general cost increases for marginal improvements over the minimum level of adequacy. In other words, Government should have a choice between various levels of investment, (Section IV (2)), rather than the situation in which it must either accept or reject a single rural water investment proposal. No major development programme should be undertaken unless alternative levels of investment initially have been identified and compared. Although this statement refers specifically to investments within the field of rural water supply, it is equally valid to investments made over several competing sectors, such as health, education, transport, and water.

In order for any investment programme to succeed, there must be selection criteria to identify projects likely to fulfill the development objectives of the programme. The selection criteria used on WD&ID projects do not deal specifically with project objectives. These criteria are a mixture of clearly-defined technical guidelines (Section V (1)), utilized by WD&I[D] itself, and ambiguously-defined socio-economic guidelines (Section IV (2)), utilized by the Regional Development Committees. The present socio-economic criteria are inadequate for the allocation of project investment in an optimal manner. They are too vague and imprecise for effective use by the RDC's which have neither the time nor the planning expertise to formulate more explicit guidelines. Finally, an investment programme should have workable methods of evaluation to determine whether or not the programme is accomplishing its objectives. Too often programme success has been measured by the amount of annual expenditure or, more recently, by the number of people served with water. Neither is a true evaluation. Both measure only the degree of activity, not the fulfillment of basic objectives.

It should be recognized that demands for more cost comparisons of alternative projects and for greater evaluation of programmes may severely strain the capacity of both regional and national level water planners to cope with current heavy work loads. There is the danger that additional administrative demands of this nature may lead to a decrease in the planning output and a consequent slowdown in project implementation. In such a case the planning capability, or "executive capacity", of the development organization must be looked upon as a scarce resource, just as finance, equipment, and supervisory manpower normally are considered. The shortage of personnel qualified to carry out project and programme evaluation in Tanzania argues strongly for planning and evaluation procedures that are administration-sparing rather than administration-consuming.[1]

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[1] Robert Chambers, "Executive Capacity as a Scarce Resource," International Development Review, II, 2, June, 1969, pp.5-8.

Therefore, new planning procedures should be made administration-sparing as much as possible. This may require developing standardized methods of project cost comparisons and programme evaluation so that planning officers throughout the country can work with uniform techniques. In the event that planning capacity becomes a limiting constraint on programme expansion, Tanzania may have to decide between large, poorly-controlled programmes having uncertain benefits or smaller, carefully-planned programmes providing well-defined benefits.

With the above remarks in mind programme planning of rural water investment should contain five major aspects: (1) a well-defined set of objectives linked to national development goals, (2) a workable definition of adequate water supplies applicable to the various conditions in the country, and (3) comparative costs of several investment alternatives starting with the minimum acceptable water supply situation,(4) specific criteria for the selection of projects, and (5) methods for carrying out a continuing evaluation of the programme during the implementation period. To some extent these aspects are mutually dependent, whereby the formulation of one modifies the others. Therefore, all five need to be determined anew for each major programme. Overall programme decisions should be made only after the formulation of these aspects is completed.

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