Third World Legal Studies

Volume 12 *Law, Accountability, and Development: Challenges and Response - Legal Methodologies of Accountability*

Article 8

1-8-1993

The Challenge of Water Provision in Rural Africa

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THE CHALLENGE OF WATER PROVISION IN RURAL AFRICA

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I. Introduction

The water resources of a country constitute one of its most important economic assets. Water resources are essential for industrial and domestic use, and irrigation. In most parts of Africa, rainfall is seasonal and highly erratic, and hence understanding the extent of water resources available helps in planning for drought conditions and preventing famine. There is no doubt that the use of water will increase and that irrigation will claim the maximum share of water resource development.

The aim of this paper is to evaluate the challenges facing African countries in the provision of water to rural areas, both from technical, and economic points of view and to assess the long term development programme in rural areas, policy options and its implications. Case studies from Northeast, East, and West Africa, highlight that there are few laws imposing accountability on development projects, and when they do exist there are not the institutions to enforce them. There is a need for national and international legislation to ensure that the user benefits from these projects, an equal sharing of water and the enforcement of laws that penalise water pollution.

II. Water Resources

Distribution of water is highly uneven. Most of it (97.41%) is in the oceans, while 2.59% is on land. Out of this only 0.014% is directly available to human beings; the rest is either in ice caps (Antarctica, Arctic) or underground.[1]

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1. Maurits le Riviere, J.W. "Threats to the World's Water", 261 *Scientific American* 80-94 (1989).

Much of Africa is semi-arid to arid or desert, and climatic change towards aridity is widely observed in the Sahelian countries of central Africa. The unreliability of rainfall coupled with deforestation, causes evapotranspiration from soils and causes widespread soil erosion, hence less water is retained to support vegetation and also to recharge rivers, reservoirs and groundwater. Hence in many regions of the world, water pumped from wells represents the sole source of water during much of every year.

The average United States citizen consumes 70 times more water than the average resident of Ghana. The need for decisive action to ensure an adequate supply of water is necessary in Africa, but there is also a need for improved water management. The floods of 1988 have replenished aquifers; however, dry spells in the next two to three years could wipe out the net gain leaving many African countries to face drought.

III. Challenges Facing African Countries

A. Rainfall: A Scarce Commodity

Generally rainfall in Africa ranges from 0-1000mm; however, large areas get less than 400mm per year. The mean annual rainfall in the Sahelian region (data from 1931 into 1960) ranged from 3-99 mm per year.[2] The wet months produce heavy rain that falls intermittently, thereby causing floods. The floods of summer 1988 in Northeastern Africa,[3] could be cited as an example.

Evaporation is very high in the Sahelian region (ranging between 100-400mm per year), which means that in certain areas of Africa almost all the rain that falls is evaporated. If we took Ethiopia and Sudan as an example, it has been observed that rainfall has decreased consistently for the last 60 years. The fact that water is becoming increasingly scarce as population, industry and agriculture expand

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2. World Meteorological Organisation, 1967 Climatological normals for the period 1931-1960, Geneva: W.M.O.

3. Wright, M. 1988. Mixed blessings of the flooding in Sudan, *New Scientist*, Vol. 1631, 44-47.

results in contentious competition for the water of major rivers such as the Nile and Niger.

B. Water Resources, Land Use and Environmental Deradiation

Agricultural development is closely interrelated with the level of rain in the various regions of Africa. However, as soil productivity declines, the pressures to exploit the remaining resources mounts. This means that areas which are semi-arid will be cleared to replace degraded agricultural land, which exacerbates environmental deterioration. Knowing water requirements by area and by land use is important in order to enable the needs of the agriculture, agropastoral and pastoral based societies to be integrated.

C. Wells, Dams and Surface Water Storage and Their Implications

Diverse geological formations require different types of structures for tapping groundwater to meet irrigation and public consumption. The choice is influenced by the nature of rock types, the depth of the water table, size of farm holdings and size of the population to be serviced. Water is tapped by digging hand-dug wells, by drilling or by building small dams.

The choice between hand dug wells and boreholes is critical, because if a borehole is less cost effective than a hand dug well, this means a net loss of money and resources. Also by doing that we may have decreased the involvement of the local people.

Is it advisable to build small dams to be used as spin offs for rural development projects or build large dams with their attendant environmental problems? This is one of the major challenges facing Africa, one which can only be resolved by detailed studies of the implications of any project. Generally the method adopted should be appropriate to the situation rather than to the available technology.

D. Safe Yield of Water Wells

What would happen to a community which has never been consulted about the consequences of overpumping water? And who is to blame if irreplaceable fossil water is overpumped and if this in due course causes the resentment of people elsewhere because wells run dry?

Since large areas of the Sahelian region have negligible recharge, significant increases in abstraction would cause decline in water levels, reduction in spring flow and progressive salination of the freshwater aquifers. This means that there is a need for sophisticated management techniques. It is important to understand water recharge in an area, before one makes a water balance, and to estimate safe yield, because failure would cause massive socio-economic problems for the rural people.

E. Quality of Water

Inadequate supply of water is not the only water problem facing African nations, but also that of water quality. It is common knowledge that industrial pollutants are poured into lakes and rivers. Organic and industrial waste such as chemicals and fertilizers have caused significant health problems. In order to encourage industrialisation, many African nations have been lax in imposing restrictions on pollution. For instance, nitrates have become one of the major pollutants around densely populated areas in Burkino Faso.[4] Although pollution has not reached the level of developed nations, there has been a marked increase in Africa during the last decade.

In the developing countries, both organic and industrial river pollution are on the increase since the annual per capita use is rising quickly. Decontamination efforts are often neglected, and there is no legislation to enforce it. Lack of proper sanitation facilities and poor

4. Groen, J., Schuhmann, J.B. and Glernaert, W. 1988. The occurrence of high nitrate in groundwater in villages in northwestern Burkino Faso. *Journal of African Earth Sciences*. Vol. 7, No. 7/8, 999-1009.

siting and protection of water supplies also increase water related diseases due to pollution by organic wastes. Many children die due to diarrhoea.

Studies have shown[5] that pollution from industrial projects in Egypt has caused harm to public health, and it is suggested that the state should carry its obligations to maintain public health by working to overcome pollution.

Because most groundwater in Africa is not polluted, it is wise to prevent contamination in the first instance, rather than resort to expensive purification technologies. Although management of water resources is widely practiced in the developed world, management practices are inadequate in the developing countries. Water management projects should lean toward increasing the efficiency of water consumption rather than increasing the supply of water. International agreements forbidding environmental pollution and local legislation to improve better monitoring schemes and enforcement measures are needed.

There should be a commitment to maintain public health, instead of totally favouring companies at the expense of its citizens. Not only is it desirable on social grounds but also on economic grounds. After all, only healthy people can produce the goods for economic development.

F. Social Impact of Water Usage

In a recent study[6] on the social impact of the water projects on the communities in Eritrea, water usage patterns show a two to three fold increase in water usage among the settled pastoralists and agro-pastoralists.

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5. Shawky, A. 1990. "The state accountability for harmful impact on health caused by industrial pollution in Egypt", *infra* this volume.

6. Berhe, S. M and Nelson, N. 1989 Evaluation of the Water development programme in Eritrea. Evaluation carried out for Inter-agency consortium on Eritrea, pp. 90.

This strong evidence of increase in water usage in pastoralist areas was confirmed by studies undertaken in Sudan, Eritrea[7] and Togo.[8]

The increasing number of wells dug near to the settlements has successfully shortened the time spent in water carrying and the expenditure of energy and effort by women who are the major bearers of water. In all cases, they were spending one-half to one-third as much time as they had previously on the task of collecting water.

The most significant impact of the water projects observed in the Sahel has been that health has improved as a result of improvements in personal and household cleanliness and water quality. Many women felt less tired and a number mentioned that they or their children were more healthy. Several specifically mentioned the drop in diarrhoea. The water projects are giving overworked women additional time in which to educate themselves and to contribute to the political and social betterment of their communities.

However, in many African countries rural water supplies could not be sustained because the needs of people have not been identified and local residents have not supported the project at a grassroots level.

G. Maintenance and Training

In many African countries there are many examples of development projects that have failed because of lack of maintenance. This is mainly due to the absence of skilled local personnel.

The demand for water services is growing; hence, maintenance cannot be carried out effectively from central authorities. The need to establish technical colleges to train students and local communities, and the establishing of satellite and mobile workshops, is manifest.

The maintenance and supervision of the wells, boreholes and cisterns and improvement of local hygiene can only be undertaken by water committees who should educate people in the proper use of water and equipment at water sites. National Water Authorities should

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7. Woldetensae, H. 1988. Evaluation of the Baden-Himer Water Supply Project. Unpublished report of the Construction Commission, Eritrea.

8. Amat, T. and Amat, B. 1988 Water point maintenance in Togo. *The Courier* No. 11 2, 86-89.

gradually shift the responsibility of pump maintenance to the rural community, as part of an overall educational drive.

H. Payment for Water

Water development projects are expensive. Most of development projects are funded by governments, bilateral and multilateral agencies. Projects based on bank loans have to be paid back by the citizens of each country. Most agencies initially funding a water project, would want it to continue being funded by the users. If local communities are to pay for water there are three options: 1) Traditionally water is free in rural areas of Africa, while in the urban areas it is a commodity. In poor areas no charges can be levied and government has to subsidise the facilities. However, the local people should do maintenance work in order to offset the overheads, 2) users should pay for the facility, provided that they are economically capable, 3) methods of low-capital water development within the means of the rural community should be undertaken.

The initial investment is important in encouraging the rural areas to develop and thus decreasing dependency. The investment must include practical training to enable people to maintain facilities. The people in small urban areas are usually willing to contribute for a regular and safe supply of water. No matter how well meaning one can only find out if there are consultations with the concerned communities.

I. Irrigation and Water Supply

In areas where rainfall is seasonal and erratic, successful agriculture is not possible without irrigation of some sort. The use of water for irrigation will undoubtedly increase and will claim the greater share of water resource development. A key to the successful exploitation of scarce rainfall and groundwater is recognition of its large interannual variability. Once this is acknowledged, settled agriculture appears possible in surprisingly low rainfall areas. The semi-arid regions of Africa contain large nomadic and semi-nomadic

populations. Where there is settled agriculture, the dominant mode of cultivation is small scale peasant farming.

In areas where rivers cannot be used for irrigation, groundwater forms a possible alternative. The higher cost of operating groundwater schemes is more than compensated by the lower order of initial investment in the scheme as compared to development of rivers using dams.

Many irrigation schemes have turned into economic, environmental and social disasters because technical experts fail to adequately account for how local farmers can use water effectively. Some of the worst irrigation disasters have happened in Sudan and Nigeria. The main problem is a failure to carry out research and training of skilled personnel. Now the consensus is towards tapping groundwater and using rainfall effectively at village level, and allowing small irrigation schemes to be controlled by farmers.

Irrigation and evaporation brings salt into the soil, and excess application causes waterlogging. Some estimates claim[9] that salinisation is now taking irrigated land out of production faster than new land is brought in. The solution is effective water management and good drainage. It is important to site agriculture on soils and slopes that encourage flushing without resulting in soil erosion. A much greater emphasis on hydrological management needed for agriculture, by capturing water by diversion schemes to stop runoff.

J. River Basin Projects

River basin development continues to account for the largest expenditure for capital in Africa.[10] In most cases the direct and indirect ecological and socio-economic costs are not assessed in advance of schemes.

There are various factors to consider and be aware of in river basin development. Human activity in a river basin can aggravate

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9. Pearce, F. 1987. A watershed for the Third World Irrigators. *New Scientist* No. 1559, 26-27.

10. Scudder, T. 1989. "River Basin Projects in Africa," *Environment*, Vol. 31, No.2, 4-32.

flood hazards. Deforestation leads to increased soil erosion and increased runoff. For instance in 1988, major floods in Sudan stemmed from heavy rains on the Ethiopian Plateau. They were magnified as a result of erosion in the source areas. The soils and vegetation could have absorbed some water had they not been washed away.

Many African nations have access to a single river basin. For example the Nile is shared by Uganda, Kenya, Sudan, Ethiopia and Egypt, while the Niger River is shared by Nigeria, Niger, Mali, Ivory Coast and Guinea. In southern Africa the Zambezi River is crucial to the survival of Zambia, Zimbabwe, Mozambique and Malawi. Many countries have been using such water resources irrespective of downstream needs. However, such policies are no longer tenable, because activities within the jurisdiction of each nation should not damage the environment and the survival of the neighbouring countries.

Egypt and Sudan concluded the Nile Waters Agreement in 1959, which allowed sharing of water. This worked well until 1970. However, because of drought in Ethiopia and the increasing water needs of the neighbouring countries, the net inflow of water to Egypt has been reduced except during the floods of 1988. Twenty years of below average rainfall had cut drastically the amount of water reaching Lake Nasser in Egypt. This uncertainty requires a far reaching conservation plan which may involve altering the mode of agriculture and may also affect the lives of thousands of subsistence farmers. This can only be achieved by involving the people in decisions that affect their livelihood.

A regional African institution should be established to inspect inter-state claims on abuse, pollution, or overdevelopment of water resources. There should be accountability by governments, not only to the people under their jurisdiction but also to the people living elsewhere in that ecosystem.

Some progress has been made in international law, but to achieve their policy objectives the member states need to enforce as well as to sign the international declarations. Shared waters have the potential to cause conflict in East Africa: for the last two decades, there has been marked changes of climate towards aridity, this could result in

less water in the Nile in the future. Only international cooperation in the integrated management of water resources can ameliorate the situation. An in-depth analysis of the interrelationship of environment and international law is provided elsewhere in this volume.

K. Water Resource Development and Accountability

Political and economic issues are interrelated, and human rights and accountability are important for effective and sustainable development. Development has usually been dominated by bureaucracies who are convinced of the correctness of their solutions and impatient with what is seen as the ignorance and incapacity of local people. In many cases, the inherited pre-independence style of operation has persisted with relationships which are paternalistic. The result is that bureaucracies remain unaccountable, with little incentive to respond to people's needs. Despite rhetoric to use state power to alleviate poverty and powerlessness, the rural people find themselves unable to stop displacement from pasture, water supplies and agricultural land. That counts as a failure of the legal system. Although the aim of the paper is not to discuss why law-makers did so little to advance development, it is the author's opinion that devices must be created to ensure accountability to the rural people, by ensuring participation in the law making process.

There are a number of documented cases (for example the Red Sea Hills of the Sudan) where millions of dollars were spent for water development, yet the new rural water supplies were appropriated by absentee landlords and used for cash-cropping.

The building of large dams has caused the displacement of large populations in rural areas. No compensation was given to the dispossessed. There is no legislation which enables the rights of these people to defend themselves. Even if it does exist there is not the political will to implement it. Without legal guarantees, rural development projects and participation of the local community remains rhetoric. Water development projects have ignored the consequences of environmental degradation, the rights of displaced people (especially ethnic or other minority groups) and the attendant human

rights issues. We should increase the capability of self-management and self help, in order to meet the basic needs of the population to secure a decent way of life.

The LOME IV convention (see LOME briefing No. 14, Jan.-Feb., 1990) states "the role and potential of initiatives taken by individuals and groups shall be recognised and fostered in order to achieve in practice, real participation of the population in the development process." Furthermore the LOME provisions state that they have to be applied within the limits laid down by the ACP states concerned. This means that the limitations imposed by ACP countries could rule out accountability or could decrease it. Probably the development projects that are funded by NGOs and aid agencies should have to be monitored, and NGOs have to offer some guidance in reenforcing genuine popular participation in development. For a technical person, there is nothing more disheartening than seeing a project collapse which cost lots of money and manpower. Conscientious people would like to see projects succeed and be able to see the fruits at first hand.

IV. Towards an Integrated Rural Development Programme

The water resources of a country affects and influences not only public consumption, but agriculture, forestry, livestock, soil, and electrification programmes. Everything requires water. Hence in order to make full use of water resources and to establish a sound rural development programme, an integrated approach should be initiated which will involve the various disciplines.[11]

A basin-wide study is required to establish surface and groundwater resources, to map soil associations and establish their agricultural potential. Reconnaissance study at a regional scale will identify areas for agriculture and resettlement, and development of cottage industries. This type of study is also important in order to enable countries that share a river basin to establish a scientific method

11. Boyle, A.E. *See* "Environment and Development: Accountability Through International Law," *infra* this volume.

for resources, in order to avoid conflict. The Nile basin can be taken as an example; however, the political and legal complexities have yet to be studied in detail.

The projects have to focus on the end user as pivotal to the development process. If there is no direct involvement of the local people, the project will collapse or will not meet its objectives — as has happened in many third world countries.

National governments and major lending agencies such as the World Bank favour the development of large capacity boreholes to supply many farmers, in order to have a better rate of return on their investment.[12] In practice, studies of some of the large scale irrigation schemes using groundwater have not always demonstrated the return on investment which was anticipated. Small-scale irrigation, controlled by farmers, is often the answer.

Since the ecosystem in most parts of Africa is fragile, land use has to be monitored in order to stop soil erosion due to deforestation and overgrazing. Major increases in agricultural production could be achieved through proper land and water use management, which will involve terraced fields for soil and water conservation. This will eventually help to resettle people, and lead to the improvement of transport, public and social services.

When widespread degradation of land and deterioration of the resource base have taken place, i.e when both vegetation and soil have been lost, or permanently degraded as in parts of Syria, Jordan, Iraq and Iran,[13] then it could be too late for rehabilitation. Large areas in the aforementioned countries produce very little, and hence even if water supplies were unlimited there is little real potential for agriculture. Or, when agricultural land becomes saline, this undoubtedly affects the kind and cost of irrigation development.

The average yields of crops in Africa are small due to land degradation, erratic water supply, war, lack of improved agricultural

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12. Wright, E. P. 1985. "Groundwater in the Third World. In Hydrogeology in the service of man," Memoirs of the 18th Congress of the International Association of Hydrogeologists. Cambridge, 53-65.

13. Robertson, V.C. 1977. *Experience in the Middle East. Philosophical Transactions Of Royal Society*, London, B, 278, 507-524.

inputs, land tenure and shortages of trained manpower and management. Even if the water resources of Africa were properly harnessed, these reasons for lower crop yield have yet to be dealt with. The problems will largely remain unresolved if they are not addressed. A practical path to development using appropriate technology to the present socio-economic conditions would be appropriate.

V. Programme For Groundwater Development: Policies and Options

In many countries, water resources development is hampered because: 1) many countries do not have a National water policy, 2) water projects run by different agencies are not coordinated, 3) management of water development programmes has suffered from administrative errors and lack of credit facilities, 4) there is no active and informed participation of people in decision making, and 5) people are not mobilized for maintenance.

In many cases of project failures, the prime cause has been a narrow information base for evaluation, planning and management strategies. Development ventures require an all-sided knowledge of the complex social-environmental system into which they are introduced. This means that a socio-economic study of the rural community is essential before executing a major Water Development Programme.

There is a need for integrated development of both ground and surface water resources in order to increase irrigation and public consumption. In Africa the needs for water development are urgent. Consequently it is not possible to wait for the results of very detailed and comprehensive groundwater investigations. These investigations are not only expensive but also time consuming. However, in normal circumstances, there is a need for scientific groundwater investigations and planning.

A working document should be written at the early stages in order to give broad guidelines for the long term development of the water resources of the country. Groundwater legislation should be drafted

to prevent: overexploitation of water which exceeds the recharge rate, reduction in committed base flow in the rivers, and waterlogging and soil deterioration due to salinity, overgrazing, and other hazards. The working document can be improved in light of continued research.

Integrated rural development requires not only government policy, equipment and investment, but also deep economic and social change. The availability of irrigation water and its economic use should be given adequate attention. The stable balance between natural resources and land use has to be preserved.

Overgrazing and deforestation have to be controlled, and the use of pastures, wells, and rivers regulated, in order for the soil and vegetation to retain the water. Irrigating low-relief land without installing drainage would inevitably create a salty swamp. Those changes can only take place if there is adequate understanding of these problems by the users.

Hydrogeological investigations should be extended to cover all of the African continent moving south from the Sahel area. These studies should include geological and remote sensing studies, geophysical investigations, exploratory drilling, meteorological studies, water level measurements and chemical analyses of water. Water balance and other specialised studies could be done in limited basins of importance to agriculture. River discharge regulation schemes, which include not only agriculture applications but also hydropower development makes more economic sense.

There are bottlenecks in the data collection, interpretation and dissemination programme that need to be solved on a national level. This requires the training and employment of technicians and field staff to assure the flow of basic data and to execute the work.

At present in many African countries, we have seen that what we call development projects destroy the topsoil, fresh water, atmospheric systems and genetic resources. I hope we will learn from these mistakes.