Special Article

TECHNICAL AND MANAGERIAL ASPECTS OF ENVIRONMENTAL AND HEALTH IMPACT ASSESSMENT OF WATER RESOURCE DEVELOPMENT PROJECTS-THE ETHIOPIAN EXPERIENCE

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ABSTRACT: Past experience in Ethiopia has shown that water resources development projects implemented without environmental and health consideration face serious environmental and social problems. The environmental dimensions of sedimentation and soil erosion through accelerated vegetation removal, loss of grazing land, displacement of people, proliferation of disease vectors, productivity decline through salinization and water logging and loss of wild life habitats constitute the major problems encountered. This paper reviews the environmental and health consequences of water resources development projects, and assesses current practices and arrangements for impact assessment and follow-up environmental monitoring in Ethiopia. Lack of compulsory Environmental Impact Assessment (EIA) and an established responsibility and procedure for follow-up actions, coupled with shortages of trained manpower and financial provisions constitute serious constraints for effective integration of environmental and health considerations into the development process. Recommendations include the need for compulsory EIA, well defined institutional responsibilities and inter-sectoral collaboration.

INTRODUCTION

It is well known that water resource development projects generate benefits to any country through production of crops and energy to meet local demands as well as export earnings. In addition, dams and reservoirs can be used for fisheries, drinking water supply, flood control and water based recreation. However, if such development schemes do not integrate environmental protection requirements, they can cause ecological disasters that could be costly to present and future generations.

Water resource development projects in Ethiopia as well as in many other developing countries were too often dictated by national economic interests as conceived by central planners. Projects have been primarily planned and evaluated in terms of their technical and economic feasibility. Ecological, social and health considerations have been either virtually ignored or at best sufficiently included in project planning and implementation. Such an approach has not only resulted in a multitude of environmental and social problems but also in some instances, adversely affected the long-term economic sustainability of the projects themselves. There are cases on record where fertile lands have been lost due to salinization; capacities of dams reduced as a result of heavy silt load, and the well being of the local populations, as well as that of migrant workers negatively affected. Many epidemiological investigations on the occurrence and spread of schistosomiasis and malaria, including its resurgence in the tropics have shown a cause and effect relationship between intensification of these diseases and expansion of irrigation and other forms of water resources development.

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It is now recognized that past development projects have had serious adverse ecological, social and economic impacts, although the level of recognition of such impacts is still far from satisfactory. Nevertheless, conservation-based development is getting more and more attention by decision makers and planners alike.

One of the commonly adopted strategies as a tool in the planning and decision-making process for environmentally and socially sound development of natural resources is Environmental Impact Assessment (EIA). In Ethiopia, some kind of EIA has been initiated for major water resource projects since the 1980s.

This paper reviews the major environmental projects, the evolution of the state of the art of EIA and its organizational and administrative managerial arrangements in Ethiopia. It also attempts to review the appropriateness and adequacy of current practices and provides a set of recommendations to address the concerns of the environment in development planning in Ethiopia.

WATER RESOURCES AND THEIR UTILIZATION IN ETHIOPIA

Ethiopia is one the countries in Africa richly endowed with water resources. The mean annual surface runoff is estimated at a little over 100 billion cubic meters. The country also possesses a considerable area of irrigable land mainly located in the arid and semi-arid areas where soil and climate are suitable for the production of a variety of tropical crops. Furthermore, the hydrological and topographical features of the country have created favourable conditions for the generation of large quantities of hydropower energy with considerable surplus for export the creation of large reservoirs.

Presently, the contribution of the water sector to the national economy is very low with only less than 3% of the potential harnessed for irrigation and hydropower generation. The nationwide area under irrigation is in the order of 160,000 hectares of which 60,000 hectares (37.5%) are small scale schemes scattered throughout the country. The small scale schemes are those below 200 hectares and mostly traditional involving simple diversions without control facilities. According to Tahal, many of these schemes are subject to frequent damages by floods and suffer from leakages and waterlogging due to the rudimentary nature of the diversion structures and lack of control and drainage facilities (1).

The remaining 100,000 hectares are medium (200-3000 hectares) and large scale (over 3000 hectares) irrigation projects with a further 45,000 hectares currently under construction. Of the existing medium and large scale irrigation schemes, 71,215 hectares are located in one of the 14 basins of the country, namely the Awash Basin. The medium scale schemes produce a mix of food and other cash crops whereas the large scale irrigation projects are primarily for sugarcane, cotton and citrus. Some 42,000 hectares in the Awash Basin are in need of infrastructural and water use efficiency improvement (2).

With regard to hydropower, there are seven major regulation schemes with a total installed capacity of about 23,000 GWH/year which represents only 1.4% of the potential (3). Hydro-electric power development as a clean source of energy, could play a major role in the expansion of industries and electrification of urban and rural areas to reduce the pressure on forests and woodlands for fuel wood. About 90% of the total energy demand is derived from biomass which has resulted in massive deforestation, soil erosion, high rates of sedimentation and loss of wildlife habitats.

The present industrial water demand is not known, but it is considered to be substantial enough to arouse concern both in terms of effluent discharges and abstraction. Unique demands are made of water resources in and around few major cities like Addis Ababa where there is some industrial concentration. Industries like food processing, breweries, meat packing, pulp and paper are known to use large quantities of water. A major concern, especially considering the lack of pollution control in the country is, however, industrial pollution.

Responsibilities for water resource development and management lie with five institutions. The Ethiopian Valleys Development Studies Authority (EVDSA) established in 1987 is responsible for water development planning including the preparation of integrated master plans and feasibility studies of medium and large scale irrigation schemes. While design, construction and maintenance of major schemes are the responsibilities of National Water Resources Commission, operation and management of state farms and hydropower plants are carried out by the Ministries of State Farms, Industry (the sugar estates) and Mines and Energy (hydropower). The Ministry of Agriculture has an overall responsibility for peasant agriculture including the planning and development of small scale irrigation projects which are basically constructed and operated by beneficiaries themselves.

In the face of the recurrent events of climatic droughts and devastating famines during the last few decades and the high population growth rate (2.9%), the development of the country's water resources, as reflected in the Ten-year perspective plan (1984/85-1993/94) is expected to increase greatly before the end of the century. According to the plan, 126,000 hectares of land will be brought under irrigation and the present hydropower generating capacity will double during the plan period. Although the plan recognizes the need

for rational exploitation of the country's natural resources, the inevitable environmental modification should be expected to bring about undesirable side effects. The growing challenge to the concerned authorities and professionals would be how to achieve the development objectives of meeting the food, fibre and energy demand of the population without compromising the interests of the environment.

EFFECTS OF WATER RESOURCE PROJECTS-PAST EXPERIENCE

General Situation

There are no comprehensive studies on the effects of past projects on natural resources and health in Ethiopia. There are, however, a number of studies on specific environmental parameters relating to soil modification, water quality, socio-economic impacts and water related vector borne diseases. These studies were mainly carried out in the Awash Valley where the major water resource schemes of the country are located.

The Awash Basin covers an area of about 120,000 sq. kms. of which 70,000 sq. kms. are effectively drained by the Awash River which runs through a course of 1200 kms. The basin is conveniently divided into the Upper, Middle and Lower Awash Valleys (Fig.1). The population inhabiting the basin is estimated at 5.9 million excluding Addis Ababa which has a population of 1.6 million (2). This represents a mean population density of 49.2 persons per sq. km. as compared to the national average of 34.4 persons per sq. km. Prior to the development of irrigation, the lowlands in the Middle and Lower Awash Valleys were predominantly inhabited by trans-human pastoralists. The rapid increase in the population of these parts of the basin during the last three decades has been accentuated by seasonal migrant workers from the neighbouring highland areas. The opening up of the Awash Highway connecting the main Ethiopian port of Assab with the central and the south eastern regions of the country has also resulted in heavy and rapid movement of people and goods through the formerly isolated Awash Valley.

Presently, as mentioned in the preceding section, some 70,000 hectares of the land is under cultivation in this basin which represent 70% of the total irrigation in the country. There are 24 plantations in the Valley producing primarily cash crops like sugarcane, cotton and fruits. These schemes are state owned and to a large extent labour intensive. The work force is in the order of 200,000, i.e., about 3 persons per hectare. Basic amenities provided in the state farms are generally considered satisfactory compared with those available to the general population. However, the level of maintenance and utilization of sanitary facilities in the labour camps are often poor. Health services, mostly curative, are provided to the workers and their dependents free of charge by the respective agencies managing the farms.

Irrigation of the agricultural estates is carried out mainly through gravity with few plantations using pumps. All canals and drains are unlined earth ditches and their maintenance depends on irrigation regimens. Primary and secondary canals in the cotton plantations are cleaned and deepened once a year before the main planting season while the maintenance intervals in the sugarcane and citrus fruit plantations are much longer due to intense irrigation regimen. As a result, growth of canal bank vegetation in the latter plantations is very prolific and has serious health implications in the spread of intermediate snail hosts of schistosomiasis.

Besides irrigation, the Awash River is used for power production, industrial processes and waste discharges. There are three dams which have a combined power output of 493 KWH/yr. All these schemes, including all irrigation schemes excepts the Amibara Irrigation Project, have been constructed without due consideration of environmental impacts. As a result, many of the development projects have resulted in immense social and environmental problems.

Impact on Water Quality

In the Upper Awash, there is a heavy concentration of industries relative to the rest of the country. Most of these industries do not have effluent treatment plants and discharge their untreated wastes directly into the Awash River or its tributaries. Based on study of selected industries, the industrial effluent contained high BOD, suspended and dissolved solids or exhibited alkalinity or acidity problems (4). Furthermore, these streams are polluted by septic tank effluent, trade wastes, oil and grease from garages. The study presented the streams as being virtually depleted of oxygen and characterized them as highly polluted and unfit for

human consumption without substantial treatment which would be expensive.

In the remaining part of the basin, extensive use of agricultural chemicals, especially pesticides, poses a serious threat to public health and the aquatic ecosystem. Over 30 types of chemicals, including toxic organo-phosphorous compounds, are used. On occasions, fish kills have been reported following the application of agricultural pesticides. Another hazard associated with irrigation is salinity. Recent data on salinity, measured as electrical conductivity showed an increase from 400 to 800 u mhos/cm over the period 1970-1985 (2).

Socio-economic Effects

The development of the Awash Basin has undoubtedly contributed to the national economy and to the well being of considerable numbers of people through generation of employment and access to basic infrastructural services. At the same time, the development has brought about some adverse socio-economic effects which by no means are unique to Ethiopia. The major negative effects in the Awash Valley relate to population supporting capacity, reduction of grazing land and social adjustment problems.

The population of the Valley has increased substantially since irrigated agriculture began in the lowlands which, prior to introduction of irrigation, were considered marginal for rain-fed agriculture. The rapid increase in the population has placed high pressure on limited resources available to meet the food, fuel wood and construction material needs of the people newly settling in the area. A recent study by UNDP/FAO on population support capacity has projected significant deterioration in the situation by the year 2010. According to the base model of this study, the majority of the areas in the valley will be converted to deficit capacity areas (5).

Although the exact size is not known, considerable portion of the area presently under irrigation is reported to have been formerly used for dry season grazing by the indigenous population of pastoralists. The net effects of this loss are pressures on the local pastoralists to move into new areas and over-grazing of existing rangelands.

Health Implications

The irrigation canals, drains and the formation of man-made swamps have provided suitable breeding habitats for disease vectors in several farms of the Awash Valley. A combination of the proliferation of the disease vectors, migration of farm workers and intense water contact have resulted in the introduction and transmission of new diseases like schistosomiasis and intensification of local endemic diseases like malaria.

Both Schistosoma mansoni and S.haematobium are found in the valley. S.mansoni was first reported from migrant workers originating from endemic areas. Transmission is now well established in the formerly non-endemic areas of Wonji and Metehara Sugar Estates and other farms in the Upper Awash Valley with a prevalence rate of 5-11% (6). The annual economic loss due to S.mansoni at Wonji alone is estimated at Birr 452,000 which is expected to quadruple in five years time (7). On the other hand S.haematobium is found in specific localities in the Middle and Lower Awash Valleys with a marked decline (50%) in the transmission due to drying up of the natural swamps (the natural habitats of the intermediate host) resulting from upstream water regulation, irrigation development and provision of drainage facilities (6).

Despite an active control programme with DDT spraying twice a year, malaria is still the leading cause of morbidity in the Awash Valley. A prevalence rate of 6.7% has been recorded in the Middle Awash Valley, a level that exceeds the critical national level of 5% (8).

Land Degradation

The main causes of land degradation in the Awash Valley are soil erosion, waterlogging and salinization. The extent of soil erosion is so high that Koka Dam lost 35% of its storage capacity over the period 1960-1989 (2). Water tables are rising at an estimated rate ranging from 0.6 m/year to 3 m/year in localized areas. Signs of salinization are already evident and recent studies have indicated the need for the installation of sub-surface drainage in much of the irrigated area of the Middle Awash before the end of the century. Waterlogging, salinization and overgrazing appear to accelerate land degradation in the Valley.

ENVIRONMENTAL IMPACT ASSESSMENT

Arrangements for EIA in Ethiopia

Environmental Impact Assessment (EIA) is relatively new in Ethiopia. EIA of water resource development projects evolved from a UNDP/WHO assisted project during 1980 to 1986. The main development objective of the first phase of the project was to assess the health implications of planned water resource schemes, especially irrigation, in the river basins of Ethiopia.

The second phase of the project covering the period 1983-1986 was reformulated to include water quality. A small unit with modest laboratory facilities was created under the name "Public Health and Environmental Health Planning Project" within the Water Resources Development Authority (WRDA).

Another complementary arrangement was the creation of the Committee for Inter-institutional Collaboration (CIC) in 1985, following a multi-disciplinary campaign against urinary schistosomiasis in the Amibara Irrigation Project from 1981-1983, by interested national scientists from different sectors. The positive results of this inter-institutional collaboration attracted the attention of various ministries and other institutions and this effort culminated in the formal establishment of the CIC by means of a Memorandum of Understanding. The main objective of the CIC is the prevention and control of water-based and water related vector borne diseases affecting populations resettling or living in irrigation scheme areas or those migrating to and from these areas.

The CIC solicits the collaboration of different sectors through a multi-disciplinary approach. It is composed of the National Research Institute of Health, the Water Resources Development Authority (WRDA), the Institute of Pathobiology of Addis Ababa University, the Ethiopian Valleys Development Studies Authority and the Ministries of Health and Industry. Membership is open to all relevant government and non-governmental organizations. Its organizational structure includes a General Assembly, ad-hoc committees and a Secretariat whose office equipment was provided by WHO.

A further development in Ethiopia relevant to the management of water resource development projects was the establishment of a semi-autonomous body known as the Ethiopian Valleys Development Studies Authority (EVDSA) in 1987. The main objectives of EVDSA are to conduct studies of natural resources of the valleys of Ethiopia, to prepare master plans and to undertake studies and initiate policies and strategies for the protection of the environment. The underlying concept is to enable the country to undertake integrated basin-wide development planning in which the full rage of alternative ways of rational utilization of natural resources and improving or maintaining the quality of the environment can be assessed. This makes EVDSA well-suited to take adequate account of the inter-relationships between environmental quality and aspects of development and use of resources. Within EVDSA there is the Environmental Conservation Studies and Research Desk initially established by transferring the Public Health and Environmental health Planning Unit from WRDA. Unlike those unit, the present desk is firmly backed by proclamation, and has broader scope, better status in the organization and better resources.

EIA Methods, Scope and Procedure

Ethiopia does not have yet a compulsory or standardized EIA system, although one is currently under preparation. Since 1980, four large and seven medium irrigation projects, two hydropower plants and one major drainage scheme were subjected to some kind of EIA. The scope, level and methods varied from one project to the other depending on availability of expertise, funds and nature of the project. The assessment was done according to terms of reference (TOR) prepared by the project proponent, namely WRDA, and was carried out during the feasibility study phase of the projects. The TOR were normally prepared following a short field visit by a small team with a view to identifying the main issues to be addressed. The main elements generally considered were:- i. Public health and sociological aspects

ii. Water quality

iii. Wildlife, and

iv. Biomass especially in relation to firewood and building materials.

These components were assessed by individual experts or group of experts like the CIC and often involved baseline data collection through rapid field surveys. Surveys were essential because there was a

general lack of data. Even if available, the data were incomplete, of poor quality or inaccessible.

The experts produced statements usually containing sections on the status of the existing environment, the possible effects of the proposed scheme and recommendations of safeguard measure together with the cost implications which were included in the total project cost. The statement was incorporated in the main report of the feasibility study in a summary form and annexed in separate volumes in its entirety. These reports were reviewed by an ad-hoc committee comprising responsible representatives from the concerned ministries and agencies such as the Ministries of State Farms, Health and Agriculture and the National Planning Office. The final reports were presented to the Council of Ministries for approval.

One such project that has been implemented is the Amibara Irrigation Project with a total area of 10,000 hectares for cotton production. The project had environmental and health components costing around one million birr as part of a loan package from the World Bank and ADB. Although the fund allocated was small, it has nevertheless created awareness among decision makers and engineers and set precedence for subsequent projects.

Monitoring

Adequate and sustained monitoring is often lacking due to institutional, financial, human resource and legal constraints. The prime interest of those who manage projects is maximization of production regardless of the consequences of their activities on the environment. The only initiative that has been undertaken so far is the creation of the Project Control Center (PCC) within the Amibara Irrigation Project. The PCC is responsible for the management of the major water diversion and distribution system.

A major maintenance operation of the PCC is desilting of canals and drains and clearing of vegetation.

The PCC has a small unit staffed by a sanitarian and two trained technicians to monitor the effects of the project on the environment and institute measures to mitigate adverse impacts. Although the unit is not comprehensive in its activities and is constrained by funds and facilities, it appears a practical arrangement for regular site monitoring and the promotion of intersectoral collaboration.

CONCLUSION

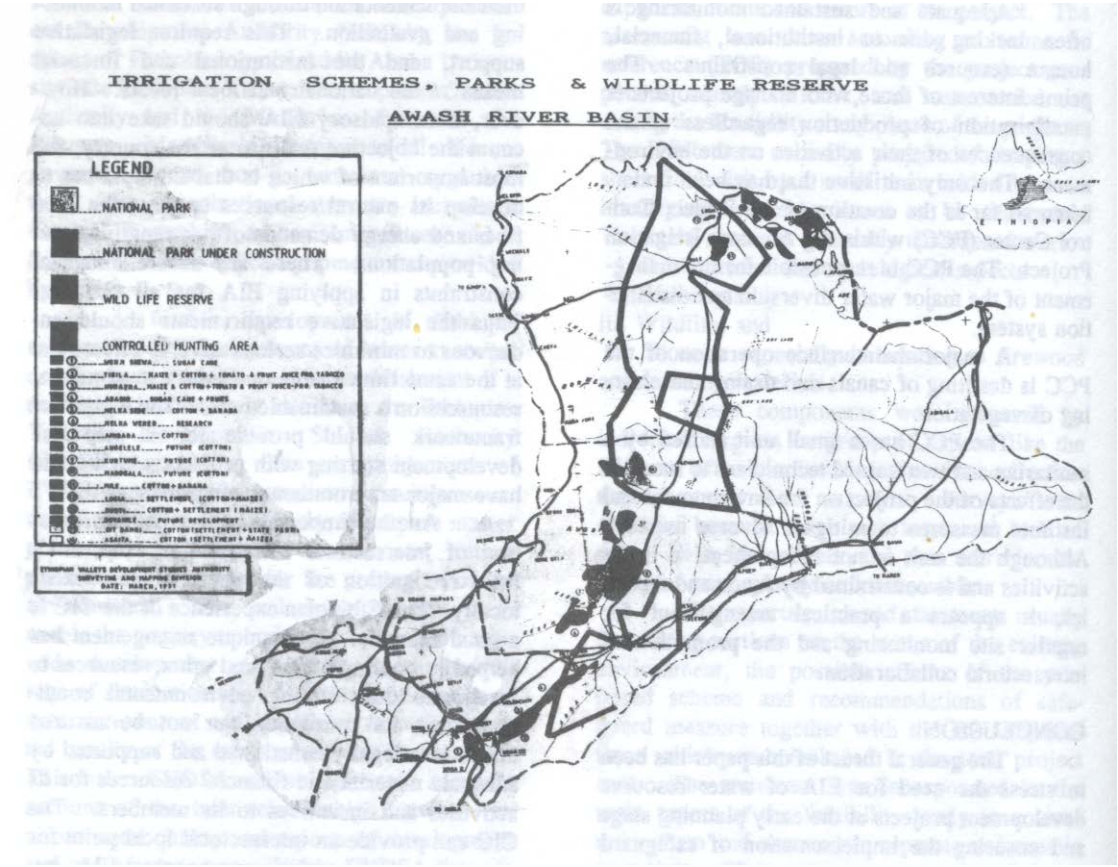
The general thrust of this paper has been to stress the need for EIA of water resource development projects at the early planning stage and ensuring the implementation of safeguard measures throughout the life of the projects. Failure to do so would result in serious environmental degradation and socio-economic impacts. What has to be realized is that once the resource base is depleted or polluted, it is financially and technically difficult for developing countries like Ethiopia to restore it to its original productive capacity.

Past efforts to incorporate environmental concerns in development planning in Ethiopia were limited both in scope and in influencing decisions. EIA requires a systematic methodological approach based on adequate knowledge of the local ecology, existing socio-economic and environmental status, careful assessment of possible impacts of the proposed project, development of simple but effective mitigation measures against adverse effects and ensures their implementation through sustained monitoring and evaluation. This requires legislative support, and the institutional and financial means at the national and local levels. However, a compulsory EIA should take into account the objective realities of the country, the most important of which is that Ethiopia has to develop its natural resources to meet the food fiber and energy demands of her rapidly growing population. There are severe financial constraints in applying EIA for all projects. Thus the legislative requirements should endeavour to minimize serious adverse effects and at the same time enable optimum use of natural resources on a sustainable basis. The legislative framework should provide for a step-wise development starting with projects which could have major environmental consequences.

Another important aspect is the promotion of intersectoral collaboration. There is little recognition of the potential that exists locally. The Ethiopian experience of the CIC is a good example. This unique arrangement has helped in pooling human and other resources to ameliorate deteriorating environmental conditions, but its continuity can not be assured unless it is legally constituted and supported by adequate material and financial resources for its activities and incentives to its members. The CIC can provide an intersectoral focal point for successive stages of comprehensive EIA implementation including evaluations.

Engineers are often inadequately informed of the environmental risks associated with the projects they design and construct. It is therefore of utmost importance to inform practicing as well as student engineers of the possible impact and of the technologies available to avert adverse effects.

Most of the large scale projects in manu developing countries are at least partially financed through donor aid or loans which often lack provisions for the implementation of environmentally sustainable development. Funding agencies especially the international financing agencies as well as the UN agencies can have a considerable influence on projects financed by



them. They should therefore collaborate with developing countries in their effort to plan and implement environmentally sound development through human resource development facilities and financial support.

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