Journal of Global Environment Engineering, Vol. 2, pp. 1–8, 1996

INVITED PAPER

ENVIRONMENTAL ISSUES AND ECONOMIC DEVELOPMENT IN INDIA: Challenges for Civil Engineers.

V.K.Sharma [1]

Abstract

Presently, civil engineers in India are being faced by two major types of challenges. The first type is related to the economic development that causes environmental degradation. Rapid economic development is necessary to alleviate wide spread poverty in the country. Despite several measures on environmental fronts taken by the Government, controversies often surround many development projects. Environmental issues that were neglected in the process of economic development earlier, must now be considered judiciously for sustainable development. The second type of challenge is posed by the problem of emerging environmental extremism and misconceptions in the country. Unnecessary spreading of environmental over consciousness among the people through the media, some individuals and organizations, is a serious concern. This may result in excessive spending of public funds on environmental problems of trivial nature and divert attention from the real issues. Present article is an attempt to address these challenges and suggest some of the countermeasures that could be adopted by the civil engineering community in India. This could minimize environmental degradation and ensure the economic development in the country.

KEYWORDS: *Economic Development, Environmental Controversies, Indian Government, Civil Engineers.*

1. Introduction

Engineers in general, and civil engineers in particular, are supposed to design their development projects in such a way that they are "the best". In ancient times, when ample resources were available, the phrase "the best" was confined to the best performance in terms of strength, durability and utility of the project. The design engineers, sometimes, used to ignore economy and this could be observed in some of the old forts, palaces, transport projects and many other public interest projects. Slowly due to resource constraints, economy was given more importance and civil engineers concentrated on designs which were "the best with economy."

Economic development is essential for a developing country like India. Therefore, national development plans and programmes should pursue sustainable growth to alleviate wide spread poverty in the country and to compete in the world market. Unfortunately, economic activities are closely linked with the various types of damages to the environment. If continued unabated, environmental degradation may result in a long-term problem that will affect the

1 M.E., Ph.D. (Civil/Environmental Engg.),Indira Gandhi Institute of Development Research (IGIDR), Goregaon(E), BOMBAY-400065, Bombay, India.

natural resource base - the foundation for future economic growth and development. Therefore, environmental issues have become much more important than ever before and they are to be integrated with economic development. Most of the development projects require skills of civil engineers. Hence, the emerging challenge is to design their projects to perform "the best with the least cost and the least environmental damage."

Furthermore, definition of environmental damage itself is a challenge for civil engineers in India. There has been, particularly in the last decade, mushrooming growth of environmental non government organisation (NGOs) and media persons. While some of them have raised genuine issues, others simply exaggerated unimportant problems obscuring the real ones. Many of the "green movements" and "green organizations" sometimes create a distorted image of environmental issues and cause fearful reactions among the people. Policy makers may be influenced by these movements and the Government's money may be misdirected to solve environmental problems of tertiary or negligible level. The discipline of environmental engineering that emerged originally from sanitary and water supply engineering have been the integral part of civil engineering(Chadderton, 1995). Due to involvement of several other disciplines, it should not lose its importance. The civil and environmental engineers should find out modern and appropriate solutions and execute their projects in such a way that they pose "the least real environmental damage" at one hand and counteract "environmental extremism" to ensure sustainable development on the other.

2. Government's Environmental Concerns

India's Constitution includes a commitment to resource conservation and environmental protection. In successive five-year plans of the Indian Government, environmental management-the term encompassing planning, protection, monitoring, assessment, research, education, conservation and sustainable use of resources has been increasingly accepted as a major guiding principle for national development. In addition, public debate on environmental issues (excluding exaggerations) is lively, leading to greater consciousness of environmental management. The Environmental Protection Act of 1986 sets out the parameters under which the Ministry of Environment and Forests(MOEF) operates to formulate and carry out environment policy at the national level. MOEF is the nodal agency in the administrative structure of the Government for the planning, promotion and coordination of environmental and forestry programmes. Within the overall framework of its mandate, the main activities of the Ministry are conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas and protection of environment.

The MOEF has empowered the Central Pollution Control Board that enforces environmental regulations through State Pollution Control Boards(SPCBs) in the country. Importance of the Ministry could be gauged by continuous increase in its budget allocation. The annual outlay for the year 1995-96 is about Rs. 3.71 billion as compared to Rs. 3.60 billion in 1994-95 and Rs. 3.18 billion in 1993-94 (US$1=Rs.34 approximately at current rate). Major steps taken by the Government in the area of resource conservation and environmental protection are illustrated in the following sub sections (MOEF, 1993 and 1995).

2.1 Conservation of Natural Resources

A National Committee on Biosphere Reserves has been constituted and Research Committees for individual Biosphere Reserves oversee the implementation and monitoring of the

Biosphere Reserves Programme. Another National Committee has started its management plan for the conservation and protection of Wetlands, Mangroves & Corals in the country.

The Forest (Conservation) Rules, 1981, have been amended to further decentralize and streamline the examination of proposals received from the State Governments and project authorities. National Forestry Action Plan assisted by the United Nations Development Programme is an integrated perspective programme for long and medium term development of the forestry sector at National and State levels. Involvement of village communities and voluntary organizations is encouraged in protection and regeneration of degraded forests based on sharing of forest produce. The rate of the diversion of forests for other purposes has come down to 25,000 hectares(ha) per annum from 143,000 ha per annum in 1980-81(MOEF,1995).

The Convention on Biological Diversity signed by the Government during the Earth Summit of the United Nations Conference for Environment and Development has come into force from May 1994 in India. A core group initiates, guides and supervises all activities related to the conservation of Bio-diversity. Action has been initiated to prepare a comprehensive status report covering various facets of bio-diversity. The network of protected areas in the country now comprises 80 National Parks and 441 Wildlife Sanctuaries including 23 Tiger Reserves. The Wildlife(Protection) Act, 1972, has been modified and a Central Zoo Authority has been established for the overall management of Zoos in the country. There is a Steering Committee under the Chairmanship of MOEF to supervise and guide the implementation of the Project Elephant. Activities like seminars, photographic exhibitions etc. are arranged to educate the people in wildlife conservation.

2.2 Abatement of Pollution

Environmental audit has been made compulsory which requires all industries applying for environmental clearance to submit an annual environmental audit report to the concerned SPCB. A scheme for conducting environmental audits in selected units belonging to the 17 heavily polluting industrial sectors and training of personnel in these units, has been initiated. The objectives of this scheme are - to evaluate the performance of the pollution control systems, to identify good pollution abatement systems and to impart on-the-job training to industry personnel in environmental monitoring.

The Water (Prevention and Control of Pollution) Cess Amendment Act, 1991, was brought into effect from January 1992, whereby Cess charges on water consumption have been increased to encourage water conservation. There is a network of 480 stations to monitor the water quality of the aquatic resources of the country under Global Environmental Monitoring Systems, Monitoring of Indian National Aquatic Resources and National River Action Plan(NRAP) programmes.

There are noise standards for various machinery and household equipment in the country and "Silence Zones" have been declared in metropolitan cities to check noise pollution. In case of automobiles, these standards are effective for vehicles manufactured after December 1992. A centrally sponsored scheme is being implemented with the objective of creating an infrastructure in the SPCBs to regulate the management of hazardous substances handled by industries. Under the scheme of "Labelling of Environment Friendly Products," several items of household and other consumer products have been identified. An eco-logo, the "Earthen Pot", known as "ecomark" has been introduced by the MOEF and given wide publicity.

In addition to the above steps, there are several fiscal incentives provided to the industries by the Government. Depreciation allowance of 100% for installing pollution abatement equipment, partial exemption on custom duty on imports, relief in excise duty on such equip-

ment etc. are some of those worth mentioning. These incentives are aimed at encouraging the industries to adopt pollution abatement measures.

3. Controversies and Engineering Measures

Undoubtedly, the rapid industrialization in India has thrown up a multitude of environmental problems. The Government has moved forcefully and strategically to address these problems at the central and state levels based on regulation, enforcement, monitoring and public awareness. Despite the several steps taken by the Government, many controversies have been raised. Following are examples of some of the major development projects which have caused controversy because of their effect on the ecology and environment (Hindu,1995; MOEF,1995). Incidentally, these projects require considerable input from civil engineering discipline. This section is not meant to speak for or against such controversies but to review the problems from a technical stand point. Also suggested are some of the countermeasures which could be adopted by civil engineers for avoiding such controversies hindering the economic development.

3.1 Aquaculture Projects

In India, the prospects of marine fishery have reduced considerably due to over exploitation and destructive fishing practices. To meet the growing demand of exports and the domestic market, the Government of India is emphasising modern aquaculture projects. Various steps have been taken in this direction, such as allowing participation of the private sector, training fish farmers and providing infrastructure for aquaculture. Chilka Aquatic Farms Limited(CAF) is one of the controversial aquaculture projects at the "Chilka Lake" in the State of Orissa. The Chilka is India's largest brackish water lake(about 100 sq. km) which is the home for about 100 species of fishes and 150 species of birds. This is also the source of the livelihood of about 100 thousand fisherfolks and local villagers. The CAF is a Rs. 200 million company formed by the State Government, lead industrialist Tatas and some other private sectors.

The promoters have claimed that the project will benefit the surrounding villagers and fisherfolks and will not cause significant ecological damage. On the other hand, the villagers say that the project has several demerits and in the long run will be harmful for them. They fear that the project will erode their livelihood and ruin their resource base by causing pollution due to high protein feed and chemicals used in the modern technology. They have opposed the project since its inception in the form of "*Chilka Save Movement.*"

From the civil engineering point of view, it is required to reassess the damage caused by the construction of embankments for such projects that may result in floods and water-logging in the surrounding area. Proper planning is required for discharge of toxic effluent that may otherwise affect the local soil and water resources. Grouping of aquaculture projects on barren and fallow land and away from the fertile land will protect the latter for agriculture. Furthermore, the possibility of over exploitation of ground water by shrimp farms that may convert the ground water aquifer into brackish water should be ascertained and avoided by the civil engineers.

3.2 Multipurpose Dam Projects

Narmada Dam Project constructed across the river Narmada is an example of a gigantic multipurpose dam project. After completion, the project will have 30 major, 135 minor and

3000 small dams consisting of hydel, multipurpose and irrigation dams. The major controversy is about Sardar Sarovar Project, a part of Narmada Project, in the state of Gujarat costing more than Rs. 130 billion. It is feared that this project may cause submergence to about 39,000 ha of forests and 11,000 ha of agriculture land and displace about 67,000 people including the local tribal population. Initially, in 1979, it was laid down by the Narmada Project that out of about 6,600 families displaced, landed or landless, each will be allotted 2 ha of irrigable land as compensation. But now the figure has risen to 40,000 families. Reportedly, the number of oustees was under estimated and there is no clear cut policy for rehabilitation and resettlement of these oustees. The affected oustees, along with some NGOs have started an opposition movement known as "*Narmada Bachao Andolan(save Narmada movement).*"

While resettlement and rehabilitation issues are the major problems and require involvement of many other disciplines, the estimates of excavations, embankments and submergence area are the tasks of civil engineers. It is the submergence area that has brought out the controversies about the number of persons affected by the dam. Therefore, engineers should come out with the clear picture of such damages so that the work of the project could progress well. They are also supposed to estimate the area required for command area development of canal networks, backwater effect and reforestation programmes. Simultaneously, highlighting the actual benefits of the project, namely, increases in irrigation potential, drinking water supply and water for industrial use is the moral obligation of engineers.

3.3 National River Action Plan

The ambitious National River Action Plan(NRAP) of the Government of India aims at cleaning some 19 grossly polluted stretches of 13 major rivers and 14 comparatively less polluted stretches of nine rivers. The plan has the estimated outlay of Rs. 10 billion spread over a period of 10 years. Central Government will contribute 50% of the funds and the remaining is the responsibility of respective State Governments.

The Ganga Action Plan(GAP) is a similar plan initiated on the river Ganga which is the largest(about 2500 km long) and considered the holiest river in the country. The first phase of the GAP was appraised and started in 1985 at a cost of about Rs. 3.43 billion. The Clean Yamuna Project, the second phase of the GAP, is to be executed in 15 major towns of Haryana, Uttar Pradesh and Delhi. It envisages cleaning of the rivers Yamuna and Gomti with an estimated cost of Rs.4.21 billion. Reports say that more than Rs. four billion have been spent on cleaning the Ganga river under the GAP but little has been achieved. The claims made by the authorities and the story from media are contrasting each other. Despite the claims of having prevented the sewage inflow, thousands of municipal sewers and industrial plants are still discharging their effluent into the river. National Environmental Engineering Research Institute investigated that many of the waste treatment systems covered under the Ganga Action Plan Phase-I are either not constructed or not functioning. The annual report of the MOEF mentions that under GAP Phase-I, out of the total planned, about 70% of effluent intercepting and diverting facilities and about 49% of effluent treating facilities has been created.

Before going ahead with such programmes, civil engineers should first chalk out an elaborate plan for the provision of sewage and industrial effluent treatment plants. This will need thorough investigation of a number of sources along the river stretch and the quality and quantity of effluent discharged by them. The major objective of such river action projects should be to reduce pollution load and setting up of self sustaining treatment plants. Therefore, it is not mere establishing the facilities, but also their proper functioning that should be ensured

by civil engineers as in these cases they are the principal officers-in-charge. Provision of Up-flow Anaerobic Sludge Blanket(UASB) plant at Kanpur is a good example of civil engineering measures to tackle the problem of effluent discharged into the river Ganga. Industrial effluent mainly from leather tanneries and municipal sewage are mixed in the ratio of 1:3. The plant has been used successfully to treat about 36 million litres of effluent per day(Sharma, 1995).

3.4 Railway Projects

Railway projects such as Konkan Railway Project(KRP), if properly planned, may act as boon to Indian economy. The KRP envisages a railway line along India's west coast covering a 760 km stretch from Roha in Maharashtra State to Mangalore in Karnataka State at a cost of Rs. 14 billion. The main controversy with this project is about 54 km long rail route passing through the state of Goa. The environmental activists argue that the present route through Goa will have detrimental impact on estuarine ecosystem, wetlands, archeological and the heritage site of the region. The activists opposing the route have come together in the form of Konkan Railway Realignment Committee(KRRAC). The committee has suggested an alternate route towards the east of the present route. On the other hand, Konkan Railway Corporation(KRC), the project executing authority, claims that the alternate alignment suggested by KRRAC will increase the project cost by Rs. 550 million. It will increase the length of railway line by 15 km and add 19 km of tunnel delaying completion of the project. The KRC also argues that alternate route will destroy 350 ha of forests in Eastern Goa, while this figure is quoted only 54 ha by KRRAC activists.

In this case, whichever the route is followed, it is impossible to avoid ecological and environmental damages but civil engineers should consider minimising them. If the claims of KRRAC are considered correct the increase in cost from Rs. 14 billion to Rs. 14.5 billion is hardly a major constraint. Rigorous environmental impact assessment should be used to resolve the ambiguity. Available current civil engineering technologies should also not cause much delay for construction of the said tunnels and 15 km more length.

4. Environmentalism and Role of Engineers

4.1 Extremism

The active efforts of many individuals and organizations are commendable in the form of their voice for protecting the Taj Mahal(one of the world's most famous monuments) from pollution, provision of lead free petrol to reduce air pollution, closure of certain polluting industries etc. However, some persons in India are just environmental advocates who only plead and do not wish to act sincerely for improving the environment. Such activities may create a distorted image and fearful reactions among the people, who then start suspecting all development projects irrespective of their economic gains. According to environmental extremists, whether it is green revolution for agriculture or blue revolution for aquaculture, each development project should be stopped on environmental grounds. In many of the cases such claims lack true analysis. Some environmentalists want publicity to come into the limelight so that government funding could be diverted towards the unimportant problems raised by them.

It should be noted that even if there is no development at all, environmental conditions may still deteriorate due to population pressure and lack of proper care and planning. That economic development will always result in environmental blunders is simply an exaggeration. Engineers should counteract such extremism and convince the people with facts and figures

based on real environmental and economic analysis of the projects. They should act in a responsible manner so that the sensitive and burning issue of environment should not become a business.

Frequently, pictures of smoke spewed through stacks, or waste water discharged from an industrial outlet can be seen in several magazines, newspapers and even watched on television sets in India. Although the media is the best way to increase environmental awareness, sometimes, it may overemphasise and exaggerate the simple problems. For example, any emission coming out of the stack is bound to be black, grey or of some other colour; any waste water discharge will naturally look dirtier than potable water but audiovisual impacts are sufficient to influence the public and create wrong impressions. Engineers should, here for instance, stress upon the composition and strength of the pollutants coming out as air emissions or waste waters *vis-a-vis* their negative impact on health and property.

4.2 Misconceptions

In air pollution problems, a possible mistake could be made if natural sources of pollution are not taken into account. Let us consider the pollution problems in two Indian metropolitan cities - Bombay (name has been changed to Mumbai recently) and New Delhi. Some may say that New Delhi is more polluted than Bombay or *vice-versa*. Taking an example of the suspended particulate matter(SPM) as pollutant, undoubtedly, annual average of the SPM levels is higher in New Delhi(around 450 μ g/m^3) than in Bombay(around 250 μ g/m^3). But one should not neglect the background effect of the aerosols transported from the Thar deserts of Rajasthan to New Delhi. Therefore, source identification and apportionment techniques should be carried out to know the net effect of anthropogenic sources of SPM. Common people may not understand such complex processes involving masses of data. Engineers should be able to produce simple indices, such as air quality index in this case, to avoid such misconceptions. Furthermore, it is not only the level of pollutant but its physical and chemical composition that matters. It may be possible that composition of SPM in Bombay may be much more harmful than its composition in New Delhi. Hence, comparisons without proper substantiation may mislead not only the laymen but also the policy makers. Engineers should counteract the spread of such misconceptions. They should promote both qualitative and quantitative solutions to environmental problems(Sharma, 1992).

In the case of industrial effluents, specifying the standards without considering stream conditions is incorrect. For example, whether Biochemical Oxygen Demand of effluent should be 30 or 50 ppm depends upon the natural pollution level of the stream. Furthermore, the effluent standards would be different for land disposal and stream disposal. Involvement of engineers in the team of decision makers will solve such problems. In most of the cases, effluent standards are violated by small firms who have misconception that the cost of treatment plants will be exorbitant. Civil engineering communities should be able to design and demonstrate low cost common effluent treatment plants and convince such firms with the cost-effective solutions.

Use of low waste technologies and waste recycling techniques will be beneficial, both economically and environmentally. Application of fly-ash based cement instead of the costly portland cement in the construction projects could be treated as an excellent example of civil engineering methods of environmental care. Utilisation of waste industrial by-products like fly-ash, calcined lime and gypsum could not only reduce problems of solid waste but also save money and natural resources. The demonstrations of strength and utility of fly-ash based cement in comparison to that of portland cement are required by civil engineers. Many consumers

have psychological impact that recycled products are not strong enough and hygienic. Such barriers to buying recyclables could be broken by simple engineering testings and experiments and specifying the product characteristics.

Last, but not the least, the Government's actions and regulations on environmental issues could be extremely expensive. Therefore, before framing, implementing and enforcing such regulations, proper cost-benefit-risk analysis should be carried out by engineering communities. General public and policy makers do not deal with complex statistical problems and may not appreciate the risk analysis. Civil engineers should take moral responsibility to solve such problems and convince people that environmental damages are not always frightening. Development projects with low environmental damage should not be hindered as the revenue generated through them could also be utilised for improving quality of life including the ecology and environment.

5. Conclusions

In view of the emerging environmental problems and urgent need for economic growth, engineers in a country like India should design their projects with the least environmental damage. Environmental policy should be based on facts and rational calculations rather than emotions and debate. Although engineers know the cost and technological issues of environmental problems, generally, they are not influential before policy makers in India. If engineers also are decision makers, they would be able to solve many environmental problems cost effectively. Engineers should come forward to counteract emerging environmental misconceptions created by a handful of individuals or organizations. They should demonstrate their ability to solve real environmental problems with simple and moderate solutions while sticking to the economics of pollution control. This will avoid wasteful use of scarce resources and promote sustainable development in the country.

References

Chadderton R A.,(1995): Should Engineers Counteract Environmental Extremism?, Journal of Professional Issues in Engineering Education and Practice, 121,2, pp 79-83, 1995.

Hindu,(1995): Various issues of the Indian National Daily "*The Hindu*", 1993-95.

MOEF,(1993): Ministry of Environment and Forests, Government of India, New Delhi, (India), Annual Report 1992-93.

MOEF,(1995): Ministry of Environment and Forests, Government of India, New Delhi, (India), Annual Report 1994-95.

Sharma, V. K. and Patil R.S.,(1992): Chemical Composition and Source Identification of Bombay Aerosols, *Environmental Technology*, 13, pp 1043-1052, 1992.

Sharma, V. K.,(1995): Environmental regulatory measures and their economic impact on the Indian leather industry, *Natural Resources Forum*, 19, 2, pp 153-160, 1995.

Times, (1995): Various issues of the Indian National Dailies "*The Times of India*" and " *The Economic Times*" ,1993-95.