ECONOMIC DEVELOPMENT, ENVIRONMENTAL ECONOMIC PRACTICES AND ENVIRONMENTAL MANAGEMENT IN GUJARAT.

A dissertation in Economics under the Faculty of Arts, submitted for fulfillment of the requirement of Ph.D. Degree to Saurashtra University.

BY

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Certificate

This is to certify that Mr. Tejpal Singh Bisht registered as Ph.D. Scholar from July, 2005 to July, 2009, worked on his research topic **"Economic Development, Environmental Economic Practices And Environmental Management in Gujarat".** The present dissertation for Ph.D. in Economics under Faculty of Arts submitted to Saurashtra University by him is original piece of research work completed under my supervision as a Ph.D. Guide.

The candidate has declared that the work is not submitted earlier to Saurashtra University or any other University for any degree, diploma or distinction.

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Declaration

I, the undersigned, Tejpal Singh Bisht, declare that this thesis submitted by me as a Ph. D. dissertation on “Economic Development, Environmental Economic Practices and Environmental Management in Gujarat” is my original contribution. However, books and journals in my area of research are used and tables taken are cited with appropriate sources. Data analysis is made by me and facts findings are my original version.

I also declare that the present thesis or its portion is not submitted by me for any diploma, degree or distinction to Saurashtra University or any other University.

(Tejpal Singh Bisht)

Place:

Date: / /2009

Chapter Plan

List of figures

List of Tables

Abbreviations used in this study.

MOEF	=	Ministry of Environment and Forest.
SPCB	=	State Pollution Control Board
GPCB	=	Gujarat Pollution Control Board
CPCB	=	Central Pollution Control Board
BOD	=	Biological Oxygen Demand
GIDC	=	Gujarat Industrial Development Corporation, Gandhinagar.
NEERI	=	National Environmental Engineering Institute, Nagpur
Mg/L	=	Per litre Miligram
CETP	=	Common Effluent Treatment Plant
ETL	=	Enviro Technology Ltd.
EIA	=	Environmental Impact Assessment
MLD	=	Million Litres per day
WW	=	Waste Water
KL	=	Kilo litre
GEC	=	Gujarat Ecology Commission
POP	=	Persistent Organic Pollutants
SS	=	Suspended Solid
EKC	=	Environmental Kuznets Curve

Chapter – I

A Framework of Analysis

Chapter – I

A Framework of Analysis

Introduction

The aim of the present research is to examine relationship of economic growth, economic development and economics of environmental process in India in general and Gujarat in particular. Economic development process has to have taken care of environmental pollution both natural and manmade. Environmental Economics and Resource Economics have evolved from various branches of economics such as welfare economics, macro economics, industrial economics, public finance etc. After economic reforms in 1991 in India, economic growth and industrialization processes have created tension for management of environmental pollution in terms of water pollution, solid waste, air pollution, noise pollution, traffic pollution etc. Global Warming has also challenged availability and utilization of resources for present and future generation along with sustainable growth of economy as well as sustainable environmental pollution. However, this study is confined to the study of industrial and water pollution in Gujarat State.

In the recent times, there has been a growing awareness of risk in environment together with a concern for the continuing death and destruction caused by environmental hazards. Natural hazards and economic progress are parts of the ongoing process of development. The process of development accompanied by rising human population has put a very heavy burden on scarce natural resources. Today a greater number of people and property are at risk from the forces of nature and man made disasters. Environmental hazards are manifested in earthquakes and floods, industrial disasters, and technological upheavals. With the advancements in the field of telecommunication, such hazards are no longer the isolated events. In this century, the study of environmental hazards has become complex and diverse.

Ecological Economics focuses on responsible consumption and calls for global and national economic practices which take the environment and human health into account. Profit-driven interests of corporations often outweigh the health and well-being of individuals. Companies are rarely held accountable for polluting the environment or for their misuse of natural resources.

The present chapter is divided into four sections:
The first one shows relationship between economic development and environmental pollution development, the problem area of this study. The second section reveals theoretical background of this study dealing with principle of polluter pay and willingness to pay by the polluter , environmental Kuznets curve, Environmental Impact Assessment, pre-cautionary principle as well as social cost and private cost principle of environmental pollution and tax. The third section reviews existing body of literature in the recent past, to sort out issues of research addressed in this study . Fourth section expresses objectives of the study and research methodology followed for this study.

Section – I

Interlinkages between Environment And Development

The UN (1992) provided a comprehensive picture of the interlinks between environment and development. The priorities of goals of the economy for sustainable development and the means to achieve them are identified by the Agenda 21 of the plan so as to integrate environment and development. The plan suggested to have a link of national and international policies for revitalization of economic growth with sustainability. It includes, combating poverty, improvement in demographic structure, changes in consumption pattern, health and human settlements, pollution control, energy management, treatment of industrial works and

control of hazardous materials. It offers the inputs which are the vital requirements for overall sustainable development of nations.

This means a concept of sustainable development may be as expanding "production possibility front", management of sustainable pollution, with reasonable population growth to cater to sustainable growth of an economy. It is clear that sustainability links present to future. Some important indications of sustainable development are as follows:

1. GDP growth rate
2. Population stability
3. Human Resources Development Index
4. Clear air index
5. Energy intensity
6. Transport intensity
7. Water Use
8. Soil Degradation
9. Forest Coverage Ratio

For the last three decades, economists and scientists have universally asserted the term with the indication as shown above.

Environmentally sustainable development concerns with degradation of resources largely due to over production and over consumption by the community. Environmental degradation produced unsustainable development but sustainable development concerns over the meeting of needs of the poor in this generation which is an essential object of sustainability. It is equally necessary to meet the needs of subsequent generations. International equity must be extended to equity within each generation Similarly, in the case of India, there must be equity of utilization of man-made production as well as natural resources among the people of

all states of India. And equity in the case of Gujarat may be concerned with utilization of production and right to get share of natural resources for present and "Future Use". Environmental pollution is one of the worst curses, which has happened in 21st century, heaped on mankind. As stated by the word Bank, " As Scientists grow richer, their environments grow poorer". This means, air, water, land, solid waste and noise pollution are increasing at an alarming rate and moreover, human activities are damaging environment. The glaring examples are inversion of the temperature, chemical fall out, the ozone hole, global warming and acid rain etc. They are drawing attention of cross-discipline scientists. Environment is the complex aggregate of external conditions, which affect life, development and survival of all organism. Man has over exploited natural resources for his comforts. There exists a mutually balanced relationship between living creatures and the forces of nature.

Thus, sustainable environmental pollution concerned with absence of negative externalities created by nature or man, which helps to achieve sustainable growth rate of a national economy. The achievement of sustained and equitable development remains the greatest challenge faced by the human race in the present century. It is equally true that environmental constraints e.g. air pollution, water pollution, etc. limit the desired rate of growth and in turn developmental process causes serious environmental damage affecting quality of life. Therefore, it is necessary to pay sufficient attention on this issue by researchers to show ways and means to come out from the situation, with suitable action plan and policy measures.

The problem

After 1991, Govt. of India and the Govt. of Gujarat have followed industrial liberalization policy which has provided a vital boost for diversification of industries from cotton textiles and agro-based industries to chemicals, petro-chemicals, pharmaceuticals and Agro-chemicals. Gujarat Industrial Development Corporation and Industries Commissioner accorded sanctions to locate additional industrial units

in existing industrial estates and in many cases new sites were selected to develop new industrial estates.

Such diversification of industries resulted in increased water and air pollution and solid waste pollution in industrial estates. GIDC provided water facilities but could not provide waste water and solid waste disposal pipelines for conservation, protection and preservation of natural resources surrounding estates. Industrialist were not ready to pay for the pollutants at point level water and air pollution and hence social cost to bear for sustainable environmental pollution increased many fold. Basic theories of environmental economics like “pollutant pay principle”, “ precautionary principle”, “transaction cost theory”, “cost benefit theory”, “internationalization of negative externalities” etc. were not found in operation in the case of GIDC industrial estates in Gujarat. More than 11% growth rate of industries resulted in excessive environmental pollution, which was not taken into consideration by the Commissioner of Industries, Gujarat Pollution Control Board and GIDC estate authorities in Gujarat State.

NGOs, activist lawyers and environmental activists filed public interest litigations in courts. However, daily newspapers like the Financial Express reported that two High Court Justices, viz. Mr. B.N.Kirpal and Mr. Gokhale visited leading GIDC estates (1995) in Ahmedabad, Vadodara, Bharuch and Valsad districts with a team of scientists. They came out with the findings that environmental pollution of waste water, solid waste and air pollution are beyond permissible limits. It has crossed the limits set by Ministry of Environment and Forest, Central Pollution Control Board and Gujarat Pollution Control Board. The Secretary, Department of Industries had to give assurance in writing to make alternative arrangement to manage environmental pollution in Gujarat after High Court decision. Only thereafter , the closed industrial units were opened for manufacturing processes. Hence following questions arise:

1. Achieving higher industrial growth vs. environmental justice to the people and natural resources.

2. Management of sustainable growth vs. sustainable environmental pollution.
3. Role of the State and the Central environmental pollution control authorities.
4. Corporate social responsibility on the part of industrialists to pay for point level environmental pollution, otherwise, social cost of pollution may be many times higher.

The present research is carried out in the light of said issues to be investigated as a research problem.

Section – II

Theoretical Background of the Research problem

It is necessary for any researcher to know the theoretical background of study. Here an attempt is made to highlight basic theories concerning the problem of the study.

There are several Laws and Acts enacted for control and prevention of environmental pollution in any form, in Gujarat. It is worthwhile to know the legal provisions for industrialists (polluters), pollution regulatory authority, people and society. The following figure shows relationship of interest of industrialists or manufacturer level of "A"s activity with level of "B"s activity.

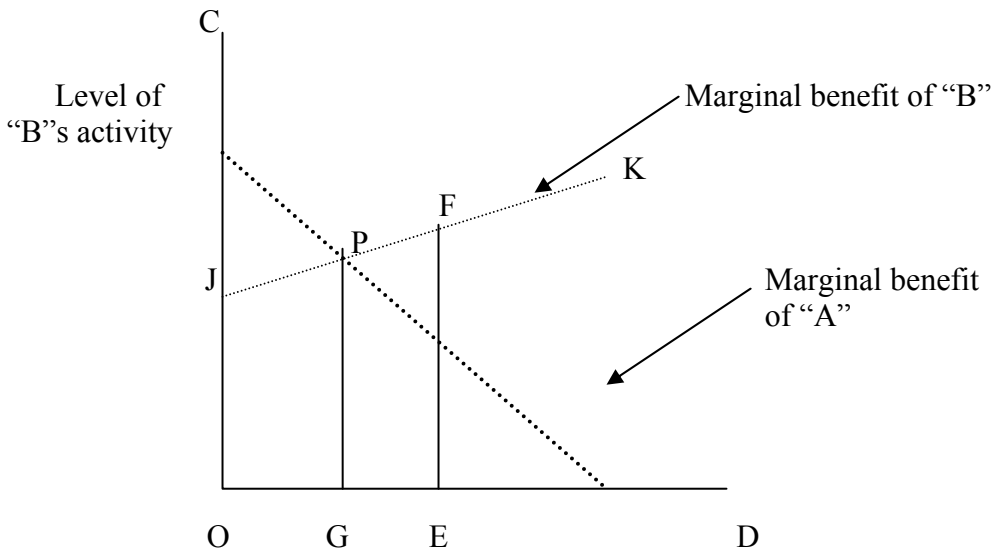

Figure 1.1

It is necessary for Activist Lawyer, Environmental activist, manufacturer and active citizen of a society to know the vision and provisions of environmental legislation for management of sustainable environmental pollution in our society. As mentioned in the figure, economic activity of "A" should not damage environmental interest of "B" in our society. If economic activity is violating norms or legal provisions set by Pollution Control Authority then "B" has a right to get justice in a court of law if mutual persuasion cannot bring solution. In the figure, where

CD = Marginal benefit of "A"

JK = Marginal damage to "B"

OE = Marginal benefit to "A" precisely offsets damage to "B"

EF = Marginal damage = Marginal gain of "A"

OE = Point where bargains take place in the presence of Taxation policies.

If "A" is an industry and "B" is society, environmental pollution problems arise and judicial intervention comes in the way as expressed in the diagram. If there are economic and legal issues for "B", courts have to give justice to the affected party.

In the case of massive growth of chemicals, petro-chemicals and agro-chemical industries in Gujarat, we find that there is air,water and land pollution in Golden corridor of Gujarat State and the society is adversely affected. For industries, legal expenses are cheaper as compared to the permanent investment in non-remunerative fixed environmental cost to treat water and air pollution.

Environmental Kuznets Curve (EKC) Hypothesis

Environmental Kuznets Curve hypothesis states that pollution level increases as a country develops, but begins to decrease as rising incomes pass beyond a turning point. This leads to the conclusion that the relationship between pollution and income can be characterized by an U-shape curve as given below. As such cost of degradation and pollution of the environment has been essentially a health cost to the people and has been estimated in crores of rupees in India, whereas in billions of dollars in the case of the developed countries. The Club of Rome Report had

projected gloomy future for the very survival of life on earth by making linear projections of the levels of pollution if the developed nations continue in their growth path and others try to catch up. The relationship between economic growth and environmental pollution revealed that degradation and destruction of natural resources like land, forests, oceans, and ozone layer in the upper atmosphere and ever increasing levels of pollution in air and water have made every one concerned.

This digram, shows that the environmental Kuznets curve hypothesis states that pollution levels increase as economy develops but begins to decrease as rising income passes beyond turning point. This gives us a clue to believe that relationship between pollution and income can be characterized by an inverted U-Shape curve. This hypothesis has created a debate on the long term relationship between economic growth and levels of pollution. Kuznets (1995) observed a stable long term relationship between poverty level and GNP and is characterized by an inverted U – curve. The phenomenon is known as Environmental Kuznets Curve (EKC). There are empirical evidences in favour of EKC hypothesis. Grossmand Krueger (1993-1995), World Bank, 1991, found inverted U-shape curve in wide range of air and water pollutants.

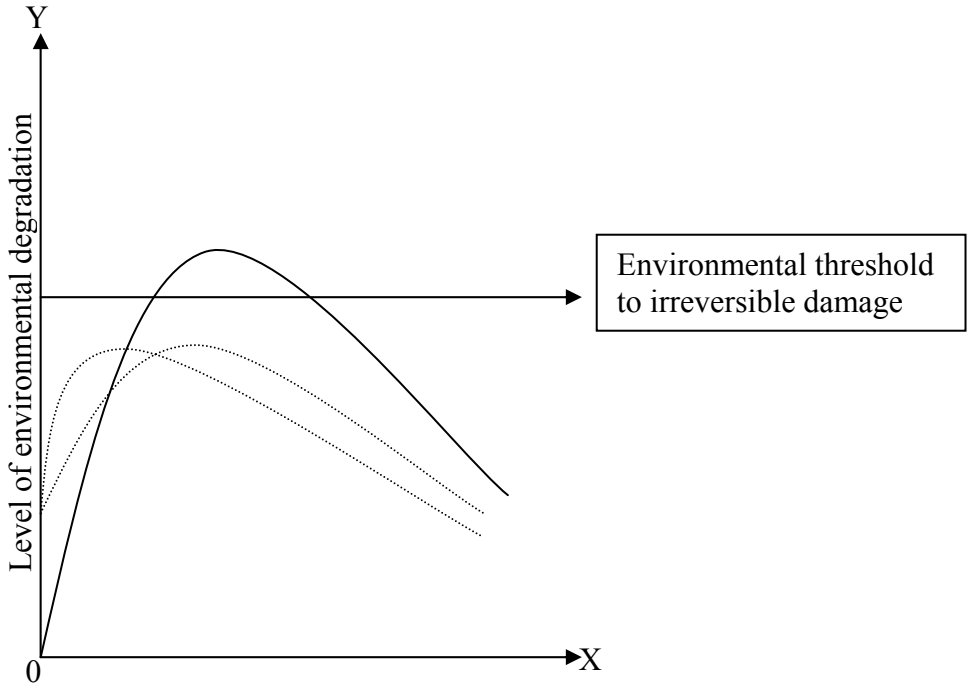

Figure 1.2

There are theoretical arguments in support of EKC Hypothesis, in favour of inverted U-shaped curve, which can be stated as under:

1. Though economic growth may initially lead to increased pollution, the other factors may cause an eventual down turn, at least for some pollutants.
2. Market forces may, by themselves, lead to changes in the composition of production and consumption leading to a great mix of (less polluting) services.
3. Governments are likely to impose increasingly strict abatement policies, reflecting positive income elasticities for environmental quality (along with increasing levels of environmental awareness and a tendency towards more open political system).

Similarly, there are evidences against EKC hypothesis. Seldom and Song (1995) and Holts and Seldom (1995) found negative relationship in the case of air pollution and carbon dioxide emissions respectively. They measured the effect of income growth on three proximate determinants of pollution:

1. The Share of manufacturing in total output.
2. Sectoral composition of manufacturing.
3. Intensity of Industrial Pollution.

Environmental Assessment

Environmental assessment (EA) is a powerful tool for sustainable development by assisting decision-makers to integrate environmental considerations and public input into decision-making. There are two main types of EA – project environmental assessment and strategic environmental assessment. Project environmental assessment pertains mainly to initiatives with physical attributes, such as the construction of a building or bridge. Strategic environmental assessment, on the

other hand pertains to policy-type initiatives such as foreign policy, trade negotiations, or funding for various programs.

While there are similarities between project environmental assessments and strategic environmental assessments, the two are very different and should not be confused. Similarities include terminology, the timing of assessments, links to integrated decision-making, use of a scoping phase before detailed analysis, and identification of mitigation and enhancement options. However, assessing the environmental implications of policies, plan and program proposals is generally more complex than project assessments due to the increased uncertainly of outcomes and the influencing variables involved. This uncertainty is compounded by limitations on scientific data and constraints on the predictability of policy outcomes. Relatively speaking, environmental assessments of projects deal with site specific variables that are tangible and more easily quantified.

- Project Environmental Assessment
- Strategic Environmental Assessment
- Environmental Assessment of Trade Negotiations
- Environmental Assessment of Grants and Contributions

The Precautionary Principle : A Simple Approach to Environmental Economic Law

During the past ten years, the precautionary principle has emerged as an increasingly popular theory which has been applied to the areas of environmental law and resource management. It has appeared in numerous international treaties and declarations, and represents the changing social conceptions about the appropriate roles of science, economics, ethics, politics and the law in a pro-active environmental protection and management regime. While varying in interpretations and having over 12 different definitions, it is fast becoming a fundamental principle of international environmental law.

The main emphasis of the precautionary principle lies in the idea that public and private interests should both act to prevent harm (to the environment) before it occurs. "It dictates that indication of harm, rather than proof of harm, should be the trigger for action - especially if the delay may cause irreparable damage." Central to this principle is the recognition that we have an obligation to protect human life. Our current methods of regulation, by contrast, appear governed by what some frustrated policymakers have called the "dead body" approach: wait until damage is proven before action is taken.

The precautionary principle was first mentioned at the Second International Conference on the Protection of the North Sea (1987). In this manner, it effectively shifted the burden of proof from the regulatory authority to the polluters. However, the principle was only codified for the first time (at the global level) in Principle 15 of the 1992 Rio Declaration on Environment and Development, which stated that "where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

With issues such as hazardous waste, acid rain, the depletion of the ozone layer, the greenhouse effect, and the scarcity of air and water more urgent than ever, it is not surprising that the global community has begun to question and reassess the basic elements of industrial production as an underlying cause of these environmental atrocities. According to Ken Geiser, the major concern has been with the inappropriate use of materials and technologies. This reassessment of industrial production has been the fundamental impetus for the reconsideration of environmental regulation and management worldwide, and has resulted in the growing application of the precautionary principle.

Increasingly, there has been a growing international consensus around the need to reconsider the conventional approaches to environmental regulation and management. Pollution prevention strategies have been replacing more conventional pollution control ones. Whether referring to the "clean technology" or

the “precautionary principle,” the concept remains the same for all: sustainable industrial practices that can be implemented without posing undue environmental risks now or in the coming decades.

Even though the concept is constantly developing, there are six basic concepts now enshrined in the precautionary principle. They are as follows:

1. Preventive anticipation: calls for willingness to take action in advance of scientific proof if it is deemed that an action will be too costly in the future.
2. Safeguarding of ecological space: involves deliberately holding back from possible but undesirable resource use in order to widen the assimilative capacity of natural systems.
3. Proportionality of response or cost effectiveness of margins of error: used to show that the degree of restraint is not too costly if there is a great danger of future life support capacities being unduly undermined.
4. Duty of care, or onus of proof on those who propose change: stresses formal duties of environmental care and strict liabilities for damages while also encouraging innovative but safer technology management and practices. The burden of proof, under this concept, shifts onto those who propose to alter the status quo, rather than simply expecting victims subsequently to seek compensation for damages.
5. Promoting the cause of intrinsic natural rights of an ecological system to allow it to function in a manner that will maintain essential support for all life on earth in the long run.
6. Paying for past ecological debt: calls on those who have already created large ecological burdens to compensate for their past errors of judgment.

Support for the precautionary principle has been increasing within the global community. As such, incorporation of the precautionary principle can be found in various international legal instruments,. Some of these international legal instruments include the 1995 Agreement on Fish Stocks (art. 5, art. 6), Annex II of the Guidelines for the Application of Precautionary Reference Points in Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, the

Convention on Biological Diversity (9th Preambular paragraph), the Convention on Climate Change (art. 3.3), the 1996 Protocol to the London Dumping Convention States (art. 3.1), and in Annex II (art. 3(3)) of the Convention for the Protection of Marine Environment of the North - East Atlantic.

Under German leadership, the precautionary principle is becoming more widely accepted as a fundamental concept of the national environmental laws and regulations. It has been elaborated in the Water Law and Planning Law of Israel, in the Environmental Protection Act of the Czech Republic, and is included in numerous draft environmental laws currently under consideration (such as the Pakistan Draft Environmental Protection Act of 1996). Many other states have also begun the process of defining the precautionary principle within their own systems. These include the Protection of the Environment Administration Act 1991 (Australia), the British government's 1994 Strategy on Sustainable Development, and Canada's 1990 " Green Plan."

Furthermore, recognizing their role in managing, preventing, and reducing environmental risk, fourteen insurance companies from around the world gathered together at the United Nations in November 1995 to sign a statement of environmental commitment. The statement committed its signatories to incorporate environmental considerations into risk management, and to adopt best practices under which management and reducing environmental risks are considered to be a core activity. These insurance companies will require their products and services to contain loss-prevention and other contract terms and conditions which promote sound environmental practices by industry. It is hoped that these insurance companies will inspire others to do the same.

However much the theory seems to have gained in importance, the effects have not been nearly as sweeping as they should be, primarily due to the lobbying efforts of oil and coal companies whose fortunes rely on the continued burning of fossil fuels.

Also many industries have preferred conventional and cheaper add-on technology to installing totally new production equipment.

As we become more aware of the global environmental stresses and strains, it is easy to see that humanity is in trouble. Upto 10,000 people die daily because of avoidable environmental hardship in their daily lives. It is necessary for collective action by every national state and every global citizen to safeguard the "global commons". In addition, since not all countries are in a position to play an equal part as protector, precaution must be employed as facilitator in devices to help the strong to assist the weak in the common cause of survival. It is imperative that both governments and industries alike take a stronger stand to protect and rejuvenate the earth's diminishing resources in order to preserve a safe and secure future for the generations to come.

In order to do this, both government and industry must accept that all people and all organizations have a duty to care for the earth, that business ethics should be governed by wider social and environmental ethics, and that the environment, not industry, determines the limits of tolerance of ecosystems. Both states and industries are urged to go beyond compliance with existing regulations and adopt the practices and technologies that achieve maximal ecoefficiency.

Social and private cost of Environmental pollution and Tax

Environmental regulation has wide effects on economy. Non-regulation on environmental pollution resulted in a very high social cost. A thorough understanding of demand for pollution goods i.e. goods whose manufacturers generate pollution is essential. The following diagram shows supply and demand of polluted good in an economy so as to know cost components:

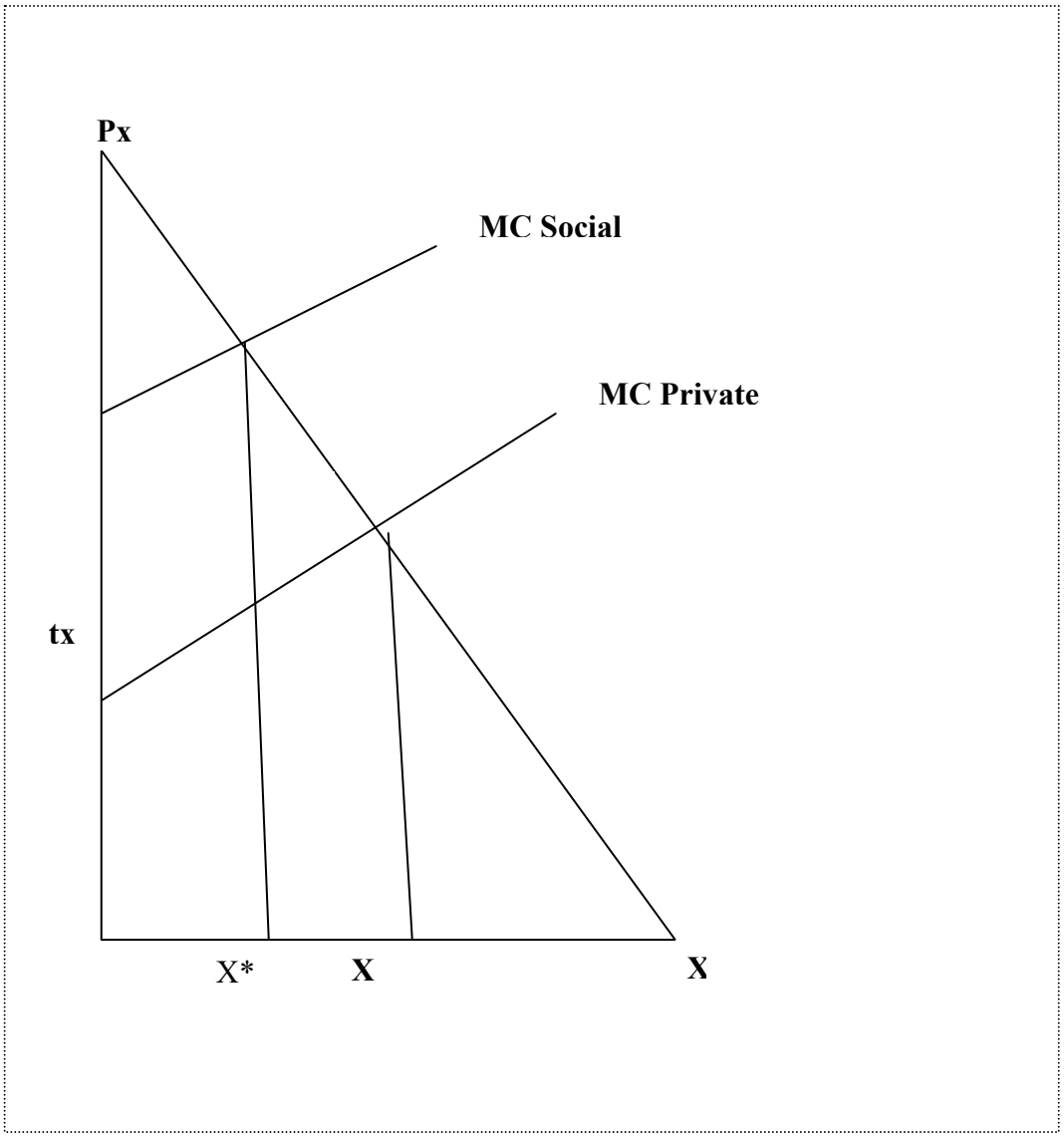

Figure 1.3

The above figure shows a typical demand curve for the goods, as well as marginal private cost curve and marginal social cost curve that includes demand for pollution goods. Without any intervention, the amount of goods produced is X*. If we wish to reduce the amount of these goods produced, this may be accomplished by taxing the production of goods (or the production of pollution) or simply by command and control, directing the firm to reduce pollution. Reduction pollution exercise will incur addition production for cleaner production. In the present case, the price increases by an amount t* and the output is reduced from X to X*. This is known as revenue neutral tax on pollution. It may have the following effects-

(A) Reduction on pollution and reduction in pollution damage (Pigovian effect).

(B) Reduce distortionary taxes on labour and hence deadweight loss associated with the taxes, (the revenue recycling effect).

(C) The third effect would be tax interaction effect that acts in the opposite direction.

The above diagram is useful to environmental pollution authority in any state to decide on public choices.

Transaction Cost Theory

Ronald Harry Coase articulated transaction cost theory and held that transaction cost accounts for considerable share of the costs of use of resources in the economy. Coase explained in his theory that the traditional basic-macroeconomic theory was inadequate because it neglected the costs of entering into executing contracts and costs of managing organizations. Ronald Coase paved a way within his theory of transaction cost for a systematic analysis of institutions or the whole mechanism of rule based behaviour in a given economic system. Property rights are important sub set of institutions. When economic agents enter into a contract, rights are negotiated rather than goods or means. Coase reformulated the theory of the firm in the light of transaction costs, which include the costs of information, negotiations and cost of monitoring and enforcing contractual obligations – including legal costs. They, put together, constitute institutional costs (Coase, R, 1937).

Further Arrow (1979 p. 491) took broader view when the costs of operating competitive markets are not zero, as is usually in our theoretical analysis. He further explained that market failure is inevitable wherein

transactions are so high that the existence of the markets is no longer worthwhile. Beside there are the costs of (1) exclusion (2) communication and information and (3) the cost of disequilibrium. If economic agents enter into transaction immediately, they are found inconsistent with the final equilibrium or they are delayed until the computation are completed. Coase viewed that transaction costs are seen in the form of social cost, which bring the problem of externalities (for example in environmental pollution). Coase's theorem can work regardless of who has rights to own how much of the resources. This would require exchanges to take place with the help of third party enforcement.

Waste Minimisation Concept

Since the beginning of environmental movement in the country, both government regulatory agencies and the industry focused their environment protection efforts on controlling the effluent at the point where they enter the environment. This concept is appropriately known as "End of Pipe" (EOP)" treatment. While this EOP approach has to some extent been effective for protecting the environment, it has also presented following disadvantages:

1) It can result in the transfer of pollutant from one medium to another thereby effecting no net environmental benefits. In some instances, this transfer can even increase the risk to human health and the environment.
2) It requires huge dead investments and recurring expenses which makes this concept highly unsustainable and at times for most of the SMEs this is just not feasible on account of poor profitability, space constraints etc.

Realising these drawbacks and looking into other pressing problems (the pollutant assimilation capacity of the receiving bodies nearing exhaustion), the concerned agencies were forced to look back into the industrial production processes and search for alternative approaches for environmental protection – thus emerged the concept of proactive approach of waste reduction at source as a means for achieving

environmental protection. In other words, waste minimization concept was realized as the need of the day. Waste Minimization can be defined as " a new and creative way of thinking about products and the processes which make them. It is achieved by the continuous application of strategies to minimize the generation of wastes and emissions".
For process, waste minimization involves conserving raw materials and energy, eliminating the use of toxic substances as much as possible, reducing quantity and toxicity of emissions and wastes before they leave the process etc.

For products, it means reducing their environmental impact during its entire life cycle from raw material extraction till ultimate disposal.

Waste Minimisation means economic savings from reduced consumption of raw materials and energy, it means lower pollutant treatment costs, it means better working conditions, it also reflects other benefits such as a better company image. Implementing Waste Minimization may not solve all environmental problems at a facility, but it does decrease the need for installing and operating end-of-pipe treatment equipment and reduces the quantity of hazardous waste that needs to be treated and disposed of.

Waste Minimization efforts often reduce workers' exposure to hazardous chemicals, as well as the frequency and severity of accidents and chemical releases. Products that are designed and produced with Waste Minimisation concepts in mind are often less harmful for consumers to use.

The Small and Medium Scale Industries form the backbone of Indian economy. There are 3 million SMEs in the country as against a mere 2000 industries in the large scale sector. The SMEs, spread over an area of 3.28 million sq. km, account for over 40% of the industrial production and 30% of the country's export. These SMEs also contribute towards more than 65% of the industrial waste generated within the country. This waste not only results in a loss of precious raw materials

but also degrades the environment. High specific waste generated from SMEs can be attributed to the following reasons-

a. Inefficient, obsolete and conventional technologies
b. Lack of technical skill
c. Lack of awareness in terms of quality control

The SMEs can ill afford the conventional methods of environmental protection i.e. End-of-Pipe (EOP) treatment as they lack technical skill, space, finances etc. They are however under constant pressure from the regulatory bodies to meet the emission standards set by them. The futility of these EOP measures has been recognized. They only alter the form of pollutants, hence, offer only a temporary solution to the pollution problem. Investment in EOP measures is viewed as a dead investment as it does not bring economic returns to the industry and therefore industry is not very receptive to it.

In this scenario, waste minimization has emerged as an attractive proposition for sustainable industrial development. The reduction of industrial waste i.e. waste minimization, apart from improving the process efficiency and consequently reducing the cost of production, also brings down the pollution load. Waste Minimisation, therefore, serves the dual purpose of making the industrial operations more competitive as well as protecting the environment.

However, the benefits of waste minimization have failed to reach the grass root level of Indian economy - the SMEs. The main reason cited for this failure is due to lack of awareness and proper guidance on waste minimization approach. The available manpower and resources are not adequate to cover the vast expanse of SMEs in the country. Furthermore, there are very few SMEs which can meet the expense of hiring external consultants and who feel the need for engaging them.

To overcome these bottlenecks and to promote waste minimization and give it a shape of a movement, the concept of Waste Minimisation Circle has been evolved.

A Waste Minimisation Circle consists of a small group of entrepreneurs in the small scale industry following similar production process and manufacturing similar products. The group holds regular meetings within the premises of one of the member units and analyses the production process being adopted in the different units. This analysis leads to identification of causes of waste generation and development of WM options through discussions. The group collectively implements the WM options in their respective units, which amounts to increase in individual profitability and overall reduction in pollution load.

The concept of WMC has evolved from the concept of Quality Circle (QC) which revolutionized the quality of Japanese goods. QC consists of a group of workers working in the same division in the industry, interacting amongst themselves to generate ideas which would lead to quality improvement. The strongly felt need to improve quality led to the promotion of QC which took the form of a nationwide movement in which every industry and very worker participated.

As regards the WMC concept the involvement of a nodal agency is essential to convince the potential industries / member units of a cluster to form a WMC. This agency also provides basic information on WM, guides the members in problem solving, provides technical assistance and ensures regulation of meaningful discussions / exploration of ideas and sharing of knowledge in the WMC meetings.

The theme behind the working of Quality Circles is generation of innovative ideas and in this context WMC concept is a step ahead of QC. In a WMC, the entrepreneur interacts with fellow industrialists / entrepreneurs and is exposed to varied versions of similar units and the observations from this exposure lead to comparative analysis enabling him to generate fresh / innovative ideas for improving the current practices and attempt improvement of the existing process.

Waste Minimisation Circles offer an opportunity to the entrepreneur to have a look at his own products and processes from an entirely different angle. Since an entrepreneur is accustomed to seeing his unit in a regular and routine manner, it generally leads to a high level of complacency and therefore a close mind does not look for possibilities of improvement. As under the WMC process the entrepreneur will meet periodically in the work premises of one or the other of its members and the host unit will have a re-look at his unit along with perspectives of three or four other entrepreneurs of the WMC member.

Section III

Review of Literature

There are several studies undertaken by institutions and individuals in India and abroad so as to know different types of environmental pollution, degree and extent in the case of natural resources, fresh water pollution, river and ocean pollution, land degradation and depletion of resources. Industrial pollution and coastal zone management have drawn attention of the researchers in the recent past.

In studies pertaining to economics of environmental theory and practices, Callan and Thomas (1996) provided important theories and practices with examples and policies with regard to modeling environmental problems and environmental decision making. They described public policy along with market failure and market approach. With regard to environmental water pollution they expressed economic decision making rule as under:

(a) The Law does not maintain that the standard be set to maximize net benefits which prevent attainment and efficient level of abatement.

(b) The standards are applied uniformly across discharges within identified industrial groups, which disallow a cost effective output (p. 473).

Mira and Godar (1997) attempted to measure pollution abatement cost in small scale factories in Gujarat. They collected primary data for the years 1993-94 and 1995-96 and collected sample of 45 small scale factories of Nandesari estate in Baroda district. Econometric analysis of the authors have data of 38 factory units so as to know non-environmental production cost with three input models. On an average, they observed that the non-environmental cost was Rs. 14.8 million and the cost of waste water treatment was Rs. 07 million in sample units.

In another article, Smita Misra (1996) observed accounting cost of water pollution of the same GIDC estate. She studied costs of treatment of industrial waste water with affected variables during 1994-95. She expressed the opinion that accounting cost and economic measures for abatement of waste water pollution have positive relationship and advised to measure such cost from time to time by the pollution regulating authority.

Parth Dasgupta and Karl – Goran Maler (et-al 1997) described the rights and legal framework, accounting for environmental degradation as well as macro economic policies and environmental resource use. They concentrated on natural resources, air pollution, management of coastal wetlands and problem of externalities. The content of analysis provided analytical and empirical issues on the role of environmental resources in the development process as well as theoretical issues for understanding of environmental policy.

Indian Economic Association (2008) compiled research papers on economics of sustainable development. Most of the papers highlighted the global warming issues, role of excessive production in agricultural and industrial sector, excessive use of natural and manmade resources and environmental pollution in India. The research

papers are confined to policy options for Ministry of Environment and Forest as well as pollution regulating agencies for sustainable economic development.

National Environmental Engineering Institute (NEERI, 1999) conducted studies on environmental impact assessment of proposed Effluent Collection and conveyance to sea from Ankleshwar, Paneli and Jhagadia industrial estates. It was sponsored by Environmental Preservation Society, Ankleswar so as to know group effort of industrialists of the three GIDC estates in Bharuch district in Gujarat. They studied point level and end-level water pollution by the industries to dispose waste by proposed pipeline to Arabian Sea. The study expressed the opinion that the group effort of industries will have to pay for their pollution, which is non-remunerative.

Bomaul and Oates (1998) provided comprehensive analysis of the economic theory of environmental economic policy. They described the theory of externalities and its application to the design of environmental policy and retained basic structure of organization. Theory of environmental regulation was not introduced and only touched upon the introduction of pollution tax, or effluent fees on pollution activities and policy makers have opted for command control instruments for allowable levels of emission. However, pricing measures for the regulation of emission have been rare. According to them environmental authority needs to determine a set of environmental standards or targets (allowable concentration of pollution) upto certain levels and then introduce a system of fees and marketable emission permits for environmental equality.

Sen and Roy (1996) provided an excellent account of sustainable economic development and sustainable environmental pollution, in LDCs and SAARC countries. They highlighted environmental issues for attainment of sustainable development in an input-output framework. Sustainability is examined in Indian context covering various segments of economy.

Tata Consultancy Services (2000) studied Industrial Pollution and waste water pollution in Gujarat which was sponsored by the Gujarat Ecology Commission, Vadodara. It has provided information on wide spectrum of air pollution, waste water pollution of bays, rivers and canals by GIDC estates in Gujarat, institutional aspects of regulation of pollution, level of industrial activities in protected areas and an action plan for green and cleaner production. The Report cautioned the Govt. of Gujarat, GIDC and pollution regulatory authorities to check future location of industries in Vatva, Naroda, Odhav, Makarpura, Mandvi, Ankleswar and Vapi GIDC estates in the State.

Sengupta and Desmukh (2000) analyzed coastal and maritime pollution in 1600 Km long coast of Gujarat to know the problems faced by marine ecology and economics on Gujarat Coast and threats due to the activities located on the coast. Marine policy and plans to regulate environmental pollution in coastal Zone were discussed in detail.

Prof. Jani studied (2001) Management of water pollution in organized industries in Gujarat – a World Bank capacity building Project - to investigate water pollution by chemical and Petro-chemical industries in golden corridor of Gujarat so as to prepare cost components of hazardous pollutants in waste water disposed by GIDC estates in Bharuch District. He studied output values and exports of chemical and petrochemical units and expressed the view that there is no logic to close down industrial units for the sake of pollution. Group efforts by GIDC estate association provided common effluent treatment plant to treat waste water and landfill site for solid waste. The study provided economics of common effluent treatment plant and land fill site for solid waste management. The study revealed that Gujarat Pollution Control Board (GPCP) and GIDC have not taken required steps in terms of preventive and positive measures. According to him environmental pollution cost to treat waste water in the case of chemical, petrochemical and agro-chemical industries is highly related to pollution load of hazardous pollutants in water.

Stavins (2000) edited published papers between 1988 to 1999 to sort out fundamentals of environmental economics as well as policy option for Government, pollution regulatory agency, ethics of industrialists and resistance of stakeholders. He has suggested policy instruments for climate change and emission leakage problem and provided comparative assessment of green house policy instruments to regulate environmental pollution. The study emphasized regulation of population, regulation of consumption and protection of natural and manmade resources for sustainable growth and cleaner production.

P.K. Jain (2000) provided the levels of pollution in Yamuna river. Sewage treatment plant, industrial effluent and solid waste effluent by local self government were recommended for due treatment. Yamuna is highly polluted due to waste disposed off by the industries located on the bank of river.

Pandya and Deb (2006) studied functioning of Common Effluent Treatment Plants in the case of small scale industries of India. The industries provide substantial employment and value addition per unit of capital employed and exports. However, severe pollution was created by SSI units regulated by command and control type of instruments. The authors expressed the view that CETP's functioning is cost effective exercise to regulate pollution.

Prabha Panth (2006) analyzed an index of regional concentration of polluting industries based on location quotient. The index studied polluting industries in the regions and districts of Andhra Pradesh. The author expressed the view that environmental degradation in the region has paved a way for relocation of the highly polluting industries.

On the basis of review of latest literature on the subject, the following issues need further research and deliberation:

Emerging Issues

1. Sustainable economic development concerns with reasonable growth rate of an economy with tolerable level of environmental pollution in geographical areas.
2. Rising population and higher level of industrial production lead to higher level of consumption of manmade and natural resources, which lead to higher environmental cost for cleaner production.
3. Sustainable environmental pollution concerns with tolerable level of air pollution, waste water pollution and degradation of land. This needs constant watch by pollution regulatory authority to manage pollution load as per set norms.
4. Higher levels of industrialization cause pollution problems and more court cases and different stakeholders are facing problem relating to their existence.
5. Golden corridor of Gujarat from Ahmedabad to Vapi succeeded in establishing chemical and petrochemical units in GIDC estates in Gujarat but did not observe polluter pay principle. Courts forced the GPCB, GIDC and industries association to go in for ground efforts for waste water pollution.
6. Constant research is required in the out come of court cases and their implications on industries and stakeholders in Gujarat.
7. Severity of pollution level is responsible for rising pollution cost in each case of waste water pollution.
8. In Central and State budget the amount earmarked for environment safety and abatement expenditure needs to be increased.
9. Strict enforcement of legal provisions is a must on the part of pollution regulatory authority.
10. Issues and initiatives for promotion of sustainable drinking water in urban and rural areas in Gujarat need to be discussed and efficient fresh water supply systems need to be augmented.

11. It is necessary for society to know negative externalities and their costs of pollution. In the case of rivers, ecosystem and bio-diversity at point level and end level pollution by industries, an organized research should be carried out by institutions and individuals.
12. Who is responsible for industrial waste water pollution? Why enforcement agencies failed to regulate? Why industrialists are not ready to bear environmental pollution cost? Why political lobby of industrialists hesitate to enforce the law? Is judiciary capable of giving due justice to the affected stakeholders in Gujarat? These are some questions which need widespread deliberations in society.
13. Looking to the damage to natural and manmade resources, central statistical organization (C.S.O) has not published deduction of damage and environmentally adjusted State Domestic Product (SDP) and GNP in India.
14. In the case of Gujarat, what are the alternative sources of funding pollution cost to industry as well as to local self government - both for pollution (air and water) and solid waste?
15. New industrial policy (1991, 1995, 2002 and 2005) provide industrial development through liberalized investment plan but scant attention is paid for state environmental pollution.
16. What kind of role can be played by pollution regulatory authorities for sustainable development and sustainable environmental pollution for vibrant Gujarat?

The present research addresses a few of the above mentioned issues in this study. An attempt is made in this study to know basic theories of environmental pollution, environmental practices, preventive actions and policies related with development of Gujarat.

Section IV

Objectives of the study

On the basis of review of literature and issues sorted out in the earlier section, this study aims at following objectives:

1. To overview economics of environment for sustainable growth.
2. To review recent literature on the subject to sort out issues of research.
3. To study nature of industrial pollution in general and waste water pollution in particular.
4. To understand growth pattern of industries, its contribution in Gujarat's economy and efforts made by industries and regulating agencies for cleaner production and hygienic life in Gujarat.
5. To identify the role of Gujarat Pollution Control Board and Central Pollution Control Board for sustainable environmental pollution management.
6. To offer policy options for sustainable environment and economic growth in Gujarat State.

Research Methodology

The present study is based on secondary data from published sources and websites of national/international and state level organizations.

(A) Secondary data pertaining to environmental economic theories for the formulation of problem are collected from books and journals published in the recent past. Earlier studies were consulted to sort out issues of research so as to concentrate on objectives of the present study.

Data pertaining to industrialization process in Gujarat, diversification of industries, industry-wise registered units, State Domestic Product, investment in

Gujarat under Vibrant Gujarat summits are collected from published and unpublished sources of Commissioner of Industries, Gujarat State.

Data pertaining to water pollution, waste water pollution of GIDC estates, industrial units in 'Golden Corridor' industrial belt of Gujarat are collected from GIDC offices, GIDC annual reports, GIDC estate industries association for group effort like Common Effluent Treatment Plants, so as to mitigate hazardous waste water pollution. Similarly, data of court cases, river and bay pollution of waste water largely by industries and regulatory role are collected from annual reports of GPCB and CPCB. Tables were prepared in Time-series and cross-section order for appropriate analysis and economic interpretation of results.

(B) Sources of Data

The following sources were consulted to receive the data for the present research. These include :

1. Annual reports of the Commissioner of Industries, Gandhinagar.
2. Annual reports of Gujarat Industrial Development Corporation, Gandhinagar .
3. Annual Reports of Gujarat Infrastructure Development Corporation, Gandhinagar.
4. Annual reports of Gujarat Pollution Control Board, Gandhinagar and Central Pollution Control Board, Vadodara.
5. Annual Reports of GIDC Estate Industries Association, Vatva, Naroda, Odhav, Makarpura, Ankleswar and Vapi.
6. Annual Reports of Ministry of Environment and Forest Gandhinagar and New Delhi.
7. Websites of Government of Gujarat, Ministry of Environment and Forest, National Environmental Engineering Institute, Nagpur, NIITE, Mumbai.
8. Books and Journals from various professional libraries in Gujarat State.

Methods of Analysis

The collected data were classified and tables were prepared in time-series and cross-section order. Averages, percentages, growth rate and environmental cost techniques were used to analyze the data. Set pollution standard and observed elements of contamination of water are compared. Court cases of 1997-98 and 2007-08 are compared so as to draw conclusions and formulate environmental economic policy for Gujarat State.

Limitations of the study

1. No quantitative technique is followed.
2. Results are limited to the data analysis for the concerned period.
3. Micro level inquiry is not conducted and hence there is no case study of individual large, medium and small scale unit.

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Chapter – 2

Process of Economic Development and Sustainable Environment.

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Process of Economic Development and Sustainable Environment.

Introduction

Earlier chapter has posed theoretical background of this study and economic problem in environmental economic science. Recent economic literature on the subject has shown that in the case of the developing countries like India, higher economic growth of agriculture, industry or transportation sector has also increased pollution in different form and has posed challenges to pollution control authorities.

The present Chapter is divided into three sections, the first one explores the concept of sustainable growth in the realm of environmental management and objectives of environmental practices, the second one reveals environmental practices in India and abroad, whereas the third one explains industrial growth vs. sustainable development.

Section – I

Sustainable Economic growth

The term sustainable economic growth is connected with longer period of growth by adhering to sufficient environmental practices to mitigate pollution problems. On the one hand economic growth will lead to higher rate of growth, whereas, rising production practices create negative externalities to GNP, human beings, natural resources and global warming. It is necessary in the case of India for agencies like Central Pollution Control Board and State Pollution Control Boards to strictly follow set rules and legislations.

Sustainable environmental pollution has posed challenges to the people, to the affected parties, pollution regulatory authority and policy makers. Here sustainable pollution management is related with different sources of pollution like air pollution, water pollution, noise pollution, land degradation and problems created by global warming in under developed countries like India. Sustainable environmental growth is connected with eco-labeling, eco-friendly production and internalization of externalities by managing units. If all countries compete to produce and achieve market in this era of globalization it will create tension and environmental problems emerging from over production. Sustainable environment with adequate rate of growth means cleaner production, clear technological growth and to have per capita availability of resources in comparison to people availing the same in developed world like USA, UK, Switzerland, Sweden etc.

Size of population and Impact on Environment

Economists like Barry Commoner expressed the view that rising population is responsible for imbalance between economic growth and environment. As population increases , total consumption and consumption-led pollution also tends to increase. Economic growth in general and industrial growth in particular increases industrial environmental pollution. This means industrial pollution and rising excessive consumption growth results into negative externalities of growth. If social cost of economic development is rising and environmental resources are vanishing, this will create an imbalance between growth and sustainable environment. He explained this phenomenon by the following formula:

$$\text{Environmental Impact} = \frac{\text{Economic Goods}}{\text{Population}} \times \frac{\text{Pollutants}}{\text{Economic Goods}}$$

The above equation shows population rise, economic goods and rising pollutants are the root causes for negative externalities which inhibit growth. Economics of sustainable development expects to gain insights into the inter relationship between the economy and the environment and to provide new knowledge that might help in preventing the inadequate, and sometimes disastrous ways by which economic systems are managed during the process of economic development. Global community has yet to succeed in effecting the required changes. Many crucial issues such as accountability, equity, justice for sustainable ends and commitments towards fulfillment of the minimum developmental goals are still far away from resolution. If the present growth trends continue in world population, industrialization, pollution load, food production and resources depletion, the limit of growth may be limited to a hundred years. Economists and scientists have identified different concept of sustainability:

(A) Global resources such as the atmosphere, ocean, and bio-diversity, are essential to all life and the degradation of them is irreversible. Hence, the cost of depletion of these resources is impossible to estimate.

(B) Renewable natural resources like forests, soil fertility, and the quality of air, rivers, lakes and wetlands should be managed for sustainable growth. Destruction and damage to the quality of the resources need to be protected, preserved and conserved.

(C) Non-renewable natural resources consist of minerals, fossil fuels and plant and animal species that become extinct or whose number declines over time. Values can be estimated for mineral and some progress has also been made in the valuation of wild life etc.

The sustainable environment and sustainable growth are not only concerned with rise in GNP or per capita rise in GNP but also with reduced environmental cost of the resources in the long run. Environmental accounting provides for deduction of

environmental cost borne by the Govt. towards sustainable environment from the GNP.

Sustainable growth and sustainable environment

In the long run sustainable growth is connected with 'Living Resources' as stated by 'world conservation strategy' in 1980. Sustainable growth is such growth which may fulfill requirement of present generation without affecting the future needs of future generations. In the words of World Commission on Environment and Development, sustainable growth is defined as " Development that meets the needs of the present without compromising the ability of future generations to meet their needs. The concept emphasizes more on economic growth than that of conservation of resources. It means that the developed countries will have to make changes in pattern of production which may save environmental resources. Here, economic growth is not dependent on environmental resources. According to Kruger (1993), to meet environmental protection and conservation expenditure, certain level of rise in economic growth appear necessary, whereas, Daly (1991) opined that higher level of production process necessarily created environmental pollution, which has several negative externalities to the society.

In short, sustainable growth and sustainable environment mean higher rate of growth of GNP with conservation and protection of environmental resources. Hence economics of ethics comes in the way. This means environmental conservation, preservation and protection are profitable and will be given weightage in Economics,other- wise not. However, environmental economistsview differently.

Sustainable growth theory is linked with justice to the people and per capita availability of resources. Main cause of environmental degradation is expansion of industrial activities leading to mitigation of natural resources. One cannot emphasize

that such sustainable growth rate is based on economic and industrial expansion which itself may be the cause for vanishing supply of environmental resources.

Economist Daly explained sustainable growth with sustainable environment in terms of (a) strategy of consumption pattern and sustainability (b) poverty and sustainability with reference to present generation and future generation sustainable pattern of consumption. The theory held the view that it gives justice to present and future generation for utilization of natural resources. The following diagram shows the fact as generation- A as present generation and generation – B as future generation.

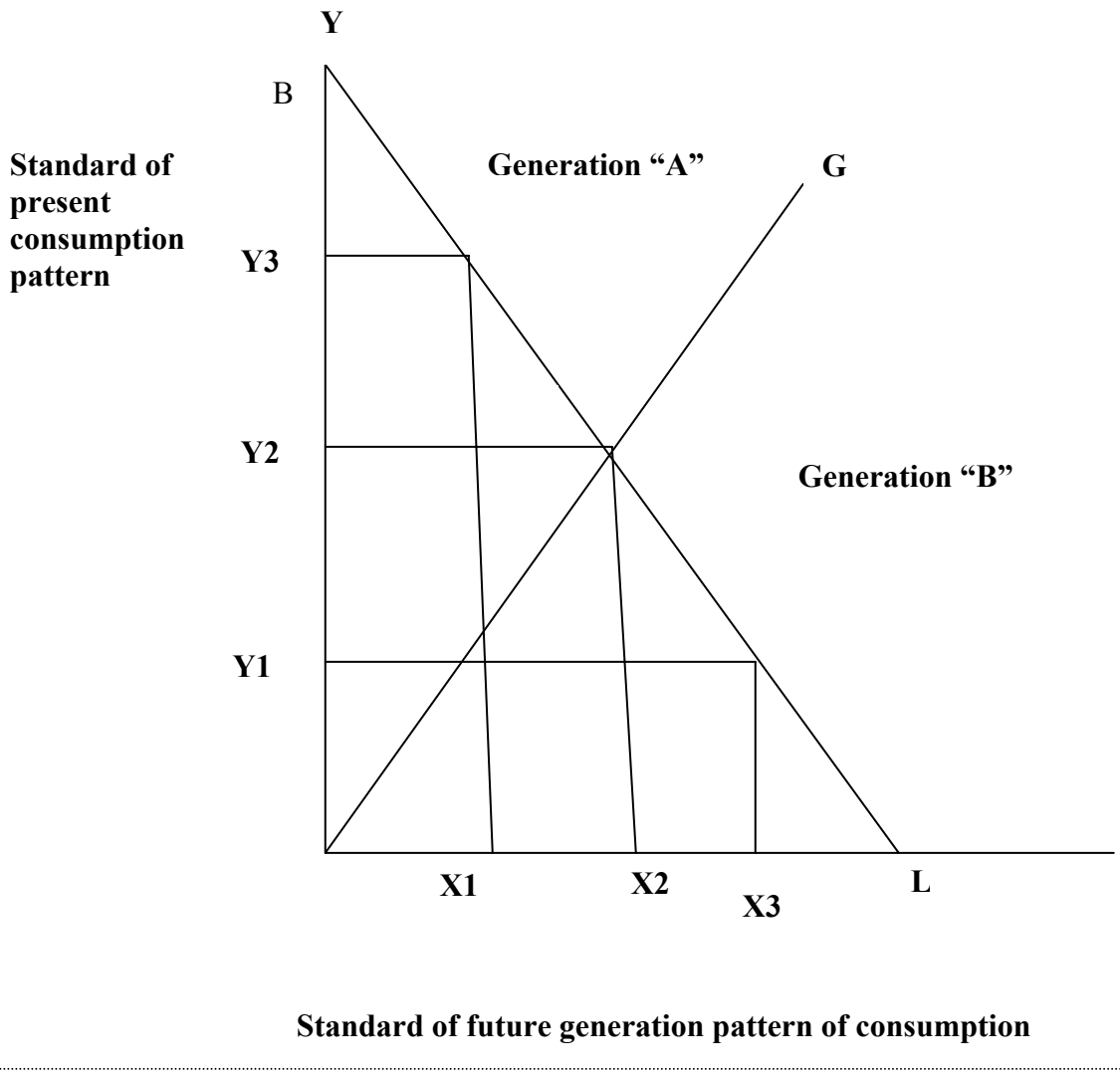


Figure 2.1

On OY axis, generation A has consumption pattern of resources, whereas, OX axis shows expected saving of resources for future generation. If generation A uses OY3 of resources, same should be available for generation – B. But level of consumption pattern by generation – A may leave OX1 resources for consumption pattern for B -future generation. OG line shows economic justice of consumption pattern for both the generations, which indicates that generation – A can consume OY2 resources. If such discipline is observed by generation –A, naturally B-generation can get OX2 resources in the diagram. OY2 and OX2 show equity among inter generation consumption pattern of resources. Natural resources are renewable and hence present saving of such resources happens to be the future regeneration of resources.

This means that indicators bringing pressure of environment, indicators showing social impact of environmental changes and indicators of sustainability of growth and environment are interlinked. For example, indicators bringing pressure on water resources cause growth of water supply, which may cause water-borne diseases in society. As against this sustainability of water supply depends on level of ground water resources.

Sustainable growth and sustainable environment concepts are going together as physical sustainability and economic sustainability upto certain level. Disequilibrium among them may bring pressure on environmental resources, which may ultimately affect sustainability of the resources having impact on society. Here, it is necessary to review major objectives connected with sustainable environment and sustainable economic growth of a nation. They can be listed as under:

Objective of sustainable environment

1. **Achieving environmental objectives in a cost-efficient way**. Since the early 1990s, many countries have renewed their efforts to preserve the environment, adopting ambitious objectives and introducing new policy

instruments. This chapter reviews performance and objective in five key environmental areas-climate change, air pollution, water pollution, waste management and natural resource management and provides data on the costs of environmental policies. On the basis of various reviews, the chapter then examines the extent to which the various instruments used for environment protection (such as voluntary agreements, regulation, environmental taxes and tradable permits) have been efficient. It also presents the recommendations adopted as a result of the peer reviews with a view to reducing the economic costs of environmental improvement.

2. **Attaining social objectives in a cost efficient way**. Achievement of social goals is central to sustainable development. In this respect, countries are faced with the challenge of ensuring adequate retirement income for the elderly in a way that is financially viable over the long term despite population ageing. Based on reviews that dealt with this issue, this chapter presents the main lessons that have been drawn from reforms in this area and the recommendations that have been made for further progress. On a global scale, the improvement of living conditions in developing countries is vital part of the sustainable development agenda. The chapter presents the main findings from seven country reviews that have looked at how countries can participate to achieve this goal through their trade and development assistance polices.

3. **Reducing emissions of greenhouses gases**. Climate change may impose very large costs in the second half of the century and later unless greenhouse gas emissions are kept under control. Given the magnitude of the emission reductions that are required in the long run, it is of paramount importance to ensure that the most cost – efficient measures are used. For this reason, the reviews dealing with the issue have focused on the capacity of climate change policies to deliver the highest possible amount of emission reductions for the cost incurred. The chapter reports the findings and recommendations from country reviews based on analysis for each policy instrument - voluntary agreements, regulations, schemes to

promote the use of renewable energy sources, carbon taxes and tradable permits. It also includes data comparing actual emissions against adopted objectives and provides insights about the extent to which emission trends have been decoupled from economic growth.

4. **Reducing air pollutants**. Air pollution inflicts considerable damage to human health and ecosystems. The data presented show that great strides have been made in recent decades to cut emissions. However, further efforts remain warranted, as is apparent from the estimates of pollution costs reported in the chapter. The chapter then examines the various policy instruments the fifteen reviewed countries have used to reduce emissions, discussing their efficiency. It also presents recommendations on how to minimize the trade – off between the costs and benefits of cutting air pollutant emissions.

5. **Reducing water pollution and improving natural resources management.** Adequate clean water is a precondition to human and ecosystem life. Eighteen country reviews looked at policies affecting the management of water resources and the control of water pollutant emissions. The chapter reports the conclusions from the country reviews as regards developments in water use, in the quality of water bodies with a focus on the capacity of policy instruments to encourage sustainable use and to reduce pollution in an efficient fashion. It also provides data and analysis on sustainability issues in fisheries management.

6. **Reducing and improving management of waste.** Reducing waste generation and increasing recycling rates have been considered as central objectives of many sustainable development strategies. This chapter provides data on performance towards these goals and on the associated costs, notably for recycling programmes. It examines which waste disposal options enable to prevent negative effects on the environment at least cost and then present recommendations drawn from peer reviews on ways to increase the efficiency of strategies to reduce waste-related environmental degradation.

7. **Policy integration for sustainable development areas .**Sustainable development requires that policy decisions aimed at a specific goal take proper account of their effects in the environmental, economic and social dimensions. All country reviews of sustainable development have briefly reviewed the arrangements in place to promote policy integration. The chapter reports on the main findings and recommendations from the reviews which examined the extent to which sustainable development plans and institutions facilitate policy integration. It includes specific analysis on the role of various instruments such as cost-benefit analysis, cost-effectiveness analysis, systematic evaluation of legislation and environmental impact assessment.

Section- II

The present section is devoted to know causes of pollution in general. As such, demand side and supply side management with quality of water affect human life and life cycle. Most of the diseases in the underdeveloped countries of Asia and Africa are the result of lack of clean and safe drinking water . Water pollution has large canvass like ocean pollution, river pollution, open tank or stream pollution connected with water bodies.

The section deals with practices of water pollution, use and misuse of natural resource like water having high scarcity in all states of India .Comprising over 70% of the Earth's surface, water is undoubtedly the most precious natural resource that exists on our planet. Without this seemingly invaluable compound, life on Earth would be non-existent: it is essential for everything on our planet to grow and prosper. Although the human beings recognize this fact, they disregard it by polluting rivers, lakes, and oceans. Subsequently, we are slowly but surely harming our planet to the point where organisms are dying at a very alarming rate. In addition to innocent organisms dying off, our drinking water sources have been

adversely affected as is our ability to use water for recreational purposes. In order to combat water pollution, we must understand the problems and become part of the solution.

Causes of pollution

Many causes of pollution including sewage and fertilizers contain nutrients such as nitrates and phosphates. In excess levels, nutrients over stimulate the growth of aquatic plants and algae. Excessive growth of these types of organisms consequently clogs our waterways, use up dissolved oxygen as they decompose, and block light to deeper waters. This, in turn, proves very harmful to aquatic organisms as it affects the respiration ability or fish and other invertebrates that reside in water.

Pollution is also caused when silt and other suspended solids, such as soil, washoff plowed fields, construction and logging sites, urban areas, and eroded river banks when it rains. Under natural conditions, lakes, rivers, and other water bodies undergo Eutriphication,an aging process that slowly fills in the water body with sediment and organic matter. When these sediments enter various bodies of water, fish respiration becomes impaired, plant productivity and water depth become reduced, and aquatic organisms and their environments become suffocated. Pollution in the form of organic material enters waterways in many different forms as sewage, as leaves and grass clippings, or as runoff from livestock feedlots and pastures. When natural bacteria and protozoan in the water break down this organic material, they begin to use up the oxygen dissolved in the water. Many types of fish and bottom-dwelling animals cannot survive when levels of dissolved oxygen drop below two to five parts per million. When this occurs, it kills aquatic organisms in large numbers which leads to disruptions in the food chain.

Classifying water pollution

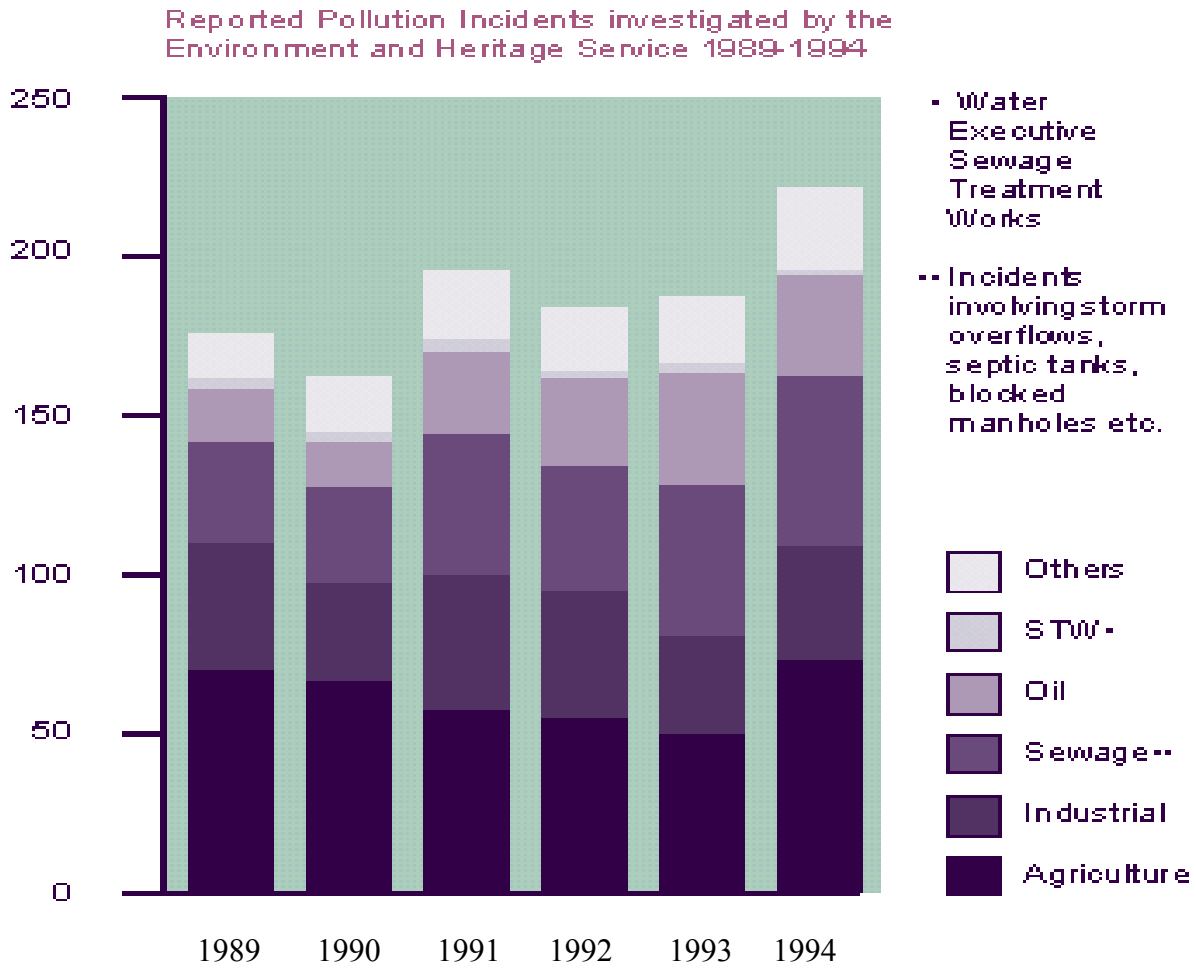
The major sources of water pollution can be classified as municipal, industrial, and agricultural. Municipal water pollution consists of waste water from homes and commercial establishments. For many years, the main goal of treating municipal wastewater was simply to reduce its content of suspended solids, oxygen-demanding materials, dissolved inorganic compounds, and harmful bacteria. In recent years, however, more stress has been placed on improving means of disposal of the solid residues from the municipal treatment processes. The basic methods of treating municipal wastewater fall into three stages: primary treatment, including grit removal, screening, grinding, and sedimentation; secondary treatment, which entails oxidation of dissolved organic matter by means of using biologically active sludge, which is then filtered off; and tertiary treatment, in which advanced biological methods of nitrogen removal and chemical and physical methods such as granular filtration and activated carbon absorption are employed. The handling and disposal of solid residues can account for 25 to 50 percent of the capital and operational costs of a treatment plant. The characteristics of industrial waste waters can differ considerably both within and among industries. The impact of industrial discharges depends not only on their collective characteristics, such as biochemical oxygen demand and the amount of suspended solids, but also on their content of specific inorganic and organic substances. Three options are available in controlling industrial wastewater. Control can take place at the point of generation in the plant; wastewater can be pretreated for discharge to municipal treatment sources; or wastewater can be treated completely at the plant and either reused or discharged directly into receiving waters.

Microbiological and chemical contaminants can enter water supplies. These materials can be the result of human activity or can be found in nature. For instance, chemicals can migrate from disposal sites and contaminate sources of drinking water. Animal wastes and pesticides may be carried to lakes and streams by rainfall runoff or snow melt. Human wastes may be discharged to receiving waters that ultimately flow to water bodies used for drinking water. Coliform bacteria from human and animal wastes may be found. Agriculture, including commercial livestock and

poultry farming, is the source of many organic and inorganic pollutants in surface waters and groundwater. These contaminants include both sediment from erosion cropland and compounds of phosphorus and nitrogen that partly originate in animal wastes and commercial fertilizers. Animal wastes are high in oxygen demanding material, nitrogen and phosphorus, and they often harbor pathogenic organisms. Wastes from commercial feeders are contained and disposed of on land; their main threat to natural waters, therefore, is from runoff and leaching. Control may involve settling basins for liquids, limited biological treatment in aerobic or anaerobic lagoons and a variety of other methods.

Ground water

Ninety-five percent of all fresh water on earth is ground water. Ground water is found in natural rock formations. These formations, called aquifers, are a vital natural resource with many uses. Nationally, 53% of the population relies on ground water as a source of drinking water. In rural areas this figure is even higher. Eighty one percent of community water is dependent on ground water. Although the State Water Quality Reports indicate that, overall, the nations'ground water quality is good to excellent, many local areas have experienced significant ground water contamination. Some examples are leaking underground storage tanks and municipal landfills.



Source:UNEP Report, 1996

Figure 2.2

Legislation

Several forms of legislation have been passed in recent decades to try to control water pollution. In USA, the Clean Water Act provided 50 billion dollars to cities and states to build wastewater facilities. This has helped control surface water pollution from industrial and municipal sources throughout the United States. When congress passed the Clean Water Act in 1972, states were given primary authority to set their own standards for their water. In addition to these standards, the act required that all state beneficial uses and their criteria must comply with the "fishable and swimmable" goals of the act. This essentially means that state beneficial uses must be able to support aquatic life and recreational use. Because it is impossible to test

water for every type of disease-causing organism, states usually look to identify indicator bacteria. One for example is a bacteria known as fecal coliforms. These indicator bacteria suggest that a certain section of water may be contaminated with untreated sewage and that other, more dangerous, organisms are present. These legislations are an important part in the fight against water pollution. They are useful in preventing evironmental catastrophes. The graph shows reported pollution incidents since 1989-1994. If stronger legislations existed, perhaps these events would never have occurred.

Global water pollution

Estimates suggest that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases. With over 70 percent of the planet covered by oceans, people have long acted as if these very bodies of water could serve as a limitless dumping ground for wastes. Raw sewage, garbage, and oil spills have begun to overwhelm the diluting capabilities of the oceans, and most coastal waters are now polluted. Beaches around the world are closed regularly, often because of high amounts of bacteria from sewage disposal, and marine wildlife is beginning to suffer.

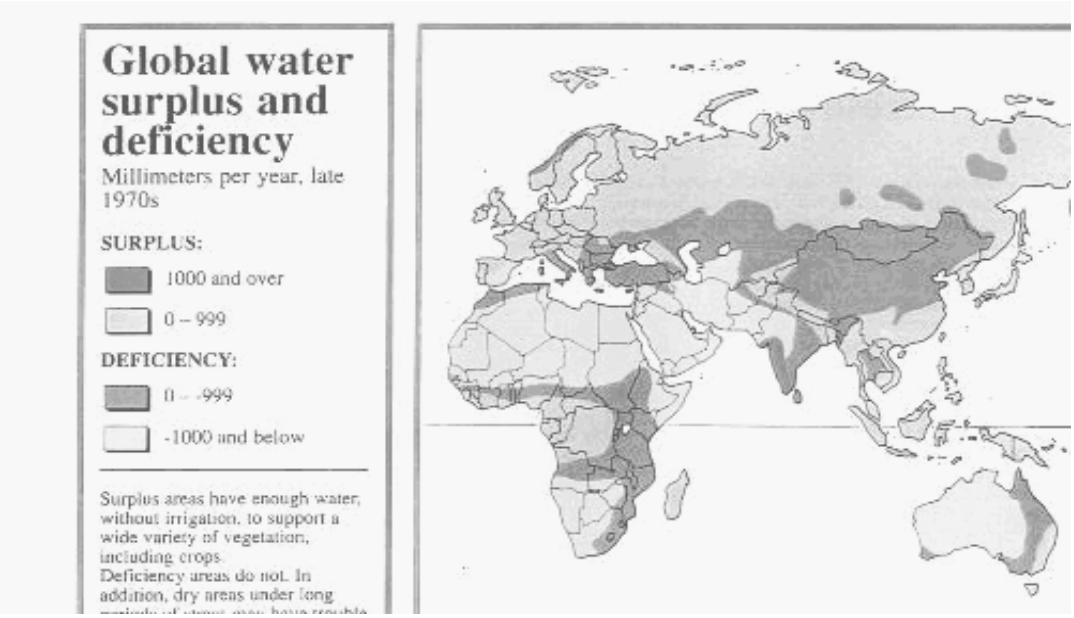


Figure 2.3

Perhaps the biggest reason for developing a worldwide effort to monitor and restrict global pollution is the fact that most forms of pollution do not respect national boundaries. The first major international conference on environmental issues was held in Stockholm, Sweden, in 1972 and was sponsored by the United Nations (UN). This meeting, at which the United States took a leading role, was controversial because many developing countries were fearful that a focus on environmental protection was a means for the developed world to keep the undeveloped world in an economically subservient position. The most important outcome of the conference was the creation of the United Nations Environmental Program (UNEP).

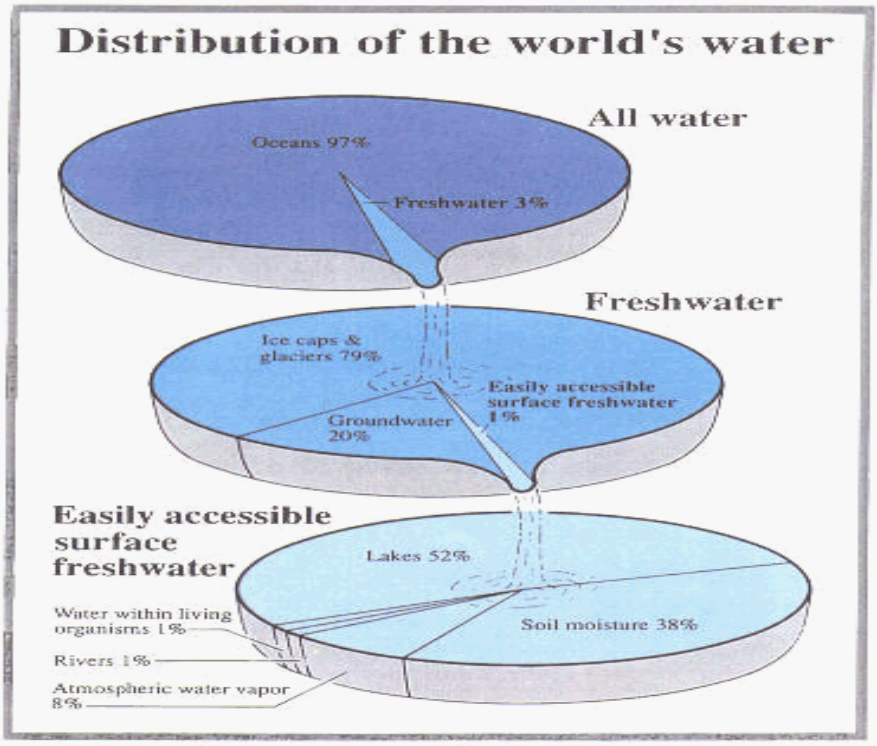


Figure 2.4

Source: UNEP Report 1996

UNEP was designed to be “the environmental conscience of the United Nations,” and, in an attempt to allay fears of the developing world, it became the first UN agency to be headquartered in a developing country, with offices in Nairobi, Kenya. In addition to attempting to achieve scientific consensus about major environmental issues, a major focus for UNEP has been the study of ways to encourage sustainable development and increasing standards of living without destroying the environment. At the time of UNEP's creation in 1972, only 11 countries had environmental agencies. Ten years later that number had grown to 106, of which 70 were in developing countries.

Missing links of water engineering and water chemistry

Water quality is closely linked to water use and to the state of economic development. In industrialized countries, bacterial contamination of surface water caused serious health problems in major cities throughout the mid 1800’s. By the turn of the century, cities in Europe and North America began building sewer networks to route domestic wastes downstream of water intakes. Development of these sewage networks and waste treatment facilities in urban areas has expanded tremendously in the past two decades. However, the rapid growth of the urban population has outpaced the ability of governments to expand sewage and water infrastructure. While waterborne diseases have been eliminated in the developed world, outbreaks of cholera and other similar diseases still occur with alarming frequency in the developing countries. Since World War II and the birth of the “chemical age”, water quality has been heavily impacted worldwide by industrial and agricultural chemicals. Eutrophication of surface waters from human and agricultural wastes and nitrification of groundwater from agricultural practices has greatly affected large parts of the world. Acidification of surface waters by air pollution is a recent phenomenon and threatens aquatic life in many area of the world. In developed countries, these general types of pollution have occurred sequentially with the result that most developed countries have successfully dealt with major surface

water pollution. In contrast, however, newly industrialized countries such as China, India, Thailand, Brazil, and Mexico are now facing all these issues simultaneously.

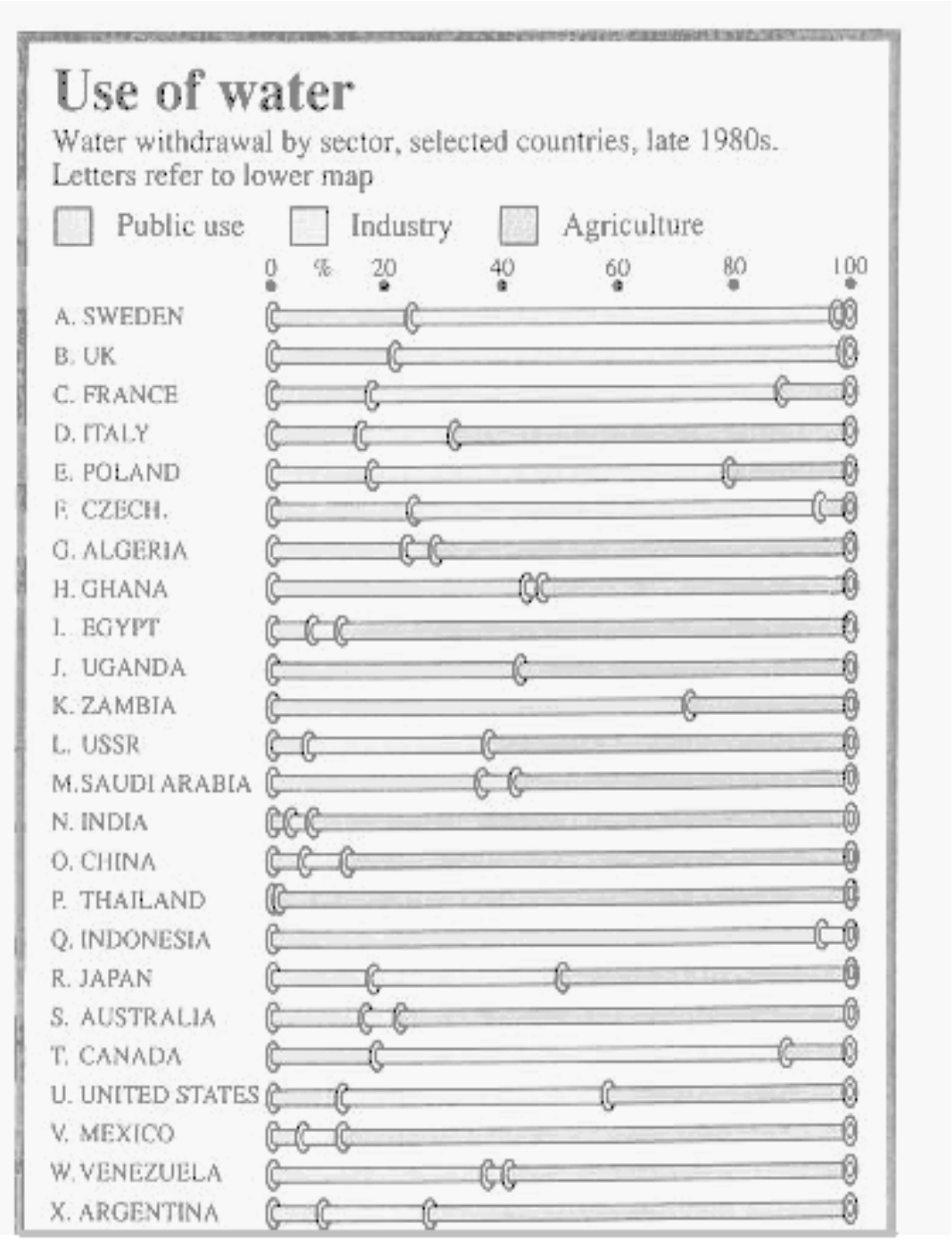


Figure 2.5

Clearly, the problems associated with water pollution have the capabilities to disrupt life on our planet to a great extent. Governments have passed laws to try to combat water pollution thus acknowledging the fact that water pollution is, indeed, a serious issue. But the government alone cannot solve the entire problem. It is ultimately up to us, to be informed, responsible and involved when it comes to the problems we face with our water. We must become familiar with our local water resources and learn about ways for disposing harmful household wastes so they don't end up in sewage treatment plants that can't handle them or landfills not designed to receive hazardous materials. In our farms, we must determine whether additional nutrients are needed before fertilizers are applied, and look for alternatives where fertilizers might run off into surface waters. We have to preserve existing trees and plant new trees and shrubs to help prevent soil erosion and promote infiltration of water into the soil. Around our houses, we must keep litter, pet waste, leaves, and grass clippings out of gutters and storm drains. These are just a few of the many ways in which we, as humans, have the ability to combat water pollution. As we head into the 21st century, awareness and education will continue to be the two most important ways to prevent water pollution. If these measures are not taken and water pollution continues, life on earth will suffer severely.

Global environmental collapse is not inevitable. But the developed world must work with the developing world to ensure that new industrialized economies do not add to the world's environmental problems. Politicians must think of sustainable development rather than economic expansion. Conservation strategies have to become more widely accepted, and people must learn that energy use can be dramatically diminished without sacrificing comfort. In short, with the technology that currently exists, the years of global environmental mistreatment can begin to be reversed in drinking water if the water is not properly treated or disinfected. These bacteria are used as indicators that other harmful organisms may be in the water.

The potential for health problems from drinking water is illustrated by localized

outbreaks of water-borne disease. Many of these outbreaks have been linked to contamination by bacteria or viruses, probably from human or animal waste. In 1993 and 1994, for example, there were 30 reported disease outbreaks associated with drinking water, 23 associated with public drinking water supplies and 7 with private wells.

Certain pathogens, such as Cryptosporidium, may pass through water treatment filtration and disinfection processes in sufficient numbers to cause health problems. Cryptosporidium is a protozoa that causes the gastrointestinal disease cryptosporidiosis. The most serious, and sometimes deadly, consequences of cryptosporidiosis tend to be focused among sensitive members of the population .

A 1993 outbreak of cryptosporidiosis in Milwaukee, Wisconsin, is the largest outbreak of waterborne disease in the United States. Lake Michigan is the source of Milwaukees water, which is treated by filtration and disinfection. Due to an unusual combination of circumstances during a period of heavy rainfall and runoff the treatment plant was ineffective, resulting in an increase in the turbidity of the treated water. Increased turbidity can be an indicator of higher levels of Cryptosporidium. Over 400,000 persons were affected by the disease, more than 4,000 were hospitalized, and over 50 deaths have been attributed to the disease. The original source of contamination is uncertain.

Nitrate in drinking water at levels above the national standard poses an immediate threat to young children. Excessive levels can result in a condition known as "blue baby syndrome." If untreated, the condition could be fatal.
Boiling water contaminated with nitrate increases the nitrate concentration and the potential risk. Persons worried about nitrate should talk with their doctor about alternatives to using boiled water in baby formula. Study says millions are drinking contaminated tap water that could put pregnant women at risk . Millions of citizens have been drinking tap water contaminated with chemical byproducts from chlorine that are far more than what studies suggest may be safe for pregnant women, two

environmental groups say in a new study. Also, a study done by the Department of Health Services, which analyzed 5,000 pregnant women, found that women who drank more than five glasses of tap water per day with 75 or more parts per billion of chlorination byproducts were 65 percent more likely to suffer miscarriages. Pregnant women are often advised by their doctors to drink several glasses of water per day. Environmentalists have sounded alarm on Water for World - Threats to water quality and quantity pose the greatest environmental challenge to the world, in large part because of climate change and antiquated and deteriorating water systems. In our country major cities are distributing water through pipes more than a century old. Water is going to be the biggest environmental issue that we face in the 21st Century, in terms of both quantity and quality. Several studies over the last year have expressed such concern about water.

The studies cited as contributing factors the deterioration of public water infrastructure such as pipes, as well as global climate effects, waterborne disease, land use, groundwater and surface water contamination, and ineffective government regulations.

Public drinking water supplies will face challenges in these areas in the next century and solutions to at least some of them will require institutional changes. A large amount of resources needs to be spent over the next 20 years to guarantee the continued high quality water. It is emphasized that estimates of the costs of meeting our future water needs did not include protecting water systems against contamination by terrorists. Most people are aware that outdoor air pollution can damage their health but many do not know that indoor air pollution can also have significant health effects. Environmental Protection Agency studies of human exposure to air pollutants indicate that indoor levels of pollutants may be 2-5 times, and occasionally more than 100 times higher than outdoor levels. These levels of indoor air pollutants may be of particular concern because most people spend about 90% of their time indoors.

Secondhand smoke is also known as Environmental Tobacco Smoke. Secondhand smoke includes both exhaled mainstream smoke from smokers and sidestream smoke from the end of a cigarette, cigar, or pipe. Secondhand smoke contains more than 4,000 substances, including over 40 that are linked to cancer. Many of the compounds in tobacco smoke are released at higher rates in sidestream smoke than in mainstream smoke. Environmental tobacco smoke (ETS) also called "secondhand smoke," a major indoor air pollutant, contains about 4,000 chemicals, including 200 known poisons, such as formaldehyde and carbon monoxide, as well as 43 carcinogens. ETS causes an estimated 3,000 lung cancer deaths and 35,000 to 50,000 heart disease deaths in non-smokers, as well as 150,000 to 300,000 cases of lower respiratory tract infections in children under 18 months of age each year. Secondhand smoke affects everyone, but children are especially vulnerable because they are still growing and developing.

Exposure to secondhand smoke causes serious health effects in children, including bronchitis, pneumonia, ear infections, worsened asthma and even sudden infant death syndrome. For children, particularly young children, the most likely place of exposure is their home. In the world, 27% of homes with children, aged six and younger currently allow smoking, affecting approximately 9-12 million children each year.

Dust mites are tiny animals we cannot see. Every home has dust mites. They feed on skin flakes and are found in mattresses, pillows, carpets, upholstered furniture, bedcovers, clothes, stuffed toys, and fabric or other fabric-covered items. Most people spend up to 90 percent of their time indoors, often at home. Therefore, breathing clean indoor air can have an important impact on health. People who are inside a great deal may be at greater risk of developing health problems, or having problems made worse by indoor air pollutants. These people include infants, young children, the elderly, and those with chronic illnesses.

Biological pollutants are or were living organisms. They promote poor indoor air quality and may be a major cause of days lost from work or school, and of doctor and hospital visits. Some can even damage surfaces inside and outside the house.

Biological pollutants can travel through the air and are often invisible. Some common indoor biological pollutants include: Dust Mites, Fungi (Molds), Infectious agents (bacteria or viruses), Pollen, etc. Some diseases or illnesses have been linked with biological pollutants in the indoor environment. Pollution exposure at home and work is often greater than outdoors. The National Air Resources Board estimates that indoor air pollutant levels are 25-62% greater than outside levels and can pose serious health problems.

Modern homes, for economic reasons, are designed to be highly insulated, sealed environments. The average person spends 90% of their life indoors in this environment. Many modern-day synthetic materials give off toxic organic chemicals, which build up because of the lack of ventilation. Carpeting, furnishings, fabrics, electronic devices, glues - such items as these emit volatile organic chemicals into the air. Chemicals such as formaldehyde, benzene and acetone accumulate in the air. Humans also emit gases (bioeffluents) such as methane, ammonia, xylene and alcohols. We breathe a mixture of all these gases in confined spaces (Indoors, pollutant levels have been shown to be 100 times greater than normal). In the outside world, nature cleans the air for us. Indoors, these chemicals can build up and it is now known that these pollutants are responsible for widespread occurrence of "Sick Building Syndrome". This has become increasingly noticeable and significant since the early 1980's when buildings began to be hermetically sealed to conserve energy. Sick Building Syndrome manifests itself in many ways, most commonly allergic reactions, sneezing, asthma, respiratory irritations (burning eyes and sore throats), and has been linked to cancer and "Sudden Infant Death Syndrome" (SIDS), also known as "Cot Death". Poor indoor air quality can also cause or contribute to the development of chronic respiratory diseases such as asthma and hypersensitivity pneumonitis. In addition, it can cause headaches, dry eyes, nasal congestion, nausea and fatigue. People who already have respiratory diseases are at greater risk.

Section-III

Industrial growth v/s. sustainable environment

In this section, an attempt is made to know curiosities of the States to boost industrial growth under the umbrella of globalization. It is a matter of concern to mention that higher the level of industrial growth higher the level of environmental pollution is visualized in Gujarat and Maharashtra. Hence experiments and experiences of Gujarat and Maharashtra are discussed here.

Maharashtra and Gujarat are the the brightest jewels in India's industrial crown. But impressive industrial growth figures fail to hide the grim realities of environmental pollution. While, the state governments are only bothered about industrial growth, the civil society is struggling to draw public attention to the impending danger to the environmental and public health.

Industrial survey statistics reveal that more than one-third — 36.3 per cent — of the total value added to the raw materials through manufacture in the factory sector of the country comes from Maharashtra (23.66 per cent) and Gujarat (12.64 per cent).They are , the two most industrialised states of India. Governments of both the states claim they have created immense prosperity in the region. But statistics do not tell the real story of thousands of workers and farmers. The workers are working in the Daru Khana shipbreaking yard of Chembur for the past 15 years. It is a life without any dignity due to a living being. Everyday for 8-10 hours, they inhale toxic fumes from the abandoned ships that they break. The fear of explosion looms large. They stay in Deonar, Maharashtra's largest solid waste dumping ground. In violation of a Mumbai High Court order prohibiting burning of wastes, wastes are still burnt in Deonar.

Driving down the Mumbai-Pune highway one will witness the horrible truth of industrialisation. Hundreds of industrial units dealing with chemicals and fertilisers dump their sludge along the roadside. Chimneys emit gases that make breathing difficult. "Industrial units never stop polluting, and people cannot stop working for

them. So, it is a treadmill that ends only with a painful death," says an industrial worker of Panvel in Maharashtra.

A few hours of traveling northwards of Mumbai will take one to the Vapi Industrial Estate of southern Gujarat. At Kolak village, about 15 km away from the estate one will get statistics of a very different kind. "Sixty people have died of cancer in the village in the past 10 years, while 20 others are fighting a losing battle," says a former sarpanch (head) of the village council, who has been vehemently opposing pollution of the Kolak river by the industrial estate. Nearly 20 years ago, cancer cases were not so rampant. But factories of the estate, which produce pesticides, agrochemicals, organ chlorines, dyes and dye intermediates, have been dumping untreated effluents in the river. Most residents of the village are fisher folk who eat fish from the river.

"The organ chlorines and other persistent organic pollutants (POPs) in the industrial effluents are known carcinogens," says Michael Mazgaonkar of the Paryavaran Suraksha Samiti (PSS), a Gujarat-based non-governmental organization. "Take the case of Deviben Tandel, who had cancer. On December 31, 1999, when thousands of people who use products manufactured at Vapi would have been celebrating new year's eve, the 50-year-old resident of Kolak quietly died. Four months ago, her elder sister had died of cancer."

As per a Central Pollution Control Board (CPCB) action plan for Vapi, factories cannot dump effluent in the rivulet Bhil Khadi but have to send it to a common effluent treatment plant (CETP). "But hundreds of industrial units do not treat their wastes as per the inlet parameters of the CETP, and are releasing untreated effluents into the Bhil Khadi. It ultimately meets and pollutes the Kolak river and the sea," says CPCB official.

The sarpanch of the village council, says: "On many occasions, we have caught tankers directly dumping effluents in the river." The fish catch in the coastal areas has gone down considerably. Says, vice-president of the Daman Fishermen

Association in Valsad district of Gujarat, “We don’t get fish catch in the seashore areas. So, only those fisherfolk who can afford to go as far as 12 km inside the sea are continuing in this business.”

There are innumerable stories like these that go unheard. Invariably, those worst hit by industrial pollution are either rural folk who are unaware of its effects or workers who earn their living from the polluting factories. But more than the polluting industrial units, the blame goes to regulatory agencies — state pollution control boards (SPCBs) and state industrial development corporations — that were created to control and monitor industrialization. Instead, these agencies have been reduced to mere rubber stamps to promote industrialisation at a frenzied pace. The industrial system has been reduced to a state wherein it makes better business sense for industrialists to carelessly dump hazardous waste rather than set up mechanisms to deal with it.

So, what are the people doing to save themselves? Actually, not much right now. But, not too long ago, there was hope of battling out the pollution juggernaut through the courts and non-governmental organizations (NGOs). Finding out that there was absolutely no point in knocking at the doors of government agencies — there is a clear bias in favour of the industry throughout the government machinery — those affected by pollution rallied behind NGOs. A spate of public interest litigation (PIL) saw the polluters being dragged to courts.

But the lack of initiative on the part of the implementing agencies tired out the public spirit. In 1995, the Gujarat High Court ordered the closure of 756 industrial units in Vatva, Narol, Naroda and Odhav, asking them to compensate the villages affected by pollution through discharge of untreated effluents. Many of these units are operating even today and are still polluting. “The failure of the court had an extremely damaging effect as even the last institution of democracy failed to check pollution in Gujarat,” laments Girish Patel, an advocate in the Gujarat High Court.

In Maharashtra, the problem is compounded by the absence of credible data. It is difficult to find any data on the environmental status. The Maharashtra Pollution Control Board does not come out with any study on pollution. So the people do not have strong baseline data to contest the powerful industry lobby. Lack of information paralyses the battle against pollution.

GUJARAT

Industrial estates of Gujarat are cesspools of filth and environmental health hazards. Yet the government is blindly promoting industry. Gujarat has more than 90,000 industrial units, according to the state government. About 8,000 of these units are polluting, also says the state government. Major polluting industries are located in the Vadodara Petrochemical Complex, Nandesari, Ankleshwar, Vapi, Vatva and Hazira near Surat. The Gujarat Industrial Development Corporation (GIDC) was managing 270 industrial estates as on March 1996, and its activity plan for the year 1998-99 included sanctioning of eight new ones. “About 70 per cent of the investment in Gujarat since the 1970s has been in the chemicals sector,” says R C Trivedi, former chairperson of the Gujarat Pollution Control Board (GPCB).He says that in the 1970s, the state government was encouraging small-scale units in the chemicals sector through financial incentives. “These industrial units came up in huge numbers. But the government gave a very low priority to the environment. This is why environmental problems cropped up in Gujarat,” says Trivedi.

Nowhere more so than in the nearly 400-km stretch between Vapi in southern Gujarat and Vatva in northern Gujarat, called the golden corridor, an industrialist’s dream come true. This stretch has become a hot bed of pollution. In the golden corridor, we have created a number of potential disasters similar to the Bhopal gas tragedy. The time-bomb is ticking very fast. Another example of an environmental nightmare is Alang, the largest ship breaking yard of the world, situated 50 km from

Bhavnagar. The 11-km coastline of the yard has been severely polluted due to scrapping of hazardous ships .

Government response

People are suffering because of the lack of proper planning in the past. But it is now a futile exercise to blame anyone for that. The situation is in front of everybody. We have to come out of it. But what is the state government doing to deal with the growing pollution problems? It is trying its best to set up more industries. The state government has planned the 'Infrastructure Vision 2010', which hardly lays any focus on environment. In a meeting organised by GEC in Ahmedabad on October 29, 1999, K V Bhanujan, principal secretary of finance to the state government, had observed: "The 'Vision 2010' is a focused and comprehensive document on infrastructure. But environmental concerns in general or anticipated as a consequence of the implementations of the vision have not been even touched upon anywhere."

Blackened rivers

Gujarat's rivers are bearing the brunt of industrial pollution, as are the people living on the banks of these rivers. All the major rivers and streams of Gujarat are in a bad state due to effluent discharged by industry, be it the Kolak, the Mahi, the Daman Ganga or the Amlakhadi. One can see red water flowing in the Sabarmati, released by the common effluent treatment plant (CETP) in Vatva. Several times, drug factories in Vapi dump spoilt batches in the open. These contain chemicals that are highly toxic.

The case of the villages located near GIDC estates reveals that the farmers from 11 villages between Lali and Navagam, irrigate their fields with untreated effluents released into the Khari river. Nearly 100 tubewells and borewells have been contaminated. "When factories were prevented from dumping effluents in the Mahi river, they resorted to reverse boring, pumping untreated effluents straight into underground aquifers," says a farmer from Sherkhi village in Vadodara district.

Two High Court Justices in Gujarat Mr. Kirpal and Mr. Gokhale filed public interest litigation in High Court. And the court ordered to submit report within a month. On the basis of the report, on August 5, 1995, the court ordered that 756 industrial units, which were regarded as highly polluting, pay up 1 per cent of their gross turnover of the year 1993-94 or 1995-96, whichever was higher. The court ruled: "The amount be utilised for the works of socio-economic uplift in the villages and on educational, medical and veterinary facilities and the betterment of the agriculture and livestock in the said villages."

"But even today, farmers use water from the polluted Khari river when water is released from the upstream Kadana dam," says Girish Patel, a lawyer based in Ahmedabad. As for compensation, sources point out that while some industrial units have paid up, others are still in the process of doing so. Several units have started production again. The situation has not changed at all. Untreated effluents still flow in the river.

Water in the 100-odd wells near Khari is still a distinct red. Kanubhai Patel, a farmer, says the paddy yield has gone down by half. The villagers find a difference in milk quality, too, which they attribute to cattle grazing in contaminated areas. In August 1999, *Down To Earth* got a sample of groundwater from Lali village analysed at the Facility for Ecological and Analytical Testing (FEAT) of the Indian Institute of Technology, Kanpur. It had a mercury concentration that was 211 times the permissible limit. Mercury is an extremely toxic heavy metal and is known to cause damage to kidneys and the central nervous system.The most damaging aspect of Gujarat's struggle against industrial pollution has been the failure of the courts to deliver. There was a phase in 1995 when the Gujarat High Court was cracking down on polluters, giving an impetus to the environmental movement in the state. Hundreds of cases were filed in the court. This continued for two to three years. As long as Justice B N Kirpal was the chief justice of the high court, he took stern action against polluters. After this period, the court got bogged down in dealing with applications to reopen industrial units after a closure order given by Justice Kirpal. But the implementing and regulatory agencies remained lackadaisical. Soon, people

handling these cases lost interest as the exercise could not yield the desired results.

Waste: solid and hazardous

Factories have been dumping thousands of tonnes of hazardous wastes in the open. Not only has this polluted the groundwater but it has also damaged fertile lands. Bajwa, a village in Vadodara district where industrial waste has been accumulating for the past 30 years and there is barely any agricultural land to be proud of in terms of productivity. Now, industries are constructing landfill sites. But even in the construction and planning of these, environmental health has not been kept in mind. One example is GIDC's Nandesari Industrial Estate north of Vadodara. Plans of a site to dump toxic wastes are severely flawed and there are fears of a major ecologicaldisaster.

From Vapi to Mehsana, several units dealing with pharmaceuticals, dyes and dye intermediaries are constructing landfills sites to dump their hazardous wastes. However, a 1977 study conducted for the US Environmental Protection Agency, conducted on 50 landfills, showed that 86 per cent had contaminated underground water supplies beyond the boundaries of the landfill.

Environment impact assessments by the National Productivity Council, Gandhinagar, in 1997-98 and 1997-98 showed high levels of lead contamination in the groundwater of Nandesari. Samples taken nearby the GIDC dump contained 38.25 milligramme per litre (mg/l) of lead, whereas the permissible limit is a mere 0.05 mg/l for drinking water. The groundwater has been severely contaminated to a depth of about 60 metres, the study says.

"Disposal of untreated mercury-contaminated effluent from caustic manufacturers has contaminated large tracks of land in Nandesari in Gujarat," says a draft Sectoral Environment Report submitted in 1997 by the Union ministry of environment and forests to the World Bank. There is no pressure from the implementing agencies over industrialists. They do not have an initiative to meet the environmental norms.

This has certainly helped big industries find ways to flout environmental norms. Today, industrialists first invest money in a project and then plead in the court that they cannot stop the work on environmental grounds as they have already made the investment. In most of the cases, the court relaxes some of the norms. As a result, what happens is that the pollution remains, but the conditions disappear. The NGOs that are working in this field do not have the support to do anything concrete. So, by and large, there is no strong voice against pollution problems in Gujarat today. NGOs here have not been able to mobilise grassroots-level support. The voice of NGOs in the state mainly comes from the middle class. But these people have not been able to carry together the grassroots level people.

Although people of Gujarat are gradually realising that pollution is becoming a serious problem, they are not reacting the way they should, considering that their very lives are at stake. The spirit of public good that saw numerous people going to court against polluting industry has been snuffed out after implementing agencies failed to enact the orders of the courts.The only way out of the present situation is to have a very democratic system of permitting industries. If we can ensure this along with easy access to information, we can reduce the problem to a great extent. We have adequate environmental rules that, if implemented properly, can control most of the industrial hazards. But the industries have found ways to circumvent these rules. So even if all these rules are implemented and the decision-making is not democratic, the problem is likely to continue.
The problem can only be dealt with if good NGOs and people take up the issue seriously. If community-based organisations come up, then some improvement can be made in the present situation. To protect their trade at the international level, these industries will be forced to comply with international environmental norms. Gujarat clearly needs direction today when it comes to environmental governance. The civil society is faced with a huge task. The first thing to do, however, is to involve rural communities and industrial workers in the struggle against pollution. That being done, solutions will emerge. But if that is not done, then the cesspool is only going to worsen.

Conclusion

The foregoing analysis contained in three sections provided broader understanding of the concept of sustainable growth and development. Sustainable growth and sustainable environment are not synonymous terms. For over all growth of a nation the concept of sustainable environment must be reviewed. For this public hearing is given by the Chairman of the GIDC estates before establishment of a new unit for manufacturing in a district. Preventive and positive checks are required to manage industrial pollution both in terms of water pollution, air pollution and land degradation.

Chapter – 3

A Macro view on Environmental Degradation: Problems, Causes and Reponses.

Chapter – 3

A Macro view on Environment degradation: Problems, Causes and Reponses.

Introduction

This chapter deals with micromanagement of environmental issues in terms of problems created by environmental pollution, causes as well as responses for sustainable environmental pollution. Details of discussion on success and failure of policy is highlighted in this chapter.

Environmental degradation is a more common and pervasive problem than rapid inflation, excessive foreign debt or economic stagnation. Rapid deforestation, watershed degradation, loss of biological diversity, fuel wood and water shortages, water contamination, excessive soil erosion, land degradation, overgrazing and over fishing, air pollution and urban congestion are common to all parts of Gujarat. And, while economic growth enables societies to better deal with environmental problems, there is an abundance of failures and a scarcity of success in dealing with environmental problems. These observations imply that (a) there are underlying causes of environmental degradation that are common to states in different geographical locations with different cultures and at different levels of development, (b) economic growth by itself neither causes nor remedies environmental degradation, the connections being far more subtle and complex, and (c) environmental problems are insidious and refractory or at least poorly understood, resulting in either failure to deal with them or to interventions that tend to treat the symptoms rather than the underlying root causes with consequent failure.

This chapter is divided into three sections: the first one shows physical manifestations of environmental degradation, the second one explores the causes for environmental degradation, whereas , the third one expresses policy failures

leading to environmental degradation in the case of governmental failure at macro level.

Section I

Physical manifestations of environmental degradation.

The term "environment" covers both the quantity and quality of natural resources, renewable and non-renewable, as well as the ambient environment which is an essential element of the quality of life. As such, the environment is a critical determinant of the quantity, quality and sustainability of human activities and life in general. Environmental degradation then is the diminution of the environment in quantity and its deterioration in quality. Correspondingly, environmental problems have both a quantity and a quality dimension. Water-related problems include water shortages as well as deterioration of water quality through pollution and contamination. Forest-related problems include both deforestation in the sense of forest cover loss and forest degradation in the sense of reduction of forest productivity, loss of diversity and replacement of primary by secondary forest. Land-related problems include growing land and scarcity as well as soil erosion, nutrient leaching, water logging and salinization. Fishery-related problems include over fishing as well as changes in species composition to less valuable species, increasing share of trash fish in the catch and fish contamination. Urban environmental problems include congestion and thereby less open space available per person, as well as air, water, and noise pollution, and hence a lower-quality environment.

Quality problems at the extreme become quantity problems. For example, water may become completely unusable because of heavy pollution. Land may become unsuitable for cultivation because of severe erosion. A forest may completely lose its forest cover because of severe degradation as it happens when shortening of the fallow cycle in shifting cultivation results in replacement of forest by imperata grass. Certain urban areas (e.g. slums, residential areas near dumpsites, chemical or nuclear plants, etc.) may become unlivable because of excessive pollution and contamination. Quality problems also become quantity problems because quantity is

defined for a given quality. For example, shortages of drinking water, or prime farmland, and of primary forests may coexist with abundance of low-quality water, marginal land and secondary forests.

Finally, diversity has value; expanding the supply of one resource or environment at the expense of another may be beneficial up to a point, but as any given resource is driven to depletion or extinction, diversity is lost, and with it an option and an element of the quality of life. Diversity of species and environments is essential to long-term productivity and sustainability. Its preservation is a form of investment for the future or insurance against future uncertainties. Its diminution constitutes environmental degradation even if its loss as a factor of production or a source of consumption has been fully compensated via substitution for an equally productive asset. In conclusion, when we speak of environmental degradation, we should keep in mind three dimensions, quantity, quality and diversity and their interdependence.

The economics of environmental degradation

A certain level of environmental degradation is an inevitable consequence of human activity. Any exploitation and use of non-renewable resources inevitably results in their partial or total depletion, as well as the degradation of the landscape and the generation of waste. Industrialization leads to increased consumption of minerals and energy and the generation of air, water and noise pollution and hazardous wastes. Agricultural extensification leads to deforestation, cultivation of marginal lands, and soil erosion while agricultural intensification leads to pesticide and fertilizer runoffs, waterlogging, soil salinity, etc. Even the use of renewable resources on a sustainable basis presupposes the mining of the stock down to a level that would generate a maximum annual growth (maximum sustainable yield). Virgin fisheries and undisturbed forests reach a natural equilibrium stock where net growth is zero; unless the stock is reduced and there is no sustainable yield to harvest. Therefore, some environmental degradation is inevitable.

The question is not how to prevent or eliminate environmental degradation altogether but how to minimize it or at least to keep it to a level consistent with society's

objectives. When environmental degradation is seen in the context of the society's development objectives, not all deforestation, soil erosion or water pollution is bad or worth preventing. Some deforestation is necessary and beneficial when the forest land is put to a superior use which may be agricultural, industrial or residential. As long as all costs involved, including those arising from diminished quantity, deteriorated quality and lost diversity of forests have been accounted for; as long as both the productivity and the sustainability of the alternative uses have been considered with a due margin of error; and, as long as any side effects of the forest conversion have been internalized and paid for deforestation should not be something we would like to prevent. The problem is that usually only the short-term benefits of forest conversion and none of its long term costs are considered. As a result, too much conversion takes place in area where no conversion should have been taking place because the present value of costs outweighs any short-term benefits. Even worse, forests are converted to wastelands with little current benefit and enormous current and future costs. It is unfortunate and renders a disservice to conservation when such wasteful forest destruction is lumped together with socially optimal forest conversion into a single deforestation figure. Considering, however, the rate at which tropical forests have been disappearing in recent years, it is understandable that all deforestation is considered undesirable, no matter what the economic justification. A similar case can be made for soil erosion and water pollution. Not all soil erosion is worth preventing. In deep fertile soils, erosion has little or no effect on land productivity, while it enhances considerably the productivity of downstream land where it is deposited. Still there may be other negative offsite effects such as sedimentation and eutrification of waterways and reservoirs that should be taken into account in determining how much soil erosion to allow. In other areas, such as in much of the tropical rainforests, where the fertile soil is very superficial consisting basically of the humus formed by degrading matter, any soil loss may make the difference between lush growth and desertification. Again the tendency is to lump together all soil erosion and express it in tons per hectare without regard to the depth of soil, fertility, natural replenishment and deposition.

Similarly, air and water pollution are excessive not in any absolute sense, but in relation to the assimilative capacity of these media and in reference to their use and the society's constraints and objectives. To attempt to prevent all forms and levels of pollution in all water resources is to leave a flow resource of little opportunity cost unused with consequent reduction of social welfare or use of resources of higher opportunity cost for the same purpose. This does not imply that individuals should be allowed to use the assimilative capacity of the environment free of charge. If they do, not only will excessive pollution be generated but the resource itself, i.e., the assimilative capacity of the environment will be diminished as a result. Moreover, as the disposal of waste increases and the assimilative capacity is reduced, there is a definite opportunity cost that should be paid by individual users, consisting of two elements, (a) the use of a scarce resource to the exclusion of others, and (b) the damage to the productivity of the resource as waste disposal increases beyond a threshold. A charge for the use of the resource can be set at a high enough level to limit effluents to a level that can be assimilated without damage to its assimilative capacity.

Prevention is often far more cost-effective than rehabilitation. Once excessive environmental degradation takes place, it is not worthwhile to attempt to reduce it back to the level that would have been optimal with prevention because costs are higher, effectiveness is lower and vested interests stronger. Not only is a 100% abatement technically difficult and economically out of the question, but the optimal level of abatement would leave us with more pollution than we would have liked had we the option of a fresh start. Because of this economic irreversibility , prompt internalization of environmental costs is both economically and environmentally preferable.

To sum up, physical manifestations of environmental degradation, such as rates of deforestation, rates of soil erosion, level of water pollution and densities of urban congestion tend to overstate the problem because they seem to suggest that all degradation is preventable or worth abating. Because they are based on observed symptoms rather than underlying causes, they tend to be devoid of analytical insight as to how to deal with the problem other than banning the activities that appear to be

responsible. For example, if logging leads to deforestation, it is common sense that banning logging will solve the problem.

Economic manifestations of environmental degradation

The first step for understanding the root causes of environmental degradation is to look for its economic manifestations, help define the true dimension of the problem and suggest the scope and opportunity for cost-effective intervention. Economic manifestations are counterintuitive observations or contradictions, their very identification calls for an analytical explanation and a policy implication. The following is a representative list of such economic manifestations of environmental degradation:

1. Overuse, waste and inefficiency coexist with growing resource scarcity.

For example, increasingly scarce irrigation water in many parts of South Gujarat is used wastefully and excessively by some farmers to the point of causing waterlogging and salinization of soils, while other farmers in the same irrigation system suffer from water shortages and unreliable supplies. This is true of most irrigation systems in the state of Gujarat. The net loss consists of current production loss by those who receive inadequate water and future production loss by those who suffer from water logging as well as general degradation of the resource.

2. An increasingly scarce resource is put to inferior, low-return and unsustainable uses, when superior, high-return and sustainable uses exist. For example, in Saurashtra, uplands suitable for fruit trees or other perennials are often planted with maize or cassava for a few years and abandoned as yields decline. A second example comes from South Gujarat where scarce irrigation water is used to grow sugarcane in an arid environment when vegetables, orchards and other higher-value crops would have produced a higher return and fewer soil salinity problems. In coastal areas, valuable forests have been converted to mining activities that generate negative economic returns.

3. A renewable resource capable of sustainable management is exploited as an extractive resource. For example, tropical forests are being mined without concern for regeneration and future harvests as evidenced by the damage to the remaining stand, even when future harvests have a positive net present value at the market rate of interest. While some forest land conversion to other uses is economically justifiable, the fact that the rate of deforestation is 100 times the rate of reforestation alone suggests that tropical forests are mined not managed. There are indeed very few sustainable alternatives that would justify failure to regenerate a renewable resource capable of yielding a perpetual stream of income.

4. A resource is put to a single use when multiple uses would generate a larger net benefit. For example, many tropical forests are managed for timber production alone when management for multiple uses such as non-timber goods, water and soil conservation, biological diversity and a host of other environmental services would generate a higher return. While not all uses are mutually compatible, the relevant question is which combination of uses would produce the highest net present value for a given forest.

5. Investments in the protection and enhancement of the resource base are not undertaken even though they would generate a positive net present value by increasing productivity and enhancing sustainability. Examples include the failure of many farmers throughout the state to invest in on-farm land development and soil conservation to reduce erosion and improve irrigation. Another example is the failure of many forest concessionaires to regenerate or replant their concessions or even to protect them from encroachment. A third example is the failure of irrigation authorities to invest in watershed protection, to protect reservoirs from sedimentation and in maintenance and rehabilitation of deteriorating irrigation systems, to increase their efficiency and prolong their economic life.

6. A larger amount of effort and cost is incurred when a smaller amount of effort and cost would have generated a higher level of output, more profit and less damage to the resource. Examples include capture fisheries and common pastures throughout the developing, and parts of the developed, world. Most fisheries employ twice as

much labor and capital as needed to obtain less than the maximum sustainable yield and virtually no economic surplus. Any profit that the fishery is capable of generating is dissipated by excessive fishing cost. Fishermen tend to be among the lowest income groups in most countries. In the long run, over fishing results in decreased productivity of the stocks, lower output and a compositional change towards lower value species.

The situation with common pastures is very similar. More animals are being grazed than the pastures can support with the result that total output is less than it could be, incomes are low and the pastures deteriorate. Incomes and output can be raised and pastures improved with a reduction of the numbers of animals but this does not happen, despite the obvious gains. It is as if the society is subsidizing the degradation of its resource base by raising and grazing an excessive number of animals. But since the other common owners would not sit and watch their share fall, they also increase their herds. The end result is neither efficient not equitable. The productivity of the pasture declines and the largest share goes to those that can afford the largest number of animals, that is, those who are initially better off. The poor suffer in what appears to be an equitable arrangement: property that is freely accessible to all.

7. Local communities and tribal and other groups such as women are displaced and deprived of their customary rights of access to resources regardless of the fact that by their very presence or specialized knowledge, tradition and self-interest, they may be the most cost-effective managers of the resource.

Many tropical resources, particularly the rainforests, are so complex and vulnerable that their sustainable management requires specialized knowledge of plants and animals and their interaction in such an environment. It also requires a physical presence to prevent encroachment or other interference by those less knowledgeable or less interested in the continued productivity and sustainability of the resource.

Fortunately, there are people who do live in the forest, depend on it for survival, have the specialized knowledge of the ecosystem necessary for sustainable management

and even have a tradition of doing so. By any criterion, such as cost effectiveness, present value maximization or equity, many local communities and tribal groups ought to be given the responsibility of managing the resource and vested with sufficient authority, protection and security of tenure to do so effectively. Yet, in most cases, central government has assumed the ownership and management of tropical forests despite their lack of specialized knowledge and management skills, their absenteeism, and often their lack of interest in the sustainability of the resource. The rights of exploitation have been subsequently awarded to equally distant logging companies, with little knowledge of the rainforest environment and no interest or stake in its long-term productivity and sustainability. Short-term concessions and perverse taxation did not help either. In the meanwhile, local communities have been deprived of their customary rights of access or displaced altogether. Under these circumstances, it is no wonder that tropical forests are being destroyed by the combined actions of logging firms that seek short-term profits and local communities that seek a livelihood without a secure resource base. Neither group has an assurance of a share in the future of the resource. For example, African women who have the responsibility for managing resources but lack access to secure property rights, extension and credit, have no choice but to overuse land and to farm areas that should not be cultivated. The encroachment of the resource by farmers in search of land for agriculture and cattle ranching further compounds the uncertainty and effectively reduces state ownership into open access land.

8. Public projects are undertaken that do not make adequate provisions or generate sufficient benefits to compensate all those affected (including the environment) to a level that they are decidedly better off with than without the project. Public projects aim to increase total welfare or to promote economic development, not to effect a redistribution of income, although other things being equal, projects that benefit more the poor than the rich ought to be preferred. Therefore, public projects should fully compensate all those affected, including future generations. If indeed the project is as beneficial as its proponents maintain, the project ought to generate sufficient benefits to make all those involved or affected better off with the project than without the project through actual not hypothetical compensation.

In addition, the expected benefits from the project ought to be sufficient to mitigate or compensate the project's environmental impacts to a level that the country's environment is not decidedly worse off with the project than without the project. For example, if a forest area is inundated by the construction of a dam, an equivalent area of forest must be created elsewhere .Many irrigation projects fail to meet these conditions and thus create social tensions and long delays that result in cost overruns and forgone benefits, if indeed they are overall beneficial. Examples abound. The Narmada project in Gujarat which has been delayed for some thirty years, is a case in point. If such projects do go through without meeting these conditions, they run into problems of watershed encroachment by the displaced population, sedimentation and loss of capacity.

9. Failure to recycle resources and byproducts when recycling would generate both economic and environmental benefits. With the exception of energy, the consumption of natural resource commodities such as minerals, wood products and other fibers generates recyclable materials. While not all recyclable materials can be economically recycled at the current levels of technology and costs, many could be profitably recycled . Inadequate recycling means more exploitation of natural resources, more pollution and loss of salvageable economic value. Recycling is implicitly taxed by depletion allowances and exploration subsidies pertaining to primary resource extraction, but not to recycling. Even when recycling is more costly than primary production, the environmental benefits from recycling (less waste disposal, less degradation of the environment by primary production) could help tip the balance if appropriately internalized.

However, because factories are free to dispose of their waste in the rivers free of charge, a profitable economic activity is foregone and, as a result, chemical waste is single most severe form of water pollution. Related losses include damage to the riverine and coastal fisheries and reduced water quality for household use.

10. Unique sites and habitats are lost and animal and plant species go extinct without compelling economic reasons which counter the value of uniqueness and diversity and the cost of irreversible loss.

As a resource becomes increasingly scarce, its social value rises regardless of whether it is traded in the market or not. The value of resources with no close substitutes, such as natural habitats and animal and plant species, approaches infinity as their numbers are reduced to levels that threaten their continued existence. Yet unique sites and habitats and threatened species are often driven to extinction by public projects or with the help of government subsidies, without compelling economic reasons to counter such enormous loss. The burden of proof that such resources have a lower value than the proposed projects or policies ought to be with those who advocate these interventions.

Section II

The causes of environmental degradation

The economic manifestations of environmental degradation raise analytical questions as to cause and effect. Why are increasingly scarce resources being inefficiently used and wasted instead of economized and conserved? Why are valuable resources being put to inferior uses when superior uses exist? Why are renewable resources being mined rather than managed for a perpetual stream of benefits when the latter would generate a higher net present value? Why are resources that generate a multitude of products and services being put to a single use when multiple use management would generate more benefits? Why are highly profitable investments that enhance both current productivity and future sustainability not being undertaken while scarce funds are being wasted on marginal investments? Why is a larger amount of effort and cost expended when a smaller amount would generate more profits and less damage to the resource? Why are resources and byproducts not recycled when recycling would generate both economic and environmental benefits? Why are local communities and tribal groups displaced and deprived of their customary rights to resources when by virtue of their physical presence and intimate knowledge they would be the most cost effective managers of the resource? Why are unique habitats and species going extinct without compelling

economic reasons to counter the irreversible loss of uniqueness, diversity and future options?

The answers to these problems are to be found in the disassociation between scarcity and price, benefits and costs, rights and responsibilities, actions and consequences. This disassociation exists because of a combination of market and policy failures. The prevailing configuration of markets and policies leaves many resources outside the domain of markets, unowned, unpriced and unaccounted for and more often than not, it subsidizes their excessive use and destruction despite their growing scarcity and rising social cost. This results in an incentive structure that induces people to maximize their profits not by being efficient and innovative but by appropriating other peoples' resources and shifting their own costs on to others. Common and public property resources (e.g. forests, fisheries) are being appropriated without compensation; the cost of growing scarcity is diluted through subsidies paid by the general taxpayer and the cost of ultimate depletion is borne by the poor who lack alternatives and by future generations whose interests are sacrificed to short-term political expediency. Preventing prices from rising in line with growing scarcities and rising social costs distorts the signals that in a well-functioning market would have brought about increased efficiency, substitution, conservation and innovation to restore the balance between supply and demand.

While policy and market failures are often intertwined and mutually reinforcing, for both analytical and policy reform purposes it is important to distinguish between them as clearly as possible. Policy failures or market distortions are cases of misguided intervention in a fairly well-functioning market or unsuccessful attempts to mitigate market failures that result in worse outcomes. Market failures are institutional failures partially attributable to the nature of certain resources and partially to a failure of the government to (a) establish the fundamental conditions (secure property rights, enforcement of contracts, etc.) for markets to function efficiently; and to (b) use instruments at its disposal (e.g., taxation, regulation, public investment and macropolicy) to bring into the domain of markets inputs and outputs (costs and benefits) that the institutional framework fails to internalize.

It is important to review market failures, but because they outline *a* potential role for government policy against which current policies can be viewed to identify areas of policy failure and policy success. Policy failure, is defined as a government intervention that distorts a well-functioning market, exacerbates an existing market failure, or fails to establish the foundations for the market to function efficiently. Policy success on the other hand is the successful mitigation of market failures; success is defined in terms of improvement in the allocation of resources among sectors and over time.

It should be seen that only a part of environmental degradation in developing countries is due to genuine market failure; much of it is due to misguided government interventions (such as tax distortions, subsidies, quota, interest rate ceilings, inefficient public enterprises, etc.), which distort an otherwise well-functioning market. Second, a good deal of genuine market failure, such as the failure arising from open access, insecure tenure, unpriced resources, and to some extent uncertainty and high transaction costs comes about because of government failure to establish the legal foundations of markets, such as secure property rights and enforcement of contracts.

Third, the mere existence of a market failure does not justify government intervention. Government intervention must lead to improved allocation outcomes over those of the free market and the ensuing benefits should exceed the cost of such intervention including those of enforcement and side effects (distortions). Fourth, experience suggests that the most cost effective intervention for mitigating market failures is the improvement of the functioning of the market through elimination of policy-induced distortions, the establishment of secure property rights over resources, the internalization of externalities through-pricing and fiscal instruments, the encouragement of competition, the free flow of information and the reduction of uncertainty through more stable and predictable policies and politics.

Therefore, it is a misconception that the presence of market failures justifies the reduction in the role of the market resource allocation and an increase in the role of government. To the contrary, mitigation of market failures through secure property

rights, internalization of externalities, increased competition and reduced uncertainty will enhance the role of markets in allocating resources such as water, land, fisheries, forests and environmental services and would make unnecessary the establishment of cumbersome and often inefficient public institutions for resource management and conservation. The government need only provide the initial institutional and policy reform necessary to allow the markets to function efficiently.

The first priority under the prevailing circumstances is to eliminate policies that have significant environmental cost or which create perverse incentives that encourage the depletion of resources and environmental degradation beyond the free-market level. Reforming policies that distort incentives for efficient resource use is a priority because unless perverse incentives are removed, project investments aiming at improved utilization and conservation of resources are unlikely to succeed and when they do, their impact would be unsustainable, lasting only as long as the project lasts.

Reforming policies that are detrimental to both the economy and the environment is an easier point at which to start. If anything, eliminating policy distortions usually reduces government expenditures and may even generate additional budget revenues. The distributional implications are also in the right direction since many of these distortions (e.g., interest rate ceilings, capital subsidies, untaxed resource rents, monopolies, input subsidies, price supports, etc.) are not only sources of inefficiency but also of inequity and perpetuation of poverty. Finally, eliminating policy distortions can be done by adjusting prices, taxes, subsidies, interest rates, and exchange rates which is easier than introducing new instruments or developing new institutions to deal with market failures.

This is not to say that market failures need not be mitigated, but that both the priority and the acid test of successful policy interventions is the elimination of policy-induced market distortions. Only then can market failures be seen in the right perspective and cost-effective interventions for improving the functioning of the market be formulated and effectively implemented.

Market failures leading to environmental degradation

Well-functioning markets are normally efficient mechanisms for allocating resources among uses and over time. Markets function efficiently when certain fundamental conditions are met. Property rights over all resources must be clear and secure: all scarce resources must enter active markets that price them according to supply and demand; there are no significant externalities; competition prevails; public goods are minor exceptions, and issues of myopia, uncertainty and irreversibility do not arise. If these conditions are not met, the free market fails to allocate resources efficiently among uses and over time. It wastes too many resources today and leaves too little for the future.

Much of the mismanagement and inefficient utilization of natural resources and the environment can be traced to such malfunctioning, distorted or totally absent markets. Prices generated by such markets do not reflect the true social costs and benefits from resource use. Such prices convey misleading information about resource scarcity and provide inadequate incentives for management, efficient utilization and enhancement of natural resources.

The most important market failures affecting resource use and management are:

Ill-defined or totally absent property rights which are essential for the efficient operation of markets.

Unpriced resources and absent or thin markets.

Pervasive yet unaccounted externalities, spillover effects or intersectoral linkages which are kept outside the domain of markets.

High transaction costs which discourage otherwise beneficial exchanges that would conserve resources and improve social welfare. Transaction costs include information negotiating, monitoring and enforcement costs.

Public goods which cannot and/or should not be provided by the private sector through the market because of either inability to exclude free-riders and recover the cost of provision of these goods because exclusion, though technically possible, reduces social welfare.

Market imperfections, particularly lack of competition in the form of local monopolies, oligopolies and segmented markets. Especially critical for resource conservation and management are the imperfections of the capital market.

Myopia in the sense of "too short" planning horizons or "too high" discount rates arising from poverty, impatience, and risk or uncertainty which affect individuals but not the society as a whole.

Uncertainty and risk aversion which may lead not only to high discount rates but also to unwillingness to undertake investments which are otherwise profitable but have a large variance of returns.

Irreversibility: when market decisions under uncertainty lead to irreversible results the market may fail to allocate resources prudently.

These market failures or rather sources of market failures are not unique either to natural resources or to developing countries. Not only are these market failures intertwined with each other, but they are also intertwined with socioeconomic and socio cultural factors such as poverty, customs, and perceptions.

Insecurity of ownership over resources: A fundamental condition for the efficient operation of markets is that there exist well-defined, exclusive, secure, transferable and enforceable property rights over all resources, goods and services. Property rights are a precondition to efficient use, trade, investment, conservation, and management of resources. Property rights need also to be exclusive in the sense that others do not have similar or competing rights to the same piece of the resource. Multiple ownership, however secure, has detrimental effects on investment, conservation and management. No single joint owner has sufficient incentive in land improvements when he or she knows that all the other co-owners have a right to the benefits that accrue from this investment. Joint investment is a solution provided that the joint owners can agree on the type, scale, and financing of the investment (or conservation). The larger the numbers of owners and the higher the transaction (or negotiation) cost, the smaller the likelihood that they will reach a stable agreement.

Property rights need to be secure. If there is a challenge to ownership, risk of expropriation, or extreme political or economic uncertainty, well-defined and exclusive property rights provide little security for long-term investments such as land improvements, tree planting, and resource conservation. If long-term investments are to be encouraged, property rights must not only be secure but also indefinite. Only investments that can yield sufficient benefits within the given time framework of the right will be undertaken, and exploitative behavior will ensue as the expiration date approaches unless there is a high probability that the property right will be renewed or extended. Property rights must be enforceable. Even if property rights are well defined, exclusive and secure, they will have little impact on resource use and management if they cannot be enforced. An enforced right is effectively no right at all. This holds for both private and public property. For example, the declaration of forest as public or state property by most tropical countries, did little to prevent deforestation and, in fact, it may have accelerated it for the very reason that public ownership over vast areas has been proven unenforceable. Effective enforcement is the discovery of violations, the apprehension of violators, and the imposition of penalties. For penalties to be effective, their expected or certainty-equivalent value (fine multiplied by probability of apprehension) must exceed the benefit obtainable from violations. When it is difficult to enforce property rights through penalties because of socio-cultural or other constraints, incentives for self-enforcement could be provided.

Finally, property rights must be legally transferable, through lease, sale, or bequest. If they are not, the incentives for investment and conservation are considerably reduced and the efficiency of resource allocation is compromised. Owners of resources who are not allowed to transfer them are discouraged from making long-term investments because they cannot recover such investments were they to change occupation or residence. For example, a logging concessionaire has no incentive to invest in reforestation or conservation because his concession is not transferable and his investments accumulate no equity. For historical and socio-cultural reasons, property rights over many natural resources are ill-defined, insecure, and in a number of cases totally absent. Insecurely held resources include

(a) private agricultural land, (b) public forest land and forest resources, (c) irrigation systems and water resources, (d) coastal zone and fishery resources, and (e) environmental resources. Resources over which property rights do not exist and therefore everybody has free access are known as open access or common property resources, or in layman's terms "no man's land". Common property must be distinguished from communal property, which is well-defined and enforceable.

Unpriced resources and thin markets

There is no market and therefore no price for open access resources since there is no secure and exclusive owner who should demand such a price and in its absence deny access. Moreover, prospective buyers would be unwilling to pay such a price as long as they have free access to the same resource elsewhere. With no sellers and no buyers, a market for open access resources does not develop and their price remains at zero even as they become increasingly scarce. True, there are markets for natural resource commodities such as fish, crops and fuel wood produced from open access resources, but the price that such commodities command reflects only the opportunity cost of labour and capital used in their production, not the opportunity cost of scarce natural resources used in their production. The implicit rent or user cost for the fishing ground, the newly opened forest land and the forest itself is still taken to be zero, regardless of scarcity and social opportunity cost.

With prices of zero and no market to register scarcity, that natural resources are depleted at rapid rates is not surprising, since demand is very high and supply very low at a zero price. In a market economy, the only gauge of scarcity is price. Price is also the mechanism through which scarcity is managed and mitigated through demand and supply adjustments. In the case of natural resources, supply is limited by nature and adjustments can be made only through conservation and substitution: both are costly processes that need to be paid for by rising resource prices. Rising prices require working markets and working markets require secure property rights over resources.

However, the absence of markets and prices is not limited to open access resources such as fisheries and the environment. Even state property such as forests and forest lands are in effect open access resources since the state's ownership is unenforceable, or deliberately not enforced. For this reason, the market in forest properties is very thin, that is, one with very little competition, which is itself another market failure.

A more obvious case of an unpriced resource is irrigation water. Here, the state has made a deliberate decision to provide farmers with irrigation water free of charge or at a nominal fee. In this case, it is not only the water, a scarce natural resource of positive opportunity cost, which is left unpriced (or zero-priced), it is also the scarce capital invested in the irrigation systems that is left unpriced. The consequences are many and far reaching: (a) water is inefficiently and wastefully used without any attempt to conserve it even when its scarcity is obvious to the user; (b) the state is unable to recover capital, operation and maintenance costs with the result that watersheds remain unprotected and the irrigation system is poorly maintained; (c) serious environmental problems such as sedimentation, soil salinization and waterlogging result from watershed degradation and from over irrigation while other potentially irrigable areas receive insufficient quantities of water to grow dry season crops; and (d) better-off farmers near the irrigation canals are indirectly subsidized by worse-off farmers who pay taxes but have little or no access to irrigation water.

Water pricing is neither technically nor politically easy to introduce especially in societies in which water has traditionally been regarded as free good. Yet, the potential gains justify some form of water pricing in the face of increasing scarcity. The alternatives range from volumetric pricing, to water rights, land taxation, contributions in kind and self-management through water users associations.

Efficiency pricing is at the heart of natural resource policy and management. In the case of irrigation water the private cost of both the commodity water and the *resource* water is constant at zero, while the social cost of both is positive and rising. Similarly, the cost to the private sector of using the environment (waste, land, and air) for waste disposal is zero, while the cost to the society is positive and rising.

Rapid deforestation and slow reforestation, even in securely owned forest land, is partly the consequence of the failure of the market to price forest products to capture the externalities of watershed and wildlife protection, and of other non-market services of the forest.

In general, the overexploitation, inefficient utilization, inadequate conservation and lack of investment in regeneration of natural resources can be attributed to undervaluation of resources arising from failure of either market or the government to efficiently price natural resources according to their social scarcity. The key to optimal pricing of natural resources is to identify and measure correctly the external social cost and the internal user cost of resource exploitation and to internalize them or charge them to the current generation of consumers through appropriate pricing or taxation. A major factor that drives a wedge between private and social valuation of resources and leads to inefficient pricing is the presence of external costs or spillover effects known as externalities. An externality is an effect of one firm's or individual's actions on other firms or individuals who are not parties in those actions. Externalities might be positive or negative. An example of a positive externality is the benefit that upstream forest owners provide to downstream farmers in the form of a steady water supply made possible by a forested watershed. It is to the society's (and the farmer's) benefit that more of such positive externalities are provided, but since the forest owners receive no payment for their watershed service they have no incentive to provide more of this service by logging less and planting more. The result is that more logging and less planting than is socially optimal takes place. Looked at from another angle, logging has negative externalities (or spillover effects) on downstream activities such as farming, irrigation, transport and industry, in the form of flooding sedimentation, and irregular water supply. These are real costs to downstream activities and to the society as a whole, but not to upstream loggers or shifting cultivators who have no cause or incentive to consider them as they do not affect the profitability of logging or shifting cultivation. In fact, taking such costs into account voluntarily amounts to a conscious decision to lower one's profit and price oneself out of the market. Another example of a negative externality is the damage that an upstream rice farmer's use of pesticides causes to a downstream

fish farmer that uses the same water source. The society as a whole (not only the fish farmer) would be better off if less of this negative externality is produced, but again there is no market (or other) incentive for the upstream farmer to take the downstream farmers' interest into account. The government may react to this problem by banning the use of pesticides altogether. This however may reduce social welfare if the loss from rice production outweighs the gain from fish production and if no other environmental effects are involved The ideal solution would be for pesticide use to be reduced exactly to the level where the combined value of rice and fish is maximized. This level is obtained where the marginal benefit from pesticide use equals its marginal cost, where this cost is understood to include both the production costs of the pesticide and its environmental cost . There are two ways in which this could happen: (a) the price of pesticide that the rice farmer pays includes a surcharge above production cost to account for the pesticide's environmental cost, or (b) if the same decision maker; owns both the rice farm and the fish farm.

Environmental costs are outside the domain of markets because these costs arise from a technological rather than a market interdependence between economic activities. It is a fundamental premise for an efficiently functioning market that economic units interact only through their effect on prices; technological interdependence is ruled out. However, the market will stretch itself to handle technological interdependence if it is a private externality. If there is only one rice farmer and one fish farmer, one of the two (or both) will recognize that one could buy off the other, combine the two operations and end up with a profit because as we have seen, combined profits exceed the sum of individual profits. Alternatively, the fish farmer may offer to "bribe" the rice farmer to reduce the use of the pesticide if the latter has the right to pollute. Or, if the fish farmer has the right to clean water, the rice farmer may offer to bribe him to accept more water pollution. In either case the result will be an improvement in social welfare through internalization of the externality accomplished by a free market.

However, as the number of polluters and affected parties increases, the market becomes less and less able to internalize externalities. First, the damage is spread

over so many decision makers that it is not perceived as important enough by any individual decision maker to induce action although its aggregate effect might be enormous. Second, it is difficult to unscramble the cause and effect or who damages whom and by how much. Third, and more detrimentally, another market failure comes into play: as the number of parties involved rises, so do information and transaction costs; bringing people together and obtaining an agreement becomes prohibitively expensive. A smooth functioning of markets assumes that information and transaction costs are zero or insignificant. In the case of public externalities, transaction costs may be so high that they will eat up all benefit from their internalization. Government intervention is justified provided that the government can bring about a more cost-effective internalization of externalities than the market. For example, a surcharge on the price of pesticides or wood to reflect respectively environmental costs of pesticide use and logging is a policy option which is likely to generate net social benefits if appropriately set and administered.

The market mechanism may work out a solution as long as the externality is private or at least concentrated and important enough for the internalization of benefits to be apparent to all parties involved. Or, at least one of the parties involved should have such a high stake as to be induced to act despite the free-riding by other beneficiaries. When the external effects are too widely spread, as is usually the case, the correction of the externality is a public good, in which case, the market does not function effectively and government intervention might be necessary if the externality is worth rectifying.

It may be useful at this point to relate externalities to common property and insecurity of ownership. Common property or open access creates externalities, and externalities create insecurity of ownership. Common owners impose externalities on each other which they ignore to everybody's detriment. The larger the catch of one fisherman, the higher the fishing cost of all other fishermen. Since this cost is ignored, everybody's catch and costs are higher than necessary leading to economic and biological overfishing and ultimate social loss. In analogous fashion, pervasive externalities may lead to insecurity of ownership with the same devastating overexploitation results as those obtained under open access. A farmer with a

secure and exclusive title to a piece of land subject to increasing erosion or flooding caused by upstream deforestation may decide to mine rather than farm his land before it is washed away, an outcome identical to that of common property or open access.

Transaction costs

Usually such costs are trivial compared to the benefits from trade that such markets make possible. Markets fail to emerge if there are very high set-up costs, if the costs per unit transacted exceed the difference between the supply and demand price, or if there are only a small number of buyers and sellers. Absence of well-defined property rights prevents markets from emerging, but well-defined property rights do not bring markets into existence if the coordination and marketing costs, necessary for the commodity in question to be traded voluntarily, are very high. Even if markets appear, they tend to be thin and inactive. The absence or paucity of futures markets and the high costs of rural credit market are usually attributed to high transaction costs. Similarly, there are costs to establishing and enforcing property rights. If such transaction costs are high relative to the benefit from secure and exclusive ownership, property rights and the related markets will fail to be established. The more parties involved, the less likely that a bargaining solution will be arrived at voluntarily because the transactions cost tends to exceed the benefits from internalizing the externality. However, the government, either through its collective or coercive power, may be able to internalize externalities at a lower transaction cost than the free market.

Public goods

When several originators and recipients are involved, externalities such as water and air pollution may be considered as public hazards and their correction as a public good. Each individual's consumption of such a good depends on the total quantity of

the good supplied in the economy. Unlike the case with private goods, the consumption of a public good by an individual does not diminish its availability to other-individuals. Although the production of public goods involves an opportunity cost in terms of foregone quantities of private or other public goods, a zero opportunity costs is associated with its consumption. In many cases, no individuals can be excluded from the enjoyment of a public good whether they pay for it or not. Because nobody can or should be excluded from the benefits of a public good, consumers would not freely pay for it and, hence, no firm would be able to cover its production cost though the market hence, the market mechanism would fail to supply a public good although the good would contribute to social welfare.

Natural resources and the environment involve many public goods ranging from environmental quality and watershed protection to ecological balance and biological diversity. Public goods range in geographical scope from local or regional to national or global. Certain goods are referred to as "publicly provided private goods" because of the large marginal cost associated with supplying additional individuals. The rationale for the public supply of such goods is their large set-up costs and the high costs of running a market for these goods. When private goods are freely provided, they are overconsumed. Since the consumer does not pay for the good, he demands and uses it up to the point where the marginal benefit he receives from the good is zero, although the marginal cost to the society is positive and often substantial. The social loss from overconsumption is the difference between the individual's willingness to pay and the marginal cost. A classic example of a publicly provided public good is irrigation water, whose overconsumption involves a double loss: a direct welfare loss from excessive consumption and an indirect loss from waterlogging resulting from overconsumption. There is a need for a rationing system to control consumption. Three possible rationing devices are (a) uniform provision, (b) queuing, and (c) user charges. The problem with uniform provision is that everyone gets the same amount regardless of his needs and desires. The problem with queuing is that it requires payment in waiting time and rewards those whose opportunity cost is lowest. User charges are particularly suited to publicly provided goods because users could be charged the marginal cost of providing the good

which is often substantial though not sufficient to cover the total cost of the public good. User charges result in both improved efficiency of use and partial cost recovery. This is particularly relevant to irrigation water pricing. According to the World Bank true efficiency pricing requires accurate measurement of supplies by metering the volume of water delivered to individual users. Although true efficiency pricing may not be attainable, even a nominal charge for irrigation water would provide an incentive to use it more efficiently .These complications notwithstanding, the pervasive shortage of public funds and the large income benefits derived from participants in irrigation schemes suggest that substantial cost recovery should be the goal in many instances. Most governments, have not attained anything like a full cost recovery from public irrigation schemes. A rule of thumb followed by some governments is to absorb the capital costs, but to establish water charges and benefit taxes at the level that in the aggregate will at least recover the operation and maintenance costs including repairs.

Uncompetitive markets

Even when markets do exist and are very active, there may be market failures in the form of insufficient competition. For markets to be efficient there should be a large number of buyers and sellers of a more or less homogeneous commodity or, at least, a lack of barriers to entry, and a large number of potential entrants as an insurance against monopolistic practices by existing firms. Because of the indivisibility of the necessary investment, the average cost of the service falls continuously as more and more customers are served until the whole market is dominated by a single firm. Other causes of limited competition may be institutional, legal, or political barriers to entry into certain professions or industries, high information costs; and the limited extent of the market, a common problem in developing countries which may result in oligopolies because only a few firms may supply the entire market. A usual monopolistic practice is to withhold supplies in order to raise lowest price. User charges are particularly suited to publicly provided goods because users could be charged the marginal cost of providing the good . User charges result in both improved efficiency of use and partial cost recovery. This is particularly relevant to irrigation water pricing.

Uncertainty and risk aversion

Natural resource management and conservation is about the future beset with uncertainties and risks. A situation is said to involve uncertainty if more than one outcome is possible from any given action. Two types of uncertainty may be distinguished: (1) environmental uncertainty arising from factors beyond the decision-maker's control, e.g., weather, epidemic disease, technological discoveries; and (2) market uncertainty arising from a market failure to provide information required for decisions affecting the future. The longer the time horizon, the further into the future forecasts need to be made and the greater the uncertainties involved. A situation is said to be risky if one of the outcomes involves losses to the decision-maker. Thus, the risk of loss to a firm or a farm may be defined as the probability that profits will be less than zero or the probability that returns will fall below some level of income. Risks may be reduced through diversification of activities with negative correlated outcomes. Risks in one activity may also be reduced by pooling them with risks from other independent activities. Individuals transfer their risks to an insurance company by paying an insurance premium which in a perfect insurance market would equal the administrative costs of the company plus the cost of any remaining risk.

However, not all risks are insurable. Insurance markets fail to appear when the outcome is not external to the policyholder, the risk affects all policyholders in a similar way. For example, a farm cannot insure itself against the risk of losses because profitability is as much a function of the farmer's actions as it is of environmental uncertainty e.g., weather. Similarly, a fish farm cannot insure itself against the risk of an epidemic because such risk would affect all farms in a similar way, which reduces the benefits from risk-pooling.

While uncertainty affects all sectors of the economy, natural resource sectors are more seriously affected for a variety of reasons. Uncertainty about the future should make people more conservative in natural resource exploitation, and therefore it should work in favour of conservation of at least those resources, such as biological diversity, which are less likely to be substituted by technology. After all, one reason

why people save is to provide themselves with a cushion against future uncertainty. For the individual, it makes good economic sense to cut down the forest and mine land to generate income which he can then consume or invest in more secure assets. From the society's point of view, it makes more sense to preserve the long-term productivity of the resource base both as a source of income in perpetuity and as insurance against uncertainty.

Section III

Policy failures leading to environmental degradation

The tendency of free markets to fail in the allocation and efficient use of natural resources and the environment opens an opportunity and provides a rationale for government intervention. Ideally, government intervention aims at correcting or, at least, mitigating market failures through taxation, regulation, private incentives, public projects, macroeconomic management and institutional reform. For example, if the market fails to allocate land to its best possible use because of insecurity of land ownership, the government intervention ought to be the issuance of secure land titles through cadastral surveys, land registration, etc., provided the ensuing benefits exceed the costs. If on the other hand, the market fails to allocate land to its best possible use because of severe flooding due to upstream deforestation, the government ought to explore the costs and benefits of taxation on upstream logging and/or downstream agriculture and the use of the proceeds to subsidize upstream reforestation. If economic analysis that considers all costs and benefits involved concludes that such an intervention can make both upstream logger/shifting cultivators and downstream farmers better off, and no one else worse off, it would be a policy failure not to act. Such an intervention is not a distortion, but a mitigation or correction of distortion introduced by a failing market.

In practice, however, government policies tend to introduce additional distortions in the market for natural resources rather than correct existing ones. Policy interventions tend to accumulate and interact with each other in subtle but profound

ways to distort private incentives away from socially beneficial activities. Policies that are seemingly unrelated to natural resources and the environment may have more pronounced effects on the environment than environmental and resource policies; for example, capital subsidies, tax and tariff exemptions for equipment, and minimum wage laws that displace labour lead to increased pressures on forest, marginal lands, coastal areas and urban slums. Thus, environmental degradation results not only from overreliance on a free market that fails to function efficiently, but also from government policies that intentionally or unwittingly distort incentives in favor of overexploitation and against conservation of valuable and scarce resources.

Policy failures may be classified into four basic types:

1.Distortion of otherwise well-functioning markets through taxes, subsidies, quotas, regulations, inefficient state enterprises, and public projects of low economic return and high environmental impact.

2.Failures to consider and internalize significant environmental externalities of otherwise warranted policy interventions. For example, fertilizer and pesticide subsidies may have a useful role to play in encouraging farmers to adopt new high-yielding crop varieties. In selecting the types of fertilizers and pesticides to subsidize and in setting the level and duration of the subsidy the effect on farmers' choice of other inputs (manure, soil conservation, weeding, irrigation, etc.) and on long-term productivity should be factored in.

3.Policy interventions that aim to correct or mitigate market failure but end up generating a worse outcome than a free and failing market would have produced. In some cases, doing nothing might be the best policy if intervening would make matters worse. However, in most cases the problem is not that no action is indicated, but that the wrong action is being taken. For example, if the free market fails to contain deforestation because the forests are open access resources and the negative externalities of deforestation are not internalized, a government intervention in the form of a logging ban is unlikely to be effective since (a) higher prices are likely to stimulate illegal logging, and (b)

concessionaires may log illegally to recover sunk costs or they may abandon their conservation.

Failures to intervene in failing markets when such interventions are clearly needed to improve the functioning of the market and could be made at costs fully justified by the expected benefits. It is unlikely to stimulate continued encroachment without significantly improving farmers' security of ownership, access to credit and incentives to invest. Such half measures risk turning a market failure into a policy failure of possibly greater dimensions.

To sum up, policy failures include both the failure to intervene when necessary and beneficial and the failure to refrain from intervention when unnecessary and detrimental. The policy failures which lead to environmental degradation range from poorly designed public projects that fail to account for their environmental impacts to structural adjustment programmes that fail to internalize their environmental repercussions. Policy failures are not the exclusive domain of governments. Development assistance agencies, through their project and programme lending and policy dialogue, may introduce or exacerbate a policy failure. Project-related policy failures, especially project selection on the basis of financial appraisal or narrow economic analysis that does not internalize environmental externalities.

(A) Project-related policy failures

Project policies refer to both public and private projects. Public projects are a potent instrument of government intervention for mitigating market failures (e.g., provision of public goods such as roads, utilities, parks, etc.), but if used inappropriately, can become a major source of market distortion. This is justified and beneficial only to the extent that public projects generate higher economic/social returns than private projects. Second, public projects, especially in developing countries, tend to be very large both by comparison to private projects and to the size of the economy.

Infrastructure projects such as roads and irrigation systems often have environmental impacts that extend far beyond the physical displacement of natural environments and any associated spillovers. For example, the environmental impact of road construction through an undisturbed forest is not simply the forest cut to make room for the road, or even the damage to the environment from road traffic and air pollution.

An econometric study of the causes of deforestation has found that population density, poverty, and infrastructure both dams and roads as well as economic incentives (wood and crop prices) played a significant role in deforestation.

Public projects are usually justified economically through cost-benefit analysis, which in principle should consider all social benefits and costs. Project level distortions or biases against efficient resource use, environmental quality and sustainable development arise for one of the following reasons: (a) projects are selected based on financial appraisal or narrow economic analysis; (b) the social benefits and costs are too narrowly defined (c) the environmental effects are unforeseen at the design stage of the project; (d) the environmental costs are foreseen and appreciated, but it is difficult to measure and evaluate them; (e) an unduly high social discount rate is used; and (f) the irreversibility of project-induced changes in the environment is ignored or not properly handled.

In most countries the framework for interrelating national economic policies with water resources policies have been collapsed down to an accounting framework whereby the possible investments in the water sector are analyzed project by project. These projects are added together to make a portfolio of investments offered by the technical agencies to the planning commission as the investment policy. The planning commission then responds by checking to see if the overall resources demanded can be met from the available current, or projected, economic resources. The planning commission then either recommends changes or passes the portfolio on to the executive for approval. Depending upon the state, and the time and resources available to it, the planning commission may, or may not, check for consistency between the water sector and the other sectors of the economy.

The bias for or against projects as opposed to policies is not unique to government agencies. Environmental groups have focused on the environmental damage caused by projects such as Nam Choan Dam in Thailand, the Narmada project in India, and the Tucurui Dam in Brazil, rather than the massive market failures and policy distortions that lead to wholesale destruction of natural resources and degradation of the environment. When projects are seen as part of an overall development policy, many of what are now unaccounted externalities would be internalized and much of the development-environment conflict resolved. Many developing economies are far from their efficient productions frontier. It is possible and feasible to produce more development and better environment at the same time by correcting market failures and eliminating policy distortions. It is in this context that public projects should be planned, designed, and evaluated.

(B) Forest policy failures

Forest policy is an excellent example of a resource-specific policy that needs to be overhauled if the link between scarcity and prices is to be reestablished. If the country is facing a growing scarcity of forests, forest product prices should be rising to slow down deforestation and accelerate reforestation. At present, not only are most forest products and services not priced, but even timber which is an internationally tradeable commodity is priced below its true scarcity value due to implicit and explicit subsidies and institutional failures. Failure to value non-timber goods and services results in excessive deforestation, conflicts with local communities, loss of economic value *and* environmental damage. Promotion of local processing of timber often leads to inefficient plywood mills, excess capacity, waste of valuable tropical timber and loss of government revenues. Replanting subsidies often end up subsidizing the conversion of a valuable natural forest to inferior mono-species plantations, with the associated loss of the value of both tropical hardwoods and biological diversity.

Concerns over rapid rates of deforestation and slow rates of replanting have given rise to export bans on unprocessed timber . The primary motivation has been the conservation of forest resources and an increase in value added through domestic

processing and forest conservation. This is a well-meant and popular action. However, unless it is supplemented with effective enforcement and forest management, it is unlikely to succeed in stemming the rate of deforestation. Illegal logging, encroachment and shifting cultivation are likely to continue and even intensify in the absence of logging concessions, because population pressures, poverty and incentives for opening land for agriculture have not changed.

(C) Land policy failures

Insecurity of land ownership is the single most severe market cum policy failure in developing countries. It prevents the optimal use of land and leads to the degradation of the land, water and forest resources. Insecurity of land owner- ship takes many forms: totally untitled land, the result of forest encroachment and squatting; land under unclear, disputed or multiple ownership; land under short-term lease or tenancy; land under uncertainty of imminent or likely land reform or appropriation; land under usufruct or stewardship certificates that are not indefinite and transferable; and land ownership that is tied to compulsory state trading, price controls, and forced cooperatives through which the owner is forced to buy inputs at higher than market prices and to sell outputs at lower than market prices. While owner and tenants with reasonable security do not seem to differ in their willingness to adopt innovations, such as new varieties, fertilizers and pesticides for annual crops they may have different attitudes towards long-term investments that enhance land productivity and sustainability over the long-run such as irrigation and drainage structures, land terracing, tree crops, etc.

The lack of security of ownership over land constitutes a serious obstacle to farm investments necessary for diversification, intensification, and increased productivity. Untitled land is not accepted by financial institutions as collateral for credit forcing farmers into the high interest rate informal credit market, which makes farm investments unprofitable The risk of eviction, however small, adds an element of uncertainty that further discourages investments in land improvements and soil conservation. Uncertainty, lack of access to institutional credit, and easy access to public forest land combine to bias agricultural development against intensification on

existing lands and in favour expansion into new lands. This leads to encroachment of forest resources thereby depleting forest resources and increasing the amount of land under cultivation. The importance of security of ownership for investment, long-term productivity, and conservation cannot be overemphasized. The World Bank based on its 40 years of experience in lending for agricultural development around the world, has concluded that:

“How farmers use land is greatly affected by the degree of security of land-tenure - with respect to such matters as duration of user rights, clarity of land rights, ability to sell these rights or pass them on to succeeding generations, and ability to obtain compensation for investments”. A farmer with unclear, insecure, or short-term tenure is more likely to "mine" the land, that is, to seek maximum short-run production gains through crop rotations and other practices that may degrade the biological and physical qualities of the soil. In the absence of enforcement of state ownership, forest land has been effectively made available for agricultural expansion free of charge. As an unpriced resource, forest land for agricultural expansion is in high demand and increasingly short supply as the limits of the land frontier are being approached. Yet, in the absence of secure and transferable titles, an efficient land market for encroached land failed to develop, and consequently, increasing land scarcity did not lead to higher prices and increased land conservation. Insecurity of land tenure and lack of access to credit have both on-farm and off-farm environmental consequences that result in further reduction of productivity. The on-farm environmental effects are soil erosion, nutrient leaching and waterlogging resulting from inadequate incentives (and funds) to invest in drainage and soil conservation practices. The off-farm effects are further encroachment of marginal lands and watersheds because of inability to maintain yields on existing agricultural lands. This results not only in loss of valuable forest resources but also in soil erosion and sedimentation of downstream irrigation systems.”

Well-meant government policies that limit property rights to fixed-term use rights, and prohibit their transferability or tie the land granted through land reform to state trading, price controls or forced cooperatives create unnecessary uncertainty and diminish the value of these rights. Such land is not likely to be put to its best use.

Concerns about land purchase and accumulation by land speculators can be dealt with through a land sales tax and a progressive property tax.

(D) Water policy failures

Virtually all countries, regardless of the degree of scarcity of water, subsidize water for irrigation and, in many cases, they supply it free of charge. Many farmers continue to think of water as a free, virtually unlimited resource whereas the facts increasingly suggest otherwise. Irrigation water is provided free of charge without any attempt to recover cost or to charge a price reflecting the scarcity value or opportunity cost of water. The result is over irrigation with consequent salinization and waterlogging in some areas and inadequate water in others. This gross waste of water limits the efficiency of irrigation systems to about 15 percent of a potential of 60 to 70 percent (Asian Development Bank, 1984), while the failure to achieve any degree of cost recovery deprives the system of operation and maintenance funds.

(F) Urban-industrial environment:

Industrial development and urbanization are highly correlated. Industries in many developing countries are often located in or near urban centers because of the skewed distribution of public infrastructure (roads, electricity, telephones, government offices, etc). Correspondingly, industrial pollution is concentrated in and around urban centers . Thus, it is often difficult to determine what part of observed environmental degradation is caused by industrialization and what part by urbanization.

Increased urbanization and industrialization in the 1990s will exacerbate already serious problems of crowding and water and air pollution in cities . This means that more emphasis and resources must be devoted to addressing urban environmental problems than have been the case in the past.

Regardless of urbanization, to employ the additional labour force more emphasis will be placed on industrial development, thus increasing the production and disposal of hazardous toxic chemicals and wastes. This is already a major problem in Gujarat . Similarly, the intensification of agriculture to accommodate larger numbers on the

same land will inevitably lead to increased use of toxic agricultural chemicals, which presents a new set of problems for policy makers. India has already had a dramatic experience with agricultural pesticides, as has the State of Gujarat with industrial hazardous chemicals.

Industrialization is certain to have environmental implications not only for the urban centers but also for the rural areas. The impact of industrialization on the rural environment will depend on labour intensity, location and type of industry. Labor-intensive industry if combined with appropriate location and educational policy is likely to attract labour out of the marginal and fragile areas and thus reduce the pressure on natural resources. Capital-intensive industry would have little or negative impact on the rural environment.

Urban and industrial environmental quality is clearly an area of massive market failures. The urban environment is an unpriced common property resource; environmental pollution is a public externality whose internalization involves prohibitively high transaction costs because of the millions of polluters and affected parties involved. Pollution abatement and its product, environmental quality, are public goods that cannot be provided by a free market because of inability to exclude and hence inability to finance.

While there is an increasing recognition of environmental problems in urban centers around the world as evidenced by increasing regulation of industrial pollution, the environment is still treated by both households and industries as an open access space for free disposal of wastes. In many centres large industries are required to submit environmental impact studies before their establishment and meet certain emission standards during their operation, but effective enforcement is lacking. Moreover, the far more numerous small industries and millions of households continue to enjoy free disposal of waste into the environment. Urban centers in developing countries lack sewage treatment facilities. Unrestricted air and noise pollution from public and private automobiles is another example of the use of the environment as a free and open access resource. Similar is the perception and use of the environment by farmer who release water contaminated with toxic fertilizers

and pesticides into the main water source. Free disposal of wastes is tantamount to a lack of property right over the environment or use of the scarce assimilative capacity of the environment free of charge. Unpriced or open access resources are commonly overused underconserved, and mismanaged.

Environmental pollution originates from a variety of sources including discharges of domestic wastewater, community solid wastes, industrial waste effluents and wastes from agricultural activities such as runoff of excess pesticides and fertilizers. It affects a variety of economic activities including industry, fisheries, tourism, and urban development, as well as the general quality of life. Thus, excessive environmental pollution constitutes both a misuse of an unpriced or open access resource and a negative externality on sectors and individuals who may or may not be parties to the pollution-generating activity. This is so because the environment serves both as the recipient of the residuals of economic activity and the medium which transmits offsite effects to second and third parties. Even agriculture, usually thought of as more benign to the environment than industry, is becoming a major source of pollution as it becomes more intensified through the use of mechanical and chemical inputs (toxic fertilizers, pesticides, fossil fuels, etc.). At the same time, as the supply of clean environment declines, the demand for environmental quality rises as a result of income growth. Thus, while the significance of forests, land, and water as inputs into the production process may decline somewhat with industrialization, urbanization, and agricultural intensification, their significance as assimilators of industrial, urban, and agricultural waste and as sources of environmental amenities is certain to rise.

Further industrialization and agricultural intensification, however, will not necessarily cause further environmental degradation. It depends on the type of the new or expanded industries, their spatial distribution, their input mix and technology and the incentive structure and environmental regulations introduced by the government.

Under the direct regulatory approach, the government sets maximum permissible levels of discharge of each pollutant from each source (effluent or emission standards) and relies on administrative agencies and the judicial system to enforce

them. An alternative type of standard is the ambient standard which sets the minimum acceptable level of environmental quality for a receiving watersource or airshed. Incentives, such as tax writeoffs, accelerated depreciation, low interest loans or outright subsidies for the adoption of clean production technologies or the construction of waste treatment facilities are similarly inefficient and ineffective.

This direct regulation and subsidization suffers from many weaknesses. It relies on centralized setting and enforcement of standards which is both costly and ineffective.It promotes inefficiency since it requires similar reduction of pollution of all sources regardless of costs. The environmental agency is engaged in endless negotiations with the polluters over the type of equipment to be installed resulting in long delays and compromise of the agency's standards. Bribing of enforcement officials is higher than in any other pollution control system because of the protracted negotiations and ambiguity of compliance to the set standards.

(G) Industrial and trade policy failures leading to environmental degradation

Industrial and trade policies may seem only remotely related to natural resource use and management, but they are in fact critical, because they affect: (a) the. terms of trade between agriculture and industry and therefore the relative profitability of agriculture and other resource sectors; (b) the use of natural resources as an input in industry; (c) the level of industrial employment and hence the residual rural labour that exerts pressure on natural resources; and (d) the level of industrial pollution.

For the pressure on the agricultural resource base to be reduced, the number of people depending on agriculture must be reduced through labour movement into other sectors. Unfortunately, the increased relative profitability of industry often fails to attract much labour out of agriculture and other resource sectors because of the capital intensity and the urban bias of the promoted industries. Open access natural resources such as forests and forest land, inland and coastal fishing grounds, mineral-bearing lands and offshore areas, and the natural environment are the most conveniently accessible sources of supplementary or alternative employment and income. Additional income is earned through the gathering of

fuelwood and other forest products, fishing and the collecting of minerals by underemployed members of the household. Illegal logging and poaching of logs or working for illegal loggers often yields substantially higher income than legal employment, if such can be found. The size of land holdings is maintained and sometimes increased by clearing additional forest land. Thus, the availability of open access resources helps halt the drop in incomes resulting from rapid population growth and slow rural development. When open-access resources in the vicinity of a rural community run out, migration to other areas where open access resources are found takes place. One of the major destinations of migration are the main urban centers where it results in squatting on public property, creation of slums, crowding, hawking and general environmental degradation.

In the context of sustainable development, ignoring the impact of sectoral and trade policies on resource use and management can be self-defeating. For example, protection and credit subsidies for urban-based capital-intensive industries, combined with agricultural taxation to squeeze increasing surpluses out of agriculture and speed up industrialization, may backfire. Because the industry in its early stages depends heavily on agriculture for food, materials capital, foreign exchange and markets for its products, policies that promote industrialization too heavily, at the expense of agriculture, undermine the country's industrial base. Such policies promote inequality, underemployment and scarcity of rural credit, thereby discouraging investments in land conservation and encouraging encroachment of forest lands. Moreover, the consequent social tensions do not constitute a sound basis for sustainable development.

The most important industrial policy reform necessary is the restoration of the comparative advantage of labour-intensive industry vis-a-vis the highly protected and promoted urban based capital-intensive manufacturing. The best solution would be a sweeping reform of biased industrial and trade policies. For political reasons such reform may not always be feasible. Given the dimensions and urgency of the employment, poverty and resource mismanagement problems and the untapped potential of rural industry a pragmatic second-best policy would be development assistance to rural, labour-intensive industries to create off-farm employment

opportunities as an alternative to encroachment and destructive resource exploitation. To be successful the promotion of rural industries should build upon the basic features of the rural areas: availability of raw materials, seaonality of labor supply and dispersion of markets.

Three other industrial policies that need reconsideration in the light of environmental costs are: (1) depreciation allowances, tax rebates and tariff exemptions on equipment and materials which might be a major source of pollution; (2) energy subsidies that may favour more polluting sources of energy over less polluting ones; and (3) the criteria for approving direct foreign investment.

The rate of interest is an important macroeconomic parameter with microeconomic implications for resource allocation . The higher the interest rate (or discount rate) the higher the cost of waiting and, therefore, the faster the rate of resource depletion and the lower the investment in resource conservation. Interest rate ceilings and implicit interest rate subsidies for promoted industries have been the main interest rate distortions affecting the agricultural sector and the rural economy in general. Minimum wage laws reduce labour employment and depress real non-manufacturing wage rates. This, under conditions of labor abundance, leads to a) increased use of low-cost labour in depleting natural resources, and b) encroachment of resource sectors by unemployed or underemployed labour.

The effects of minimum wage rates, subsidized credit, interest rate ceilings, and exchange rate adjustments on the rate of resource depletion in a resource-based economy cannot be ignored.

To help governments restructure their economies to better deal with the emerging problems, the World Bank, the International Monetary Fund (IMF) and other international development agencies have been financing structural adjustment loans (SALs) and sectoral adjustment loans (SECALs). For several reasons it is important to consider the impact of these structural and sectoral adjustment programmes and loans on resource management and sustainable development: (a) these adjustment programmes more or less define the macroeconomic and sectoral policies to be followed for a good part of the 1990s and, as we have seen, macroeconomic and sectoral policies affect resource allocation and use ; (b) since these programs aim to

restructure the economies of the region, their impact will extend far beyond the expiration of the programmes and loans; and (c) for the first time, environmental concerns have been raised by several countries and development assistance agencies in the context of macroeconomic and development policies and some provisions relating to natural resources and the environment have been included in the loan agreements. Regardless of the adequacy or effectiveness of these provisions, the mere recognition of the implications of macroeconomic, trade, and development policies on the resource base and the environment is a significant step in the right direction. Yet, questions have been raised as to the overall impact of structural adjustment policies on the environment.

(H) The effects of structural adjustment programs on environmental degradation

Trade and industrial policy reforms amount to promotion of exports, liberalization of imports and encouragement of foreign investment. This is done by reducing absolute and differential protection, lowering production and transactions costs of exports and imports and promoting competition through institutional reform.

The environmental effect of these policies operates at several different levels. To the extent that these policies generate economic growth, create additional employment and reduce poverty, they help improve environmental conditions in the country. Similarly increased industrialization and foreign investments are not detrimental to the environment as long as all environmental costs have been accounted for. Similarly environmental conditions should be specified as part of any foreign investment project at the time of application and monitored as part of regular performance evaluation. Environmental conditions include industrial location, waste disposal, pollution control, accident prevention and site rehabilitation. Environmental regulations may also be supplemented by emission standards, effluent taxes, or pollution permits. To ensure that industrial and trade policy reforms result in environmental improvement, the import tariff structure should be used to internalize environmental costs into the pricing of technologies and products.

The environmental effects of industrial and policy reforms taken by themselves are rather ambiguous. On the one hand, to the extent that these policies generate economic growth, create employment and alleviate poverty, they help improve the environmental conditions in the country. On the other hand, to the extent that they lead to intensified exploitation and export of natural resources at prices which do not reflect the true cost to the country, they lead to deterioration of environmental conditions .

Agricultural policy reforms involve: (a) increases in product prices and reduction of taxes on agricultural exports to improve incentives for agricultural production; (b) changes in relative prices by reducing price support for certain crops and (c) reduction in agricultural input subsidies to reduce the drain on the budget, save foreign exchange and improve the efficiency of resource use . Reduction of export taxes on certain crops such as tree crops helps diversify the economy away from soil-eroding crops such as maize, wheat or cassava and towards high value perennial export crops with positive environmental side effects.

However, the excessive and indiscriminate use of pesticides encouraged by generous subsidies has proved counterproductive by eliminating the pests' natural predators or promoting the emergence of pesticide resistant strains of pests. Similarly, overapplication of chemical fertilizers over a prolonged period of time, to the total exclusion of organic fertilizers damages the structure of the soil. Heavy use of pesticides and chemical fertilizers also leads to water pollution and poisoning of aquatic life through runoff into water systems. It does not matter that chemical subsidies have been cut to reduce the drain on the budget; their reduction also reduces the drain on environment. Structural adjustment programmes also call for reductions in subsidies for farm equipment and land clearing machinery. This policy reform has several positive effects on resource use and the state of the environment because subsidized land clearing machine:

(a) encourages deforestation and the clearing of marginal lands for agriculture (b) compacts and damages the structure of fragile tropical soils; (c) increases use of fossil fuels; and (d) distorts the farmer's labour-capital choice in favour of capital and against labour in countries with abundant labor. Aside from economic inefficiency

and misallocation of scarce capital that the latter entail, it also reduces agricultural employment thereby promoting encroachment of forest lands or undue urban migration.

Policy intervention that control environmental degradation

Policy success is defined as a government intervention, or elimination of one that improves the allocation of resources and reduces the degradation of the environment. Policy successes may be classified into three groups:

(a) Reduction and eventual elimination of policies (taxes, subsidies, quotas, public projects) that distort well-functioning markets or exacerbate market failures. Cases in point are the elimination of the pesticide subsidies in Indonesia and the ranching subsidies in Brazil.

(b) Correction or mitigation of market failures through interventions that improve the functioning of the market or result in outcomes superior to those of the free market.
(c) Consideration and internalization of environmental, social and other side effects of public projects and sectoral and macroeconomic policies.

In response to these concerns, government has introduced changes in existing policies as well as new policies and programs to deal with growing environmental problems. Particularly encouraging is a growing shift towards reduction and gradual elimination of pesticide and fertilizer subsidies that have been responsible for both misallocation of resources and environmental pollution.

Conclusion.

This chapter has highlighted environmental degradation at macro level and causes for environmental degradation and policy failures related with environmental management in related segments of environmental pollution. Action taken are not found suitable as well as successful. At national level and state level, pollution norms as well as action by CPCB and GPCB need due consideration for sustainable management of environmental pollution in India and Gujarat.

Chapter IV

Industrialization and rising pollution: Prevalent practices in India and abroad.

Chapter IV

Industrialization and rising pollution : Prevalent practices in India and abroad.

Introduction

The present chapter deals with industrial growth and lacking internalization of negative externalities created by industrial environmental pollution. By and large, water pollution, air pollution and noise pollution are the bye-product of severe competition to achieve global market by achieving higher industrial growth rate in the case of the developed countries in general and developing countries like ours in particular. As such, chemicals, leather and paper industries consume highest amount of available water and dispose highly toxic water harmful to humans and animals. They also adversely affect land surface and agriculture prosperity.

This chapter specifically examines water contamination largely due to industrialization and violation of pollution principles. Industrialists have enjoyed benefits of fiscal and financial incentives with industrial liberalization policy. However, they are reluctant to pay for industrial pollution. It appears that pollution control authority has become an "Ambassador of Industrial Lobby". No industrialist is ready to bear non-remunerative expenditure for preventive pollution practices.

The present chapter is divided into two sections. The first one shows overall earth pollution in general and rising pollution due to urbanization and industrialization. The second section examines chemical pollutants in industrial waste water.

Section – I

Industrialization, urbanization and rising pollution

The Industrial Revolution began in the late 18th and early 19th centuries in Britain, before spreading around the world. Coal, oil and gas (collectively termed fossil fuels) offered levels of energy production previously undreamed of, leading to shifts

towards factory-based systems and the mass production of goods such as cotton. Fossil fuels, principally coal at the beginning of the Industrial Revolution, were primarily used to generate steam power and electricity, but their applications were vast, with many industries becoming automated, hence increasing their output. In the search for a better standard of living, many people moved from the countryside to the cities to find work in the new factories. The burning of fossil fuels led to a massive increase in urban air pollution, although most people felt that such a disadvantage was not significant in the context of their new found prosperity.

In addition to urban air pollution however, other impacts of industrialisation were felt. There were drastic changes to land use with the construction of new buildings, including factories and houses for employees, and transport facilities, including new roads and rail tracks. Areas of countryside were destroyed and replaced by industrial developments. In order to make best use of the remaining land, agricultural machinery was modernised to make the production of food more efficient.

Today, industrialisation continues in the less well developed areas of the world like Africa and parts of Asia. We have gradually become aware that there are many environmental impacts as a consequence of industrialisation, and that we have the ability to take the appropriate action. The main impacts of concern are pollution, resource consumption (including energy resources) and population growth.

In Gujarat, industrialization and urbanization process took place after 1981. Gujarat achieved premier status in industrial growth. However, such process encouraged waste water pollution, air pollution and traffic pollution . Both Gujarat and Maharashtra are facing this problem. Ahmedabad – Vapi Golden Corridor is facing highest level of waste water pollution and air pollution in Gujarat. Chemical and Petro-Chemical units were issued licenses by the Commissioner of industries and

GIDC approved sites without taking care of industrial environmental pollution. Let us examine pollution in terms of population and pressure on environment.

Earth – population.

Agricultural advances caused the world's population to grow from 170 million during the Roman period 2,000 years ago to 900 million in 1800. By 1900 the industrialisation of large parts of the world had led to a trebling of the world's population in only 100 years.

This growth in population has increased the stresses on the environment. Larger populations required more resources, which involved a greater intensification of farming and industry. In addition, the rapid population growth associated with industrialisation during the last two centuries has led to considerable depletion of raw materials (most notably fossil fuels, metals and stone) extracted from the Earth. Furthermore, as we consume more and more resources, we are accumulating waste at an alarming pace.

Today, the world's population stands at 6 billion. This is expected to almost double within the next 50 years. Most of this increase is due to occur in the developing world. One in five people alive today are desperately poor and each year 40 million die from malnutrition and diseases related to poverty (more than 100,000 per day).

Such a large population can be sustained only as long as food resources are properly managed and distributed, and the environmental impacts of agriculture and housing are minimised. By being prepared, population growth and development can be sustained by using sensible planning and suitable modern technology. Agenda 21 recognises that to achieve sustainable development throughout the world, population must be managed and controlled by a process of "demographic dynamics".

Impact of pollution

The environmental impact of human beings has grown in scale, become more rapid, and changed in character. Whereas we once transformed locales or regions, today we can be said to be transforming the Earth on a global scale. Changes which once took decades or centuries are now taking place over the course of a few years. And whereas we once changed the Earth in relatively small ways (for example by clearing a field of forest cover), we are now able to substantially alter the flows of elements and energy that constitute the planet's basic life-support systems.

Through burning fossil fuels and industrial processes, we are releasing many pollutants into the atmosphere. Some of these reduce air quality, whilst others are most probably causing a change in the Earth's climate. Other wastes from the consumption of natural resources can pollute soil and water environments as well. Water contains a great variety of trace elements and mineral compounds. Industrial and agricultural activity and urban waste increase these constituents and add others. This fact sheet focuses on water pollution due to human activity: such as by lead, mercury, cyanide, nitrates, radioactivity and pesticides. While some may be found as traces in water sources remote from obvious sources of pollution, the main threat to human health is through contamination from industry, mining, chemicals used in agriculture, intensive livestock husbandry leading to contamination of drinking-water supplies. It can be difficult to assess exposure since humans may take in small amounts of trace elements and other compounds via air and food as well as in water. The effects depend on factors such as the duration of exposure, varying susceptibility by age and the presence of disease or malnutrition that may increase vulnerability to the effects of exposure. The growing world population and industrialisation has focused concerns both on the implications of water pollution and also on the threat to water supplies from industrial accidents. There are also the 'future spectres' of the long-term effects of pollutants, including substances that may affect our hormones. On the positive side, trends towards less polluting industry and agricultural reform are helping to reduce contamination, for example by control of industrial emissions and by promotion of integrated pest management.

Section- II

Chemical Pollutants in Industrial Waste Water.

Water, unless it is distilled, is not simply 'H2O', but also contains many natural elements. Water gathers constituents from the rocks and ground through which it permeates. Some benefit health, others are harmful. Water constituents are defined as a hazard when they have the potential to impair health. The risk posed by such hazards is the quantitative calculation of the probability of causing harm, based on the degree of exposure. In contrast to other health hazards, the risks posed by chemical pollutants may be quantified described through research and modelling or dose-response curves. In addition to the natural hazards, humans add to the constituents through industrial processes, mining operations and agriculture, often with a lack of awareness or insufficient knowledge of the potential risks to health.

As industrialists are not disposing daily treated waste water at the point level undesirable contaminants may enter water. For most of these contaminants, something can be done to make the water safe or identify an alternative supply - if we know about the contamination in good time and water treatment facilities are available. Monitoring, treatment and preventive action may, however, be costly. This section also covers future threats of pollution from growing world population, increasing industrialisation and the possible increase in industrial accidents. The Chernobyl nuclear power station explosion in Ukraine in 1986 showed how quickly radioactive contaminants can spread into waters far away from the pollution source. Similarly, the Bhopal disaster in India (1984) included pollution of large volumes of water. A fire at a large pharmaceutical company in Switzerland (1986) caused water pollution in neighbouring countries. In the UK, an accident at a water works in 1988 showed the problems that can occur with the chemicals used for water treatment, in this case aluminium sulphate. These are not just past spectres, for the history of such catastrophic events suggests that they will surely occur in future. They are

examples of accidents whose impact is of an order of magnitude that they make the headlines. The cumulative effect of many other, smaller accidents that do not make it to the headlines poses an insidious threat to our health. Water supplies are also vulnerable to pollution from other sources related to human production systems: pesticide run-offs from agriculture or toxic waste from mining operations. Bioavailability from pollution depends upon the form of the chemical in the water body and factors such as water solubility that affect entry into the food chain. The residues of many first and second-generation pesticides function as so-called endocrine disruptors: chemicals with the potential to affect the hormone system in humans and animals. Prolonged exposure to some chemicals may also cause cancer. Risk assessment for water pollution thus requires long term monitoring, as the harmful effects may take years to develop.

Understanding the risk posed by contaminants in water in our environment involves viewing the environment as a whole: the physical, chemical, biological, social, cultural, and economic conditions with which human beings interact. Exposure to toxic substances can occur by multiple routes: air, food, discarded containers on refuse sites, unsafe containers of chemicals within the home, leakage from transport containers, contaminated soil, as well as water. A ‘safe’ level in one of these exposures may combine to produce toxic effects if multiple exposures are involved. The risk is much greater if health is already compromised by malnutrition, poverty and poor sanitation. Children are particularly susceptible to such combined exposures: 61% of poisoning cases that are not work-related occur in children under the age of 6 years (American Association of Poison Control Centers, PAHO, 2000). Sixteen percent of fatalities due to such pesticide poisoning are children (PAHO, 2000). Contaminated water often combines with other hazards such as inadequate ventilation to add to the toxic load experienced by children, for example child labourers in the mining industry . While hazards from some elements, such as lead and mercury, are decreasing due to risk-based interventions, the rapid expansion and spread of industry also means that an increasing proportion of the world's population is exposed to new industrial processes and their discharges into the

environmental water sources. New chemical compounds are constantly introduced into the market place, some safer than previous chemicals, others with unknown effects on health. Around 100,000 chemical substances are presently used in commerce, with 2000 new compounds coming onto the market every year (WHO-IPCS, 2000). There is no reliable information on the health impact of almost two thirds of the 70,000 chemical products used in industry (PAHO, 2000). This lack of data limits preventive measures or advice on precautions.

The health risks can also be defined in terms of acute or long-term (chronic) exposure. Acute exposure is defined as exposure for less than 24 hours and usually involves a single dose of a chemical. Long-term exposure refers to repeated or continuous exposure for more than 3 months. The health effects differ markedly between acute and chronic exposure: in most cases of contamination via water, there is more concern about long-term effects, for example linked to accumulation of the chemical in the sediments of rivers and reservoirs, or where industrial discharge continues over a long period. Guideline values for chemicals in water are based on available evidence, frequent presence of the contaminant in water and international concern about particular substances. In many cases the values are much lower than those described in documented toxic effects, but in other cases the evidence is unclear and guidelines may not be available on substances not normally present in water, or where the evidence of health effects is inadequate (WHO, 1993; WHO 2000).

Industrial pollution

Where waterborne sewerage systems are used to dispose of human excreta, the system tends to be used also for disposal of industrial waste, especially liquid discharges. Municipal sewage sludge may contain high concentrations of heavy metals, such as cadmium, lead and chromium. Poisons in industrial discharges can quickly exceed the safety limit: levels may be 10 or 20 times higher than those of municipal waste only (Chang, Page and Asano 1995). Disposal of industrial waste by incineration or land-fill may also contaminate water sources, if the waste filters into

groundwater or drains to rivers. Heavy metals eventually accumulate in filter-feeding shell fish and plants.

Mercury: the Minamata case

One of the most infamous cases of industrial water pollution occurred in Minamata, Japan.This demonstrated the links between water pollution and food: the main contaminant, methyl mercury entered the food chain via fish, the chief source of protein in the local diet. Fishing was an important means of livelihood, as was the factory responsible for the pollution: this contributed to the delay in identifying and accepting that mercury was the cause of the mysterious Minamata disease in the community. Even when pollution was suspected, other elements in the wastewater were initially suspected, such as manganese, selenium and thalium. The now classic Minamata story was a key lesson in the enduring effects of water pollution and the problems in removing it. Chemical contamination of fishing waters often reduces the fish harvest, as in Minamata; and this may be the first sign of the potential human health risks. Industrial discharge from a textile factory in Mauritius reduced fishing harvests: the fishermen went on strike until the government offered compensation but the underlying problem is harder to address. Industry is essential to a country's wealth, and dealing with industrial discharges is expensive, although it may be cost effective to a society when account is taken of the hidden costs of health care and reduced productivity due to ill health and other effects. As a result of the investigation of the Minamata case, there is now much more awareness of the importance of mercury pollution, for example due to mining in Amazonia, where the greatest health hazard index values have been estimated for people eating contaminated fish (Lodenius & Malm 1998).

Between 1932 and 1968, a factory producing acetic acid discharged waste liquid into Minamata Bay, Japan. The discharge included high concentrations of methyl mercury, increasing as the industrial activity expanded with production of polyvinyl

chloride, using mercury as a catalyst. The Bay was rich in fish and shellfish, providing the main livelihood for local residents and fishermen from other areas. For many years, no one realised that the fish were contaminated with mercury, and that this was the cause of the strange disease that appeared in the local community and in other districts where the discharge reached the fish population. Minamata disease reached high levels in the 1950s, with severe cases suffering brain damage, paralysis, incoherent speech and delirium. Because the disease seemed to affect whole families and their neighbours, an infectious cause was suspected, especially when cats also became sick and died.

The disease was officially recognised in 1956 but epidemiological studies were slow to start and incomplete. Mercury poisoning was suspected in 1959 when sediments and shellfish from the Bay were found to have high levels, but this was not officially recognised to be the cause of Minamata disease until 1968. The industrial discharge was stopped at this time, but removing the contamination from the Bay involved a ten-year dredging operation, completed in 1987. By 1995, mercury levels in fish were below 0.4mg/litre and no longer considered to be a significant hazard (WHO guideline value for total mercury in water is 0.001mg/l). Okada and Peterson (2000) estimated that up to 100 kg of methyl mercury had been discharged annually at the peak of the pollution, in the late 1950s and early 1960s. Over the long period of mercury discharge from the factory, at least 50,000 people were affected to some extent and over 2000 cases of Minamata Disease have been certified (Baxter, 1990). Sources: Baxter 1990, Okada & Peterson, 2000; WHO (IPCS), 2000; W.E.Smith & A.M. Smith, 1975

Industrial and sewage pollution in Mauritius

Fishermen in Port-Louis, Mauritius, blockaded a ship carrying material for the laying of sewerage pipes, because of their concerns about pollution of a lagoon used for fishing. The fishermen claimed that industrial pollution from the textile industry had already decimated the fish population: they now feared that a planned outfall sewer would further pollute the seawater. The authorities claimed that the sewage would be

treated before disposal into the sea: the blockage ended when the government promised them financial compensation for lagoon pollution (PANA, 2000).

Mining and water

Mining for precious metals, coal, and other commodities forms an important part of many countries' economies. Developing countries, for example Brazil, China, India and Peru, contribute a large proportion of the world's mining products. For example, of the total world production of iron ore (1,020,000 metric tons), 21% is produced by China, 19% by Brazil and 7% by India (USA National Mining Association, 2002). The largest producer of copper is Chile (30% of total world production), while Mexico produces the largest proportion of silver (16% of world production). While large producers have modern 'mega-mines', small-scale or surface mining is common in many countries. Mining activities affect health via water through: the method of extraction (for example health effects on children of panning for gold in the Amazon or use of cyanide to leach heavy metals);contamination of local water sources (for example arsenic contamination of ground water in Thailand, as well as having harmful effects on the environment such as beach erosion from sand mining or by longer term effects on reducing biodiversity or fish populations. The health effects may be far away from the mining source, as demonstrated in studies of methylmercury poisoning in the Amazon (Harada et al 2001): mercury levels in head hair were studied in residents of three fishing villages on the Tapajos River, an effluent of the Amazon, several hundred kilometres from the gold mining areas. Many had high mercury levels in addition to symptoms suggesting neurotoxic disease.

Arsenic contamination from mines in Thailand (WHO-SEAR, 2001)

Past mining activities caused heavy arsenic contamination of groundwater and topsoil over a 40 square kilometer area in Nakhon Si Thammarat province, Thailand. The contamination was revealed in a study commissioned by the Japan International Cooperation Agency (JICA) in 2000. One conclusion of the study was that the

contamination would last for the next 30-50 years. Testing of 1,000 samples showed the contamination in some groundwater wells to be 50-100 times higher than the World Health Organization's guideline value for drinking water. Most people in the affected district stopped drinking well water in 1993, with an associated high cost of providing tap water to residents.

Health effects tend to be associated with long-term pollution, but industrial accidents or fires may cause a sudden increase in contaminants. Following a fire at a chemical storehouse in Switzerland, the issues included the lack of knowledge about the potential effects of many of the substances that discharged into the River Rhine. Lessons were learned about prevention and the effects of fire fighting on water pollution, but one of the future spectres is that this type of industrial accident will increase, particularly in areas where rapid industrialisation is occurring or where there are insufficient funds to provide adequate safety measures for processes and maintenance of equipment. A recent assessment of chemical safety and governance in Brazil identified a wide range of problems and accidents relating to water, many with implications for water safety and assessing levels of vulnerability in the local population (de Freitas et al 2001).

The Red Rhine Incident (Dieter, 1994)

In 1986 a fire destroyed a chemical store in Basel, Switzerland, near the borders of France and Germany. Chemicals reached the water through the plant's sewage system when huge amounts of water (10,000-15,000 m3) were used to fight the fire. The store contained large quantities of 32 different chemicals, including insecticides and raw ingredients, and the water implications were identified through the presence of red dye in one of the substances. The main wave of chemicals destroyed eels and fish, as well as habitats for small animals on the riverbanks. The highest concentration of organic thiophosphates (40mg/l) was 362 km downstream from the fire and the total eel population was destroyed 500 km downstream, from Basel to Loreley. Concentrations of contaminants reached normal values 3 months after the incident. Human health effects were harder to assess, as the potential toxic effects

are likely to be long-term and not yet well understood. As a result of this incident, the permanent chemical load in the Rhine has been reduced and information systems on potential incidents improved.

Nuclear accidents and water

Nuclear accidents (and explosions) pose a risk of radioactive contamination of water supplies, through fall out onto soil and water catchments. While water contamination usually accounts for only a small proportion of the risk following a nuclear accident, it may persist for some years due to wash-off from contaminated soil and persistence of radioactive nuclides in sediment. The explosion at Chernobyl in 1986 released a radioactive cloud that passed over several countries . This was the largest radiation accident to have ever occurred in the world. To some, it was an accident 'waiting to happen' and poor maintenance was one of the factors implicated in the Chernobyl disaster. The Chernobyl example provided a frightening example of the peacetime threats from nuclear power stations, particularly where dwindling national resources prevented appropriate safety and maintenance procedures. The accident prompted better planning of appropriate monitoring of health and the environment, including the presence of radioactive residues in water supplies. The accident also forced governments to acknowledge the possibility of another massive release of radiation from an accident.

The Chernobyl nuclear accident (WHO, 1995)

The Chernobyl explosion occurred on 26 April, 1986, killing 30 workers at the reactor site and causing various degrees of radiation sickness in hundreds of other staff and local residents. Its wider effects are still being monitored.

Cause of the accident: Staff were testing a turbo generator at night, just prior to shutting the reactor down. Test procedures were poorly written and operating rules, including safety measures, were not followed: this is a common finding in industrial accidents, but particularly tragic in the case of Chernobyl. A huge power surge in the reactor should have triggered an automatic shutdown, but the appropriate safety

system had been disabled. The system could not be controlled manually and the power surge triggered the explosion. Early attempts to control the explosions and fires included dropping 5000 tonnes of boron, dolomite, sand, clay and lead onto the unit: this increased the core temperature in the early stages and increased the plumes of particles pouring out of the reactor. The reactor did not begin to cool down until 5 May.

Health effects and water contamination: The radioactivity of the material released in the Chernobyl explosion was estimated to be 200 times higher than the combined releases of the atomic bombs dropped on Hiroshima and Nagasaki, Japan, in 1946, during World War II. Hundreds of people in the heavily contaminated areas around Chernobyl required hospital treatment and five million people in Belarus, the Russian Federation and Ukraine were exposed to harmful levels of ionising radiation. The early effects included increased levels of thyroid cancer in children, due to the radioisotope iodine-131. Lower levels of radiation reached many other countries, including evidence of contamination of water supplies and in rainfall. Increases in radioisotopes in water were reported from Finland and the Baltic Sea (Nielsen et al 1999, Saxen and Ilus 2001). However drinking water contamination in nearby countries such as Austria compromised only about 5% of the exposure to radioactive nuclides following exposure to the Chernobyl radiation (Hennighausen, 1999). An initial lack of information increased fears of health damage in the exposed populations, and the psychological trauma of enforced evacuation.

Lead and water

Lead is a general toxicant that builds up in the skeleton and its effects are most serious in infants, young children up to the age of six years and pregnant women. Lead is toxic to the nervous system and its other effects include interference with Vitamin D metabolism, anaemia and possible cancers from long-term exposure. The risk to children and babies growing in the womb is due to the much greater absorption of lead at these ages. Lead exposure comes from a wide range of sources, broadly grouped into industrial and domestic exposures. Sources include

lead-acid batteries, solder and alloys, paint, dust, petrol and water. Lead additives are being phased out in petrol, paint and in solder used in the food processing industry; air and food levels are also declining. This has led to a greater emphasis on the previously small proportion of total lead intake from water.

Lead poisoning Natural lead levels tend to be higher in soft and more acidic waters where metals and their salts dissolve more easily. While natural levels are rarely high enough to cause toxic effects, combined exposure from other sources may lead to symptoms and signs of lead poisoning. Lead pipes, gutters and drains are still common throughout the world: the amount of lead dissolved from plumbing depends on factors such as acidity, temperature, water hardness and standing time of the water. Concentrations of lead in water tend to be higher in the morning, so water has to be flushed out before use for human consumption. is rare where pipes are made of other materials: the threat of lead from water can be almost eliminated by removing all lead pipes and fittings in the water and plumbing systems. This is an expensive intervention and it is likely that lead pipes will persist in many countries for several decades. Meanwhile, the policy is to reduce total exposure to lead from other sources, such as car exhausts. The tolerable weekly intake of lead is 25 mg/kg of body weight for infants and children. The health based guideline figure for water is a maximum of 0.01 mg/litre.

Cyanide and water

Cyanide is highly toxic to humans: it is readily absorbed by the gut and causes symptoms even in very small concentrations, particularly in malnourished adults and children. It lowers vitamin B12 levels and damages the thyroid gland, reducing the iodine uptake essential for hormone production. Exposure during pregnancy also causes malformations. It is usually only present in water as a result of industrial contamination. Cases of goitre and cretinism in Zaire reduced after improvement in industrial processing methods, as well as in general nutritional status. The guideline value for drinking water is 0.07mg/ litre (WHO 1996).

In January 2000 a cyanide spill in the Baia Mare region of North Western Romania contaminated rivers as far as the River Danube. Cyanide in solution was used to dissolve heavy metals out of exposed piles of waste rock, a leaching process that allows extraction of precious metals such as gold and silver. The impoundment containing the contaminated water burst, quickly reaching local watercourses and then spreading as a polluted plume across countries in Eastern and central Europe. Ice on the rivers and low water levels in Hungary delayed the dilution of the cyanide and increasing the risk to municipal water supplies. Increased concentrations of copper, zinc and lead, leached by the cyanide, compounded the problem.

Agricultural pollution in waste water

Agriculture to feed growing populations, and to provide food for export, requires careful management to avoid pollution. Intensive agricultural practices, essential to achieve high crop and livestock yields, presents particular risks to water sources. Fertilisers and pesticides can readily penetrate the ground water sources and run off during rainfall adds to the level of contaminants in surface waters, such as rivers and lakes . Adverse weather events add to the contamination risk: after a hurricane in North Carolina, USA, contamination of seawater with large quantities of chicken waste caused algal blooms and affected shellfish production. Pesticides - chemicals used to control pests, weeds or plant diseases - cause particular concern, as some use carrier agents toxic to humans, such as carbon tetrachloride and chloroform. Such carrier agents may be classified as ‘inert’ for the purposes of the pesticide use, thus they may be ignored in discussion of health effects. Impurities in agricultural chemicals, for example dioxins in phenoxy acid herbicides, may be more toxic than the named compound and these need to be taken account in the general health risk assessment.

Pesticide contamination of water in Mali (UN OCHA 2000)

Pesticides were found to have polluted the water in villages in northern Mali in a survey conducted in 1999. A European Commission Humanitarian Office (ECHO)

grant enabled a water quality improvement programme, including construction of new wells, cleaning up storage depots of expired pesticides, and sealing contaminated wells; it also provides medical care for the victims of poisoning. ECHO has estimated that there at least 85,000 litres of obsolete pesticides throughout northern Mali.

Acute pesticide poisoning is largely a problem of the developing world: it has been estimated that 5-10% of the agricultural population in some of these countries are likely to have significant exposure to pesticides (WHO, 1990). Much more is known about direct effects than about the exposure via water and accumulation in the environment; and the extent and severity of chronic pesticide exposure is still controversial. Epidemiological studies are mostly confined to small geographical areas, which may not be representative of other regions or other climates: use of pesticides, fungicides and insecticides tends to be seasonal, varying with the growing period of crops and known breeding cycle of pests. For accurate risk assessment, pesticide and other agricultural chemical exposure need to be quantified: a five stage pattern of use has been described, from very low (Stage I) to very high (Stage V), with corresponding definitions of dosage, number of products in use and other factors (WHO, 1990), which helps to define the dose-response relationship with observed health effects.

Pesticides of various types have been used in agriculture for centuries and safer alternatives have been found to arsenicals and other agricultural chemicals used in the past. An ecosystems approach to pest management now replaces concepts linked to economic threshold of damage that prevailed during the 1970s and 1980s. As with many other water related pollution issues, the task now is to find the right balance that protects the ecosystem while also allowing efficient agriculture and pest control. All substances, whether natural or made by humans, have the potential to cause adverse health and environmental effects, and alternatives to synthetic chemicals may have unexpected side effects, so the solution is not necessarily a

biological means of control. As with all environmental hazards, a balanced approach is needed in assessing the risks, compared with advantages for crop yield, the cost of alternative agents and the health damage caused by insects and other pests. The balanced assessment includes taking account of intentional and unintentional exposures, as well as the ecosystems approach to pest management. Globally, unintentional exposure accounts for an estimated million cases of pesticide poisoning each year (WHO 1990), the greatest source being in agricultural chemical pest control, with a relatively small contribution from vector control campaigns. Unintentional exposure to agricultural pollutants may also arise due to drainage into ground water. Poor irrigation practices, for example using untreated or insufficiently treated wastewater, adds to the load of contaminants. Irrigation with polluted wastewater in China may have been linked to disease such as cancers, congenital malformations and liver damage (Yuan 1993). Organochlorine pesticides are now little used because of concerns about environmental accumulation and associated health effects, for example neurological damage. The Stockholm Convention on Persistent Organic Pollutants (POPs), agreed in May 2001, requires action on elimination of POPs, including recognition of the importance of water sources. Resistance of pests to chemicals has led to introduction of other agents with toxic effects on humans and other organisms.

Methaemoglobinaemia and other effects of nitrate contamination in water

Nitrates can build up to high concentrations in groundwater, for example due to wash-off from agricultural use and in wastewater. Nitrate in groundwater is associated with methaemoglobinaemia (blue baby syndrome) when contaminated water is used to prepare infant feeds. Chronic nitrate exposure in drinking water has also been suggested as a cause of cancer, thyroid disease and diabetes (Knobeloch et al, 2000). Excessive nutrients including nitrate from manure and fertilisers may also cause eutrophication in water sources - undesirable levels of algal growth and cyanobacteria, associated with loss of biodiversity. The toxins produced by some

cyanobacteria cause a range of health effects, from skin irritation to liver damage (Chorus and Bartram 1999).

Endocrine disrupters and water

A number of substances, including some pesticides, have the potential to interfere with normal functions of the body, particularly the endocrine system that regulates physiological functions through hormonal signals. Endocrine disrupting chemicals (EDCs) include many natural and synthetic chemicals. While not all persist in the soil and water environment, many are classed as persistent organic pollutants (POPs). Most of the implicated chemicals are widely distributed in the environment and are found across national boundaries. The health concerns are difficult to assess because of limited information about exposures and mechanisms. While the contribution of water to endocrine effects is still unclear, Water is an issue in these concerns because of the accumulation of the substances in water sources and particularly in the fatty tissues of fish that enter the food chain. The International Programme on Chemical Safety is preparing a state-of-the-science report on the human and environmental impacts of EDCs and has established a global inventory on current research in the field.

Endocrine disruptors are substances originating outside the body that alter functions of the endocrine system, with resulting adverse health effects on an intact organism, its offspring, or in subpopulations. Examples include natural and synthetic hormones, natural plant constituents, pesticides, monomers and additives used in the plastics industry. Industry adds to the natural levels of these substances in the environment, including accumulation in water sources, with insufficient information as yet on the contribution of water consumption to these exposures. Some of the effects have been observed in studies of invertebrates, fish, amphibia, reptiles, birds and mammals; others have been suspected in human studies, although research is still at an early stage. For example, dibromochloropropane (DBCP), a nematocide (worm killer) has been associated with male infertility (WHO 1990) but studies of the reproductive effects of other substances have produced inconsistent results. The

following potential human health effects are a guide to the suggested risk posed by endocrine disruptors:

There is a general lack of information on specific exposures, how the disruptors may act and the influence of other factors such as the quality of the diet. This makes it hard to be precise about cause and effect for these substances.

Reducing water pollution

Water is essential to life and to general health, so we do not have a choice about this increasing spectre of water as a poison. It has seemed that an environmental disaster has to occur before lessons are learned and preventive measures put in place. Minamata disease demonstrated the dreadful effects of methyl mercury contamination and led to identification of similar poisoning in other countries, linked to both water and food pollution. One of the Minamata lessons was the need for good epidemiological surveillance, including collecting and analysing reports of unusual cases: many cases of the mercury poisoning were misdiagnosed or common exposure factors were unrecognised, before the mystery was solved. The Chernobyl disaster led to better programmes of maintenance and monitoring of radioactive hazards, which may make us better prepared for a similar disaster. Such tragic incidents have provided more precise data on numbers, types and timescales for the diseases linked to environmental hazards: this is an essential basis for risk assessment. They also provided a basis to verify and corroborate dynamic exposure models that had been developed on a theoretical base. Risk identification and management is now an established approach for controlling industrial pollution, with far fewer excuses for pleading ignorance of the potential health effects . Yet the risks remain in all countries. The economical necessity of industry, and of keeping down the costs of processing and maintenance, tends to take priority over risk assessments, especially where the evidence is still unclear or speculative, for example in the potential effects of endocrine disruptors. In the example of pollution in Mauritius fishermen took action against a planned sewerage system for mainly

economic reasons, because industrial discharges were already damaging the fishing harvests in a lagoon.

Basic principles of risk management

Risk management includes prevention, control, mitigation (remedies) and risk reduction, based on scientifically sound characterisation of specific risks. Effective risk management involves the participation of all who have significant and legitimate interest in the exposures - the stakeholders. Equity issues must be included, for example the distribution of costs for controlling the risk and the interests of the risk producer as well as those who are subjected to the risk .Risks may be voluntary or involuntary or otherwise out of control of individual choice: the risk assessment includes identifying vulnerable groups and the risk management includes providing adequate compensation for those affected.

While these principles apply to all environmental risks, they may be particularly important in control of hazards from water and sanitation, because the exposures affect large proportions of the population; thus they frequently raise issues of cost, multiple responsibility for control and debate about relative risks and the quality of the scientific evidence.

Interventions to reduce risk include those possible at the international, national and local community levels. At the international level, commitment to reduce pollution at inter-governmental conferences and summits provides goals and targets, as well as pressure to conform to international guidelines. Agenda 21, an action plan to guide national and international activities, was agreed in Rio de Janeiro, Brazil in 1992, with a specific chapter devoted to the environmentally sound management of toxic chemicals (WHO-IPCS, 2000). The POPs Convention (2001) has been adopted as an international legally binding instrument. Legislation on pollutants is an important intervention at the national level, although it must be linked to monitoring and means of enforcement. Legislation may be ineffective if economic pressures combine with

low risk perception to allow hazardous exposures to continue unchecked, or to persist in poor communities without sufficient political power to affect planning decisions. The health link between clean water, nutrition and livelihood needs to be more clearly understood by communities, before the short and long-term pollution effects on health can gain more priority. Education, starting with the primary school level, is essential for developing awareness of risk and the environmental interaction with health.

The amount of water being used in India from underground sources is estimated to be 45 per cent more than what natural systems or artificial recharging can replenish. There's no alternative to water. The only solution, therefore, is to to utilize underground water resources more efficiently. There is a discrepancy between what scientific findings by independent sources say about the current stock of ground water in the country and what official sources proclaim. Scientific surveys show that underground water in Punjab, Haryana and Rajasthan is disappearing at the rate of one foot per year. Another investigation has revealed that while the UP government claims that more than 80 per cent of agricultural land is under irrigation, farmers say it is barely 25 per cent.

Water insecurity has come about because of poor hydrological management – water storage, distribution, usage and conservation – as well as failure of water authorities to periodically survey and record accurately the state of the country's water table, the extent of its usage and wastage. Agriculture is the chief consumer of water. Therefore, it's imperative to ensure scientific delivery and usage of water for irrigation, besides encouraging drought-resistant seeds and changing cropping patterns where necessary. Drip irrigation – where water is delivered in measured doses through slender pipes close to the plant, thereby avoiding wastage from spillovers and evaporation – is being used successfully in countries like Israel where water is scarce. Collaborative efforts in this area between the two countries ought to be explored further so that more farmers can benefit from the new technology. Growing water-intensive crops like sugarcane and rice ought to be confined to areas where the crops are grown traditionally because of water availability. Cost of

electricity supplied for agricultural purposes – primarily to pump water – needs to be recovered from the consumer. A scarce commodity can no longer be given away free.

India depends on ground water reserves for most of its agricultural and domestic water requirements – hence the stress on grounds water reservoirs. Urban and rural rainwater harvesting is an option that has not been explored fully. Check dams can be thought of as an alternative to mega dam projects to provide local water support. Above all, the problem needs to be acknowledged first by government agencies and ministries before solutions can be found.

Ten positive actions for reducing industrial water pollution

One can list the following ten positive actions for reduction in industrial waste water pollution:

International and national agreements on safety precautions; banning dangerous chemicals or prohibiting their discharge into water sources; improving drinking water and sanitation; also legislation: environmental protection laws to protect and monitor water sources, including fishing areas, recreational water areas and drinking water sources at risk from industrial discharges, clear labeling of chemicals used in industry and use of marker chemicals (e.g. harmless dyes) in case of water contamination.

Public-private partnerships to foster joint ownership of environmental issues and ways of reducing water pollution.

'Think globally, act locally': encourage community agreement on the causes of environmental water contamination.

Improved surveillance of health effects: epidemiological evidence of effects of contaminated water is essential to convince and influence legislators and industrialists.

Education: community environmental projects for schools, national campaigns, local community initiatives. Education at all levels should promote an understanding of risk, the interactions of the ecosystem and the importance of biodiversity in water sources. Also education about the importance of diet and general health in minimising the impact of environmental hazards.

Improving the health and living conditions of disadvantaged groups, such as women and children: clean water and improved sanitation contribute to reducing pollution risks.

Conservation activities: recycling, cleaning up refuse areas, reducing risk of harmful substances reaching water sources; voluntary restriction on use of chemicals.

Learning from past disasters: studying the ‘classic’ water pollution cases such as Minamata to ensure that the lessons are understood - and remembered .

Developing risk assessment and health and environmental impact assessments (HIAs and EAs) for industry and urban planning: environmental impact assessments in the past have not given enough priority to the cross cutting nature and scale of health impacts. Also, potential water pollution needs to be specified in public health impact assessments (Birley, 1995).

Developing and promoting the use of environmentally safe technologies in developing countries, for example use of pesticides of biological origin and integrated pest control management, which has less cumulative effect on ground water and other parts of the environment.

Chapter – 5.

Industrialization and Pollution Regulation Practices: The Gujarat Experience.

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Industrialization and Pollution Regulation Practices: The Gujarat Experience.

Introduction

In this chapter, an attempt is made to analyse economic growth in general and industrial growth in particular and to find out positive and preventive checks to regulate pollution in Gujarat. The State has remained a pioneer in industrial growth, diversification of industries, contribution to State Domestic Product and rising share of industries in employment and exports. After the 1991 economic reform policy, Gujarat economy has transformed from textile industry to chemicals, petro-chemicals and other innovative groups of industry. According to Industries Commissioner's report (2004-2005) , " this has happened largely due to the State's Industrial Liberalization Policy". Gujarat Industrial Development Corporation and other State Sponsored Corporations provided a vital boost to industrialization process in the State.

This Chapter is divided into two sections, the first one exposes sub-period sectoral growth in Gujarat as well as industrial growth process in the State, whereas, the second one highlights experiments and experiences of environmental regulatory practices by the industry and industries associations at GIDC estates in Gujarat.

Growth Pattern in Gujarat

The State Industries Department, Finance Department and other Government Departments have periodically examined growth pattern in Gujarat. Growth Rate of Gujarat economy remained higher than national average which is evidenced by 11 % rate of growth as against 8.5% in 2005-2006. It is expected that the State can achieve 13% rate of growth during the XIth Five Year Plan period. Decennial growth

shown in Table 5 indicates that growth pattern of over all growth in Net Domestic product of the State is not matching with per capita growth of Gujarat. This has happened largely due to urbanization, industrialization and migration of people from rural to urban as well as from other neighbouring states. Primary sector in general and agriculture sector in particular has shown negative growth rate during 1980-81 to 1989-90 and 1990-91 to 2000-01. During this period, agriculture has faced scanty rainfall and experienced the years of drought.

As against this, performance of the secondary and tertiary sector is found to be improving in all three decades as shown in the table. Due to liberalization policy in the nineties, Gujarat achieved about 8% rate of growth of the secondary sector. As against this, growth of unregistered industrial units and total manufacturing units achieved higher rate of growth than all India rate of growth of the secondary sector in the nineties. Among the sub-sectors electricity, gas and water supply achieved 10% growth rate whereas construction industry achieved 6.9% of growth.

Between 2001 to 2008, Gujarat achieved 12% GDP growth rate and 10.5% industrial growth rate in the State. This has happened largely due to NRI investment attracted by the State Government and new projects being commissioned. Significant growth rate is achieved by the tertiary sector in Gujarat as service sector remained dominant in value addition, employment generation and industrial development in the State.

Table No. 5 : 1

Sub-period growth in NSDP of Gujarat.

Sectors	1970-71 1979-80	1980-81 1989-90	1990-91 2000-01
Primary Sector	3.0 3.2	-1.4 -1.6	-0.3 -0.3
Secondary sector	4.8 6.7	6.3 3.9	7.9 7.9
Unregistered total manufactures	3.9 6.0	7.1 8.4	8.8 8.3
Construction , electricity, gas, water supply, mining and quarrying	4.4 9.3 2.7	4.1 9.2 1.6	6.9 9.9 0.9
Tertiary sector	5.0	7.0	8.0
Transport, storage and communication.	7.3	13.4	11.3
Trade, Hotel and restaurant	5.5	5.5	70
Banking and Insurance	8.5	13.1	8.8
Real estate, ownership of dwelling and business services, public administration, other services	3.3 6.5 3.0	3.1 7.8 5.2	2.5 9.3 8.3
(NSDP) Net State Domestic product	4.6	4.7	6.6
Per capita SDP	2.1	2.7	4.9

Source:- Calculated from different Annual reports of Directorate of Economics and Statistics, Gandhinagar, Gujarat State.

At 1993-94 prices, in Gujarat over a period 1970-71 to 2000-01, it can be observed from the table that the secondary and tertiary sectors in the State of Gujarat have shown significantly higher rate of growth. The registered manufacturing units displayed a trend accelerating from 6.7% in the seventies to 7.1% in eighties and

further to 8.8.% in the nineties. The annual growth rate of output of unregistered manufacturing sector, which includes cottage and small scale units has shown a rise from 3.9% in the seventies to 7.1% in the eighties and further to 8.8% in the nineties.

Net State Domestic product (NSDP) of Gujarat State at factor cost at constant (1999-2000) prices in 2007-2008 has been estimated at Rs. 178917 crore as against Rs.157187 crore in 2006-2007, which has grown by 17.72% during the year. The following table (No. 5:2) provides recent year-wise increase in Net State Domestic product (Rs. in crore)

Table No. 5: 2

Year	Current price	Constant price	% growth over previous year Current price	Constant price
1999-2000	92541	92541	-	-
2002-2003	118130	101603	16.5	8.72
2003-2004	142534	118525	20.66	16.66
2004-2005	155184	125599	8.88	5.97
2005-2006(P)	187223	143536	20.65	14.28
2006-2007 (P)	218898	157187	16.92	9.51
2007-2008 (Q)	257694	178917	17.12	13.82

P = Provisional

Q = Quick estimate

It can be observed that there is difference in percentage growth rate considering the rate of current price and constant price. But it is a fact that growth rate of Gujarat has remained higher than all India average after economic reforms if viewed either from current price or constant price. This has happened largely due to industrialization and liberalization policy of the government of Gujarat.

The trend in growth of service sector escalated from 7% in the seventies to 4% in the eighties to 8% in the nineties. Industrial and trade sector has substantially benefited by 1991 economic reform policy than any other sector in the State. However, International Labour Organization observed disconnecting development in India in the nineties and world over that economic growth rate has been accompanied by much lower rate of growth in employment. It is negative growth rate for employment.

In the recent past large flow of investment have entered in 'Golden Corridor' (Ahmedabad-Vapi industrial belt) and silver corridor (new region of Saurashtra and Kutch.) Remaining areas of Gujarat have witnessed little growth of per capita income and employment matching the growth of workforce.

It is observed by NSSO and social economic review of the State that unemployment has fallen from 63.8% to 59.8 in 1991 and further to 52.5% of labour force in 1992. Gujarat contributes 13.86% of total value addition by industrial sector in Indian economy, whereas, it has contributed 11.41% of total fixed capital formation and 14.11% in net income.

This means that industries should not be closed down in the name of sustainable environment in Gujarat. For this, individual industry, entrepreneurs as well as associations of individual industry will have to find out way for cleaner production so as to manage sustainable industrial growth with sustainable environmental practices management.

Table No. 5:3 provides industry-wise classification of registered units in Gujarat. During the year 2006, Gujarat had total 312782 registered industrial units out of which textile composed of 66914 units, metal products 23421 units and food products 16467 units dominating the State economy. As against this, information technology -led industrial units have significant contribution in the economy. However, there is concentration of large, medium and small scale industrial units in Ahmedabad-Vapi "Golden Corridor" of Gujarat, which have posed several challenges to management of environmental problems. Here, it is interesting to note that GIDC and industries department played promotional roles.

Table No. 5: 3

Sector-wise Registered Industrial units

(As on 31.9.2006)

Sr.No.	Industry Sector	Registered Units
1	Food Products	16467
2	Beverages, tobacco & tobacco products	1455
3	Cotton textiles	66914
4	Wooden products	13498
5	Paper & printing	8244
6	Rubber & Plastic products	11780
7	Chemicals & chemical products	15553
8	Non-Metallic Minerals	11345
9	Basic Metallic products	8795
10	Metallic products	23421
11	Leather products	2456
12	Electrical goods & Appliances	6451
13	Transport equipment and Instruments	2944
14	Other products	99647
	Total	312782

Source :- Commissioner of Industries, Gujarat Sate, Gandhinagar.

Employment in manufacturing sector has gone down from 17.2% in 1981 to 15.9% in 1991. However, service sector is dominating in employment share and has shown rising trend. These reverse trends have affected employment elasticity of income in all the three decades.

Pace of industrialization in Gujarat has always been impressive on the whole. In the eighties, the State occupied third position among industrially developed States of the country. Industrialization was given priority largely due to poor correlation of the

growth of agriculture sector with that in the secondary sector. Still water, coal and electricity shortage did not allow all district for location of industries equally. Hence water surplus and agriculturally prosperous districts succeeded to locate industries, where one can find concentration of large, medium and small scale industries in Gujarat. It appears that the Government has primary duty to provide industrial and infrastructure investment climate and sufficient confidence to entrepreneurs and investors about peaceful co-existence with business and manufacturing sustainability in the State.

It is evident from Table No.5: 4 that as per annual survey of India 2004-05 published by the CSO, contribution of Gujarat remained higher in industrialization process of India. One can observe from the table that 9.98% of total factories, 16.98% of total fixed capital, 13.69% of total working capital and 16.23% of total investment was formed by Gujarat at all India level. Similarly, it has a contribution of 9.20% in direct employment and 10.89% of total workers are indirectly engaged in industries.

Table No. 5: 4

Comparison of Annual Survey of Industries

India and Gujarat

Sr. No.	Particular	Unit	Gujarat	India	% share of Gujarat
1	Factories	Nos.	13603	136353	9.98
2	Fixed capital	Rs. in crore	87111	513069	16.98
3	Working capital	"	21909	160054	13.69
4	Total investment	"	123275	749418	16.23
5	Workers	in 000	607	6599	9.20
6	Employment (apart from workers)	" 000	202	1855	10.89
7	Total individual Employment	" 000	809	8454	9.57
8	Salary of workers	Rs. in crore	32449	33635	9.66
9	Profits	"	6742	64406	10.47
10	Total inputs	"	216125	1362941	15.86
11	Total production	"	260784	1672561	15.59
12	Net Value Added	"	36016	259907	13.86
13	Total fixed capital formation	"	8583	72250	11.41
14	Net Income	"	31459	222915	14.11

Source : Report of Annual Survey of India : 2004-05

Published by CSO, New Delhi.

Table No.5:5 provides facts about average growth rate of Gujarat State between 1991-92 to 2004-05. It is evident that the number of factories increased from 1.05% in 1992-93 to 13.86% in 1995-96 and again 5.78% in 2004-05. Contrary to this, growth rate of productive capital increased from 52.46% to 88.54% in 1995-96 to

2.43% in 2004-05, whereas, growth rate of employment increased from 5.23% to 24.14% in 1995-96 to 10.47% in 2004-05. However, there are several periods , when negative growth rate is found. Similarly, growth rate of industrial production increased from 34.67% to 36.70 in 1995-96, which declined to 25.62% in 2004-05. As against this, net value addition decreased from 96.43% to 34.99% in 1995-96 and again declined to 24.74% in 2004-2005.

This means that fluctuating trend is visualized in industrialization process of Gujarat looking to different parameters of growth rate in the State. Still, however decimal growth rate of registered factories was 1.74%, production capital growth rate 16.44%, employment growth rate 1.61% and production growth rate 18.44% during the period as shown in the table.

This means, that industrialization process in Gujarat has low rate of employment generation and the highest rate of production capital. Comparing with all India level average growth rate is found to be satisfactory. In view of this ,it may be concluded that scant attention is paid towards the environmental issues in the State.

Table No. 5:5

Average Annual Rate of Growth : Gujarat State

(in%)

Year	Growth rate of No. of factories	Growth rate of production capital	Growth rate of No. of employment	Production growth rate	Net value added growth rate
1991-92	-	-	-	-	-
1992-93	1.05	52.46	5.23	34.67	96.43
1993-94	5.45	22.03	4.72	13.22	17.26
1994-95	2.31	22.46	1.34	32.67	38.50
1995-96	13.86	88.54	24.14	36.70	34.99
1996-97	-2.96	17.49	-14.60	2.85	9.49
1997-98	0.40	35.96	6.51	27.14	-0.32
1998-99	15.20	3.45	-6.0	2.07	-1.72
1999-2000	-4.82	4.21	222.0	4.94	2.01
2000-01	-4.21	7.30	0.85	7.95	-12.55
2001-02	-0.99	18.40	-6.61	1.29	0.18
2002-03	-5.52	-	-5.21	23.42	35.55
2003-04	-2.92	3.44	1.71	13.48	26.11
2004-05	5.78	-14.16	10.47	25.62	24.74

Source :1. Industries in Gujarat 2. Gujarat State – Result of Annual Plans 2005

Table No.5:6 provides latest figures of MOUs and investment under the vibrant Gujarat Summit ,2009.

It can be observed from the table that small and medium scale industry sector benefited to a large extent by getting the highest number of MOUs (7204) with total investment of Rs.7000 crore. Though the amount is low but looking to the number of MOUs signed which are fairly high, it is likely to generate more value addition, exportable surplus, employment and SDP of the state than any other sub-sector under the Vibrant Gujarat Meet. These sub-sectors like urban infrastructure are having only 257 MOUs signed with the highest amount of investment Rs. 1,02000 Crore. In order to boost industrialization process in the state , sub-sectors like Special Economic Zones (SEZs) and Industrial Parks have 14 and 13 MOUs respectively with investment potential of Rs.16,5000 crore and Rs.8060 crore. Renewable energy sector had 67 MOUs with investment potential of Rs.10,2000 crore and it draws attention of industrialists Similarly, Tourism and aviation, financial services, social infrastructure MOUs appear important for the development of formal and informal sector growth in Gujarat economy.

The government of Gujarat has also facilitated relocation of Nano Car project of Tata from West Bengal to Gujarat and provided all necessary infrastructure to it. The project has high potential for exports, employment and rise in SDP of Gujarat.

Table No. 5: 6

Industry-wise MOUs and Investment under the Vibrant Gujarat Summit -2009

Sr.	Sector	No. of MOUs	Total investment (potential in Rs. crore)
1	SEZs	14	66500
2	Industrial parks	13	8060
3	PCPIR	107	38017
4	I/T	20	46500
5	Oil & Gas	16	43000
6	Power	29	20400
7	Ports	20	85700
8	Renewable Energy	67	102000
9	S.E.R.	03	100000
10	Road	05	20500
11	Other infrastructure	14	12000
12	Tourism & Aviation	115	55000
13	Chemicals	44	57000
14	Pharma	30	3000
15	Bio-technology	30	2500
16	Food & Agro	205	28700
17	Engineering	92	40000
18	Textiles	47	8500
19	Gems & Jewelleries	10	9000
20	Urban Infrastructure	257	102000
21	S.M.E.	7204	7000
22	Environmental Management	09	5700
23	Social Infrastructure	111	16500
24	Financial Services	80	61700
25	Minerals	30	50500

Source : Sandesh ,14th Jan. 2009.

In the case of solid waste management, Gujarat will make industrial units and Municipalities free from solid waste. Only 30% solid waste is recycled in Gujarat at present. It is aimed that in 2021 Gujarat will be able to manage solid waste due to better infrastructure, technology and efforts by the industry. Industrial experts believe that 1% rise in industrial growth results in 2.5% rise in hazardous waste. The figures about industrial waste in Gujarat show that every year 6.5 lakh million tonnes waste is generated by the municipal corporations. Of those only 1.2 million tonnes of solid waste is recycled. 70% of solid waste is absorbed in land and 30% is recycled. It is estimated that Gujarat will be free of solid waste in the year 2021.

Vibrant Gujarat Meet 2009 witnessed MOUs worth of Rs. 9300 crore for waste hazard treatment, their recycling and development of environmental infrastructure. For this, Japan Development Institute provided business development plan and agreed to invest Rs.2500 crore. It was expressed that higher industrial growth rate in the State can create problems of solid waste. It is necessary to recycle iron, steel, plastic and bring economic value addition. It was suggested to start recycling zones in Gujarat to cater to solid waste management . Similarly, 11 Urban Development Authorities in Gujarat made 257 MOUs worth of Rs.102593 crore investments so as to develop integrated townships, carbon credit, solid waste management and housing for urban poor. For this table No. 5: 6 provides details of sector-wise MOUs and total investment which is likely to take place in the State.

Vibrant Gujarat summit during January, 2009 made 39 MOUs worth Rs. 57000 crore investment in chemicals and petro-chemicals with additional employment of 14070 people. Gujarat contributes 62% of total output in production of petro-chemicals in the country . New investment under vibrant Gujarat 2009 was three times higher than that in 2007 summit . In all, 8500 MOUs were signed in vibrant Gujarat Summit 2009 (worth Rs.12,00,000 crores) having potential employment to about 25 lakh people in the State. As against this, in 2007, 3 MOUs were aimed at Rs.13412 crore investment with 15169 potential employment.

This researcher is of the view that additional investment for water, air, land and traffic pollution is required. Gujarat Pollution Control Board and Central Pollution Control Board need to participate in future programme of investment in environmental technology where existing and new industries are to locate. For this, foreign companies need to be invited for the purpose for possible investment in environmental pollution technology/machineries. Public private partnerships are required in R&D to develop new technology having high efficiency and cost-effective ness for sustainable development. This is required for both point (industry) level pollution as well as end level pollution (last percolating point).

Gujarat Industrial Policy : 2009

The New Industrial Policy declared by the State Government has holistic approach and it would identify specific interventions across the sectors. It has the primary aim to achieve significant industrial growth and to attract global investment. This means, the policy is investment-friendly for the State as it has succeeded to channelize higher investment not only from all destinations in India, but also the world. The policy aims to increase strength of the economy. The salient features of the policy can be enlisted as under:

1. The role of the Government would be to facilitate and encourage further diversified industrial growth in the State.
2. The Government would try to bridge the investment gap in the State.
3. The policy intends to achieve highest level of human development indicators in the country.
4. Industrialization process needs to boost high standards of quality .
5. The primary policy objectives are to facilitate investment in the State, employment generation and employability enhancement and adherence to high quality of life and standards of production.
6. The investment would be directed and planned in such a way that it would achieve not only excellent results but also achieve sustainable and

inclusive development. It is expected that global economic down turn may result in relocation of capital to safer investment destinations.

7. The process of investment in the state would boost growth of both formal and informal sectors of the economy. It will bring innovation, dissemination of information in most user- friendly technology in the State.

8. The policy adequately dwells upon right kind of infrastructure development with competitive operations for better utilization of land in the State.

9. The policy has indicated that the Government is interested in public private partnership (PPP) in areas of power, water, gas, roads, railways, port connectivity, communications and quality of human resources development in the State.

10. Several Vibrant Gujarat Summits of investors, businessmen, entrepreneurs, companies provided background for Rs.505542 crore estimated investment in Gujarat in 2008, whereas Rs.160531 crores investment projects were implemented till August, 2008. In 2009, 8690 MOUs worth Rs. 1221541 crore investments are signed with 2682737 proposed employment in the state.

11. The policy contains specified vision for the growth of micro, small and medium scale enterprises in the State. For this, definition of the various categories of the industry has been changed. Micro enterprises are such having investment worth less than Rs.5 lakhs, small enterprises with investment of less than Rs.5 crore and medium enterprises having investment in plant and machinery not more than Rs. 10 crore. In the case of medium and large scale industries, there were 2100 units out of which 1570 (76.25%) are found working units. In 2000-01, overall investment in functioning 1570 units was Rs. 96999 crore, with production valued at Rs.108821 crore and employment is reported to be 378194.

12. The policy is full of industrial development programmes but very silent on rising environmental problems in the State. PPP is also required in air, water and solid waste pollution management It should allow foreign investment with latest technology to enter the State. Industrialization

process is supposed to reduce the rate of environmental crimes for sustainable environment and sustainable growth of the State.

Section II

Anti-pollution practices in Gujarat

In this section an effort is made to know environmental practices and action taken by industries and regulating authority to control, to prevent, to plan and to monitor pollution in Gujarat.

Water Pollution in Gujarat State

Gujarat is leading in many areas of industrial development and agriculture in India. The State is facing water problems and is prone to health hazards. Gujarat Infrastructure Development Corporation has attempted to search and identify safe drinking water resources. Earlier, it was considered that only surface water required treatment because pollutants and micro organisms can enter it easily. Largely due to industrial waste and water pollution, groundwater is not found to be safe and potable. The change or disturbance of natural eco-systems has resulted in breakdown of the lifecycle of micro organisms.

Gujarat is facing water problem in both urban and rural areas . Rural resources are more vulnerable to contamination than piped water system largely due to poor yards, cess pools, drains, open sewers, wet manure heaps, cattle sheds, grave yards, dry cultivation, stray animals, poultry etc. (R.M. Purohit 2000).

Rising Water Pollution

Environmental Pollution in respect of surface water resources can be enlisted as under:

1. Industrial solid and liquid waste merging with small streams and rivers.
2. Domestic Sewage from urban areas discharged and merging with surface water.

3. Deterioration takes place due to dumping of agricultural and domestic waste without proper treatment and planning.
4. There are other sources like unused fertilizers, micronutrients, insecticides, pesticides etc merging with catchment areas.
5. Condition of famine results in shortage of water and scanty rainfall, which may reduce and dilute natural removal of pollutants.

Causes of water pollution and acquifers

1. Over extraction of water led to water level going down in most of the areas of Gujarat State.
2. High rate of drawl, increase in the concentration of pollutants in undergrounds acquifers.
3. High rate of irrigation through canals has created water logging problems and resulted in deterioration in water quality.
4. Continuous re-changing of open wells and bore wells.
5. Location of highly polluting industries near perennial rivers.
6. Acid rain due to air pollution.
7. Urban agglomeration containing excess nitrate, total dissolve solids and bacteriological pollution deteriorate ground water quality.
8. Medical waste, bio-medical waste, plastic bags and containers are very harmful for ground water.

Table No.5.7 provides information about geo-climatic zone-wise water quality problems in Gujarat . It can be observed from the table that 9% of west-north Gujarat is facing highest salinity, fluoride and chronic scarcity largely due to inherent salinity and low rainfall with low recharge of water. 5% of geographical area of South – Kutch and Jamnagar district is facing high salinity and scarcity owing to sea water intrusion and low rainfall.

So far as ocean water pollution is concerned, 22% of Gujarat is covered by Saurashtra region known as Peninsula of Saurashtra having rocky land in Rajkot, Amreli, Jamnagar, Junagadh, Bhavnagar and Surendranagar. These regions are facing chronic scarcity due to low rain fall, high runoff and poor acquifers over drop.

Similarly 11% of North Gujarat is hilly area and 11% of southern Gujarat is facing seasonal scarcity of water due to very high run off and very poor acquifer. 10% of North Gujarat is facing high fluoride and salinity due to low rainfall and high salinity. This means that geographic climatic conditions of the State cause water pollution apart from industrial and man-made pollution. Table No.6 : 7 provides details of geographical areas of Gujarat which contains 56.7% rocky land, 18.9% suitable alluvial land, 17.83% saline and arid areas, 0.80% lime stone and semi-arid areas and 7.15% sand stone areas. Table No. 6: 8 provides details of ingress of salinity in different coastal talukas in the State. It is noticed from the table that Una and Veraval talukas are highly affected by salinity as highest number of people are affected and water resources are also affected.

It is necessary to study District-wise villages affected by fluoride, nitrate, and salinity contents of pollutants in ground water. Table No.6:7 provides details of number of villages affected . Out of all villages of Gujarat ,2798 (15%) are affected by fluoride, 748 (4%) are affected by nitrate and 1031 (5.5%) are affected by salinity.

Environment Scenario in Gujarat

According to Annual Survey of Industries, 2005-2006, chemicals, semi-chemical, agro-chemicals and marine chemicals constituted 39% of the total industries in Gujarat. However, rubber, plastics, resource-based industries constituted 15% and textile 8% of industries. The survey expressed the view that out of 2500 large and medium scale units, 71% are in the polluting sector, whereas 53% of total small scale sector are in the polluting sector. CPCB has identified 18 highly polluting industries in Gujarat.

The Labour Commissioner of Gujarat State has identified 45 highly inflammable, poisonous, lethally toxics and hazardous chemicals being produced in Gujarat. Out of these, some are either banned or agreed to be purchased in the developing countries. The CPCB inventory of water polluting industries listed 856 large and medium industries in Gujarat (2005-2006). The major group of the industries are textile (288), petro-chemicals (61), pharmaceuticals (85), pulp and paper (126),

organic chemicals (81), pesticides and insecticides (32), paints and dye stuffs (30) and others.

Most of the water polluting industries are located in “Golden Corridor” (Mehsana-Vapi industrial belt). Ahmedabad District (289), Surat Dist (201), Bharuch dist. (180), Valsad dist. (102), Vadodara Dist. (98) and Mehsana Dist. (42) are having medium and large scale units polluting natural resource water at different levels. The Golden corridor area includes the basins of Sabarmati, Mahi, Narmada, Tapi and Daman-Ganga rivers. The implications are very serious for the surface water, groundwater, rivers and ocean. Gujarat Environment and Social Infrastructure Vision, 2010 observed that 85.54% of total water resources in the area are polluted.

Table No.5:7 provides details of water quality of leading rivers at selected locations in Gujarat, in terms of chemical parameters. The figure are annual averages from samples taken by GPCB regional offices so as to know river pollution in main bodies of the rivers in Gujarat .

Table No. 5 : 7

Water Quality of Selected Rivers in Gujarat

		Parameters			
River	Place	H	D.O.	B.O.D.	C.O.D.
Sabarmati	Miroli	7.33	0.4	77	205
Shedhi	Kheda	7.92	7.1	04	20
Shedhi	Mahemdabad – Nadiad Road	8.07	5.7	22	64
Khari	Lali	7.73	2.4	77	222
Mahi	Anandpuri	8.51	8.7	02	03
Mahi	Kadana Dam	8.25	8.5	02	03
Mahi	Virpur	8.37	8.8	02	03
Mahi	Sevalia	8.41	6.3	03	09
Mahi	Vasad	8.49	8.3	02	03
Mahi	Mujpur	8.58	8.9	03	04
Mahi	Umeta	8.71	8.4	03	03
Anas	Kushalghadh	7.72	8.5	02	03
Panam	Lunawada	8.19	8.2	02	03
Dhadhar	Kothwada	7.96	1.1	13	27
Narmada	Garudeshwar	8.39	8.6	02	03
Narmada	Chandod	8.32	8.3	02	07
Narmada	Panetha	8.37	8.4	02	03
Narmada	Zadeshwar	8.39	7.8	02	03
Narmada	Dahej Jetty	7.9	6.6	04	29
Amravati	Before confluence near Dadha	8.31	7.4	01	09
Kaveri	Gumandev	8.05	7.3	01	07
Kaveri	At Kaveri bridge, Billimora	8.00	6.4	05	29

Tapi	Kathor bridge	7.98	7.0	04	19
Tapi	Mandvi bridge	8.12	7.6	04	10
Tapi	Sherulla bridge	8.01	6.6	04	13
Tapi	Kathor Upstream	8.06	7.1	04	14
Mindhola	Mindhola S.H.Bride	7.92	5.0	06	19
Purna	At Purna bridge	8.04	6.1	05	19
Ambica	At Amalsad bridge	7.95	6.4	06	29
Damanganga	Kachigaon Bridge	7.27	4.7	10	63
Damkmanganga	GIDC Weir, Vapi	7.78	7.4	1.1	9
Kolak	Pataliya Bridge	7.43	6.0	5.0	38
Par	Rly. Bridge, Atul	7.77	6.1	6.6	37

Looking to table No.5:7 there are 17 rivers in Gujarat which are facing water pollution at 33 places. Fresh water of the river is used for drinking purpose. Therefore, preservation, protection and conservation of water from environmental pollution appears absolutely necessary to save people from contagious diseases . However, industrialization process in Gujarat ignored the fact that perennial rivers like Sabarmati, Narmada, Mahi and tapi are highly polluted both by industries as well as by the negligence of local self-governments of towns and cities located on the bank of rivers. In the case of industries, point level water pollution causes disposal of waste water in small streams, which are merging with important rives and ultimately to Arabian sea. This means industrial waste water pollution is causing river pollution and ocean pollution which has damaged the ecosystem and aquatic life. There may be heavy loss in fish catchment and other ocean products like coral reef, mangroves etc. The study of Gujarat Ecology Commission, 2000 has provided excellent account of this fact . Table No.5: 8 provides results of chemical analysis of leading rivers in Gujarat. It is possible that results of chemical analysis of river water may differ from the analysis made by private labs.

Table No. 5: 8

River water quality of selected locations in Gujarat

Parameter	Class-B Standards	Sabarmati at Vautha	Mahi at Debka	Narmada at Ambebha	Tapi at Hazira village	Daman Ganga from 50 meter from CEPT discharge
Ph. units	6.5-8.5	6.5	9.2	7.9	8.2	7.4
Colour hazel unit	300	6500	6.7	NA	91.7	NA
DO	5	0.9	6.2	6.4	7.1	NA
BOD	3	350	BDL	23	20.0	NA
COD	-	965	BDL	NA	55.3	218
Turbidity	-	NA	NA	1726	NA	NA
TDS	NS	9158	994	NA	10174	2105
Faecal coliforms /100 ml	500	>1600	>1600	NA	>1600	NA
Total coliforms (/100 MI)	500	>1600	>1600	NA	>1600	NA
Designated Classification at Selected locations	-	E	NA	NA	NA	NA

Source: Gujarat Economic Association, conference volume, 2007 p. 144

N.A. Data not available

BDL- Below detection limit.

Table No. 5:9

Surface water standards

Standard	Particulars
Class-A	Drinking water source without conventional treatment but after disinfection
Class-B	Useful for outdoor bathing
Class - C	Drinking water source without conventional treatment
Class -D	Fish culture and wildlife propagation
Class- E	Irrigation, industries cooling or controlled waste disposal.

Source : CPCB Reports on Rivers.

The table has provided designated classifications about quality of river waters. However, table No.5:9 provides surface water standards as mentioned in CPCB annual reports. Chemical analysis of river water must express the quality of water as class-A, Class-B, Class-C, Class-D and Class E considering different purposes of utilization of water as well as to maintain quality of water. If it is beyond the reach of the GPCB, public-private-partnership may be allowed by the State for ocean and river pollution as it can gather periodic continuous chemical analysis and monitor the quality of water . River studies in Gujarat by CPCB in the eighties show that waste water and solid waste dumping by the local-self government created 80% of total river pollution. 20% pollution was created by industries located near perennial rivers.

Operation of Common Effluent Treatment plants in Gujarat

There are several common effluent treatment plants at GIDC estates run and managed by a private Company formed by the association of industries. Normally, medium and small scale chemicals and petro-chemicals and other categories of industries cannot afford to run and manage their own treatment plants. As a result, industries associations at leading GIDC estates in Gujarat started common effluent treatment plants for treatment of toxic waste water. A private company is formed by the member industries of GIDC estates for fixed and operation cost expenses.

Table No. 5 : 10 provides details of 14 such CETPs in Gujarat at various GIDC estate locations. The table provides information pertaining to area of operation, name of management of CETP, number of members, designated capacity in (M3/day) and present status of the plants. Out of 14 CETPs 2 are under construction and 12 are in operation. A member industry has to send toxic waste water by tankers to the site of the CETP for primary, secondary and tertiary treatment of the waste water with latest technology. Operation charges are recovered from the industry on the basis of quality and quantity of waste water. Most

of the CETPs are profit-making and distributing dividends to the investor member industry.

Still there are doubts about the reliability of operation of CETPs in creeks located near GIDC estates as they are full of untreated toxic waste water several times round the year.

Table 5:10

Status of CETP in Gujarat

Sr. No.	Area	Name of Management	No. of members	Designated capacity (M3/day)	Present status
1	GIDC Vatva	Green Envi. Service Co-op. Society Ahmedabad.	1997-98 (450) 2007-08 (518)	16000 16000	Working
2	GIDC Odhav	Odhav Env. Project Asso. Ahmedabsd.	1997-98 (64) 2007-08 (60)	1200 1200	-do- -do-
3	GVMSAV Odhav	Gujarat Vepari Mahamandal sahakari Ind. Est. Ltd.	1997-98 (34) 2007-08 (357)	1000 1000	-do- -do-
4	GIDC Naroda	Naroda Envi. Project Ltd. Ahmedabad	1997-98 (201) 2007-08 (242)	3000 3000	-do- -do-
5	Naroda Dystuff Association	Naroda Dyestuff Mfs. Asso. Ahmedabad.	1997-98 (38) 2007-08 (12)	100 100	Commi. Working
6	GIDC Nandesari	Nandesari Ind. Ass. Nadesari	1997-98 (252) 2007-08 (168)	5500 5500	Working “
7	GIDC Ankleshwar	Env. Tech Ltd.	1997-98 (96) 2007-08 (244)	1000 1000	“
8	GIDC Jhagadia	Jagadia Assn.	1997-98 (24) 2007-08	- -	Under Const.
9	GIDC Panoli	Panoli Ind. Assn.	1997-98 (58) 2007-08	- -	Under Const.
10	GIDC Pandesra	Pandesara Ind. Assn.	1997-98 (329) 2007-08	- -	Under Co-nstruction.. Working
11	GIDC Sachin	Sachin Ind. Co-op. Soc. Ltd. Glob Env. Care ltd.	1997-98 (187) 2007-08 (35)	- 500	working working
12	GIDC Sorigam	Project Env. control	1997-98 (06) 2007-08 (06)	200 400	Working Working
13	GIDC Vapi	Vapi Waste & Efflu. Mg. Co. Ltd.	1997-98 (576) 2007-08 (725)	55000 55000	“ “
14	GIDC Jetpur	Jetpur Dying & Printing Asson.	1997-98 (1200) 2007-08 (1200)	5400 5400	“ “

Source : Annual Report GPCB, 2006-07.

As such, each CETP has limited designated capacity of M3 per day and hence toxic waste water generated by chemicals, petro-chemicals and agro-chemicals has created problems in disposal of surplus untreated water. The interests of industrialists are quite different from that of environmental management for sustainable period of time.

A recent study organized by Green Peace regarding industrial water pollution in Gujarat shows that groundwater in Sarigam GIDC estate in Surat district is contaminated with organic hazardous pollutants like orgonochlorine, carcinogen, which continuously remained in Industrial waste water of the area.

A closure notice by Gujarat Pollution Control Board was served to Sabero organics for disposing toxic water and toxic solid waste. The production made by the unit is banned by several countries in view of health risks. A public hearing was held at the collector's office in Valsad on March 31, 1999.

Similarly industrial units in Jhagadia, Panoli, Ankleshwar, Vilayat and Dahej were discharging chemical effluents into Amalkhadi. The Khadi meets Narmada river in Bharuch and then meets the Arabian sea. This means chemicals and petro-chemical units are responsible for point level water pollution and end level water pollution causing damage to the main bodies of the river and ocean. Waste water pollution in Amlakhadi is visualized by GPCB in its annual report that it has a chemical oxygen demand (COD) of 11007 milligram/ litre (mg/L) when the prescribed level is 250 mg/l, whereas biological oxygen stood at 442 mg/L which exceeds the GPCB limits of 30 Mg/L (1994-95).Organizations like Green Peace found toxic metels like lead, mercury, chromium and zinc disposed into Amlokhadi by the units (2003-2004). Only Ankleshwar Industrial Estate Association (AIA) estimated that its members are generating a waste of 250-270 million litres per day. 58% toxic waster water is generated by dye and dyes intermediaries, 10% by drugs and pharmaceuticals (GPCB 1996).

Many villages are protected by the able performance of the NGOs working in the Golden Corridor of Gujarat. Centre for science & community(cescom) , Vadodara and Narmada Pradushan Nivaran Samity, Jhagadia have filed public interest litigation in the Gujarat High Court in the nineties.

As mentioned earlier in Chapter No.1, two high Court Justices Mr. B.N.Kirpal and Mr. Gokhale filed public interest litigation in the High Court of Gujarat for water and air pollution in GIDC estates in Naroda, Vatva, Nandesari, Ankleshwar and Vapi. The units were closed and the Secretary industries department of the Government of Gujarat had to give an undertaking in writing to find out alternative arrangement for the disposal of the waste of the estates. Such chemical units significantly contribute in export market. Gujarat contributes for 1/4th of nation's annual turnover of the chemical sector.

Table No.5.11 provides details of important creeks located near highly sensitive GIDC estates well known for disposal of toxic coloured water by the industries. Chemical water quality is stated in the table for Amla Khadi near Ankleswar, Boleswar Khadi at Baleswar, Kalkada Khadi near Kalkada Kanchi village, Bill Khadi at Vapi and Tokar Khadi located near Sarigam Khatwala. All khadis are full of untreated waste water disposed by the industry in the Golden Corridor of Gujarat. Water of such creeks merges with fresh water of perennial rivers and ultimately in the Arabian sea. This suggests that untreated toxic waste water is causing river pollution and ocean pollution in south Gujarat areas and these locations are full of untreated waste water disposed by the GIDC industrial units. It causes land degradation and water pollution in the small streams merging with perennial rivers.

Table No.5.11

Status of water Quality of some creeks located near GIDC estates in Gujarat.

Name of Khadi	City/Town location	Chemical Water Quality			
		PH	D.O	BOD	COD
Amala Khadi	Ankleswar 1997-98 GPCB 1997 CPCB 2007-08 GPCB	 5.6 8.9 7.4	 0.5 NA 00	 71 713 247	 191 1917 1020
Baleswar Khadi	Baleswar 1997-98 GPCB 2007-08 GPCB	 7.52 7.88	 3.0 5.43	 19 4.12	 106 10
Kalkada Khadi	Vapi 1997-98 GPCB 2007-08 GPCB	 5.9 7.47	 5.6	 56 33.75	 99 102.67
Bill Khadi	Vapi 1997-98 GPCB 2007-08 GPCB	 6.9 7007	 2.9	 61 139	 88 406.07
Tokar Khadi	Sarigam Khatwada 1997-98 GPCB 2007-08 GPCB	 7.4 7.70	 6.2	 15 3.37	 68 25.24

During a recent visit to Gujarat, Union Minister for environment and forests told senior Gujarat officials that the ban imposed on giving environmental clearance to new units as also expansion projects in Vapi, Ankleshwar and Panoli areas will not be lifted till their effluent treatment plants (ETPs) start functioning properly. He found serious lacunae in environmental management of industrial units.

The ban on environmental clearance was imposed on July 25, 2009. They found that industrial waste water with high degree of pollutants was still being pushed into Amla creek from Ankleshwar and Panoli industrial uinits. In Vapi, industrial waste water was being pushed into Damanganga. Two central effluent treatment plants (CETPs), working for units in Ankleshwar-Panoli and Vapi, were not working properly.

As a result, CETPs' lines got choked. Untreated water is found to be gushing out at different places in a haphazard manner. The state government wants to run CETPs, which were originally set up for respective industrial associations .

In the Minister's presence, state officials decided to work out a six-point plan of action for treating waste water. It includes regular weekly monitoring by Gujarat Pollution Control Board and Central Pollution Control Board officials. Also, Gujarat Industrial Development Corporation, which has taken over Vapi CETP and is in the process of taking over Ankleshwar-Panoli CETP – has been asked to clear the choked pipelines and ensure smooth functioning of conveyance system. GIDC has been told to ensure that everything should be in order by March 2010.

Environmental crimes and cases in Gujarat.

Table No.5: 12 provides details of number of cases filed in the courts under various environmental acts and provisions in the state. The table expresses comparative picture for the period 31.3.1998 and upto 31.3.2008 regarding the cases filed, cases disposed off as well as cases pending in the courts.

Rising number of cases shows that industry is not ready to bear unproductive and non-remunerative expenditure. Entrepreneurs and enterprises are not ready to

include environmental pollution cost in total production for cleaner production. GPCB has been very strict to enforce environmental laws under different categories of provisions. Researches maintained that about 30-35% of the total cost (as environmental cost) needs to be added in total production cost and let the prices of goods and commodities be allowed to rise proportionately so as to abate environmental pollution in general and industrial pollution in particular. If this happens then polluter pay principle comes to practice in the case of industrial pollution. The table indicates that the number of pending cases are higher during both the periods. In the case of important decisions of various courts, Honorable courts have punished 12 and 28 such violators as on 31/3/98 and 31/3/08 respectively. This means, that judiciary is not capable of giving speedy justice to the society. To a poor victim of pollution not getting due justice, it makes him believe that the court has favoured environmental criminals. One can observe that justice can be bought by the lobby of Industrialists not only in Gujarat but in other states also.

Table No 5:12

Prosecution launched and cases finalized by the Courts.

Sr. No.	Particulars	Upto 31.3.1998	Upto 31.3.2008
1	No. of cases filed in the Courts.		
	(a) under the Water Act 1974	2381	2440
	(b) under the Air Act 1981	333	635
	(c) underCrimProcedure Code section 133	247	247
	(d) under the Envi. Protection Act, 1986	--	79
	Total	2941	3401
2	No. of cases disposed of :		
	(a) under the Water Act 1974	798	1453
	(b) under the Air Act 1981	180	274
	(c) under Cri. Pro. Code section 133	203	236
	(d) Envi. Protection Act, 1986	_	20
	Total	1181	1983
3	No. of cases pending in the Courts:-		
	(a) under the Water Act 1974	1583	987
	(b) under the Air Act, 1981	153	361
	(c) under Cri. P.C. section 133	44	11
	(d) Env. Protection Act 1986	-	59
	Total	1780	1418
4	Important Decisions of Courts		
	(a) under the Water Act, 1974		
	(i) ad interim injunctions restraining industries from discharging trade effluent	409	429
	(ii) ad interim injunction confirmed	110	219
	(iii) passing of conviction orders (imprisonment or fine)	12	28
	(b) under the Air Control Act, 1981 Punishment for running plant without permission of Board	41	51
	(c) Under Cri. P.C. section 133 Order/injunctions issued by the Executive Magistrate	148	150
	(d) Action taken under the Air Act 1981 (i) Notices issued	1573	NA
	(ii) directions issued	325	
	Action taken under the EPA 1986 (a) Cases recommended to the Govt. for taking action	2028	NA
	(b) legal notices issued under the Hazardous Waste Act, 1986	1197	NA
	(c) cases filed under Act	18	3624
	(d) Directions issued under the Act	21	972
	(e) Close down industries notices issued.		

Source:- Compiled from Annual Reports of Gujarat Pollution Control Board,

Gandhinagar.

This researcher can conclude that legal cost of fighting court cases is cheaper for entrepreneurs and owners of industry than that of permanent cost of utilization of anti-pollution devices It is equally true that state domestic product figures are not real. The real SDP can be arrived at by deduction of environmental pollution cost borne by the affected parties in the society. If industrialists do not bear environmental pollution cost at point level, the cost may be many times higher for society.

Environmental challenges in Gujarat State

It is necessary to run through environmental challenges based on the analysis of this chapter affecting different sectors and segments of Gujarat economy. They can be listed as under:

1. Per capita availability of clear hygienic water
2. To compel industries to treat and retreat waste water for re-use looking to the shortage of water.
3. All local self-governments to run and manage effluent treatment plants .
4. Diversification of pastures to other development uses as degradation of soil is largely due to unplanned industrialization process.
5. Development and Conservation of Marine fish and other ecosystem in the ocean.
6. Judicious distribution of common property resource like water both in urban and rural areas.
7. Clean results of pollution load in water at point level and industry level.
8. To encourage individual industries and industries association to bear environmental cost in total production cost for cleaner production.
9. Mangroves and coral ecosystems, which are disappearing in Kutch and Saurashtra Coastal areas should be saved .
10. Frequent failure of monsoons and high coefficient of rainfall variability with highly skewed distribution of water in different districts of the State.

11. Surface water resources in the state have turned into most complex environmental issues.
12. Advances in technology to bridge the gap between growth and environmental management so as to ensure quality, skill and investment.

Conclusion

Present chapter on experiments and experiences in Gujarat for industrialization and high growth rate reveals that diversification of industries posed several challenges including management of sustainable environmental pollution in the State. In spite of several provisions and actions taken by the GPCB and CPCB, management of liquid and solid waste remained a matter of concern. Emerging hypothesis shows that higher the level of industrial growth, higher would be environmental pollution problems . Environmental management requires co-operation of the Government stakeholders, industrialists, industries associations, chamber of commerce and awareness in people for sustainable industrial growth in the State.

Chapter – 6

Role of Environmental Pollution Regulatory Authorities in Gujarat.

Chapter – 6

Role of Environmental Pollution Regulatory Authorities in Gujarat.

Introduction

In this chapter, an attempt is made to know the preventive and positive role of environmental pollution regulatory authorities. However, Ministry of Environment and Forest, New Delhi and Department of Environment and Forest, Gandhinagar provide general guidelines to regulate environmental pollution in any form. For this, specific standards for waste disposal are provided, which are followed by local self-governments, entrepreneurs and industries in Gujarat. It is the duty of Pollution Control Board which statutorily enforces different environmental laws, regulates set standards of pollutant disposal and provides consultancy to the entrepreneurs and industries for eco-friendly cleaner production. Due to the pressure of these agencies, industries will have to pay for the pollution created by them.

This chapter is divided into three parts to analyse the promotional and developmental role of pollution regulatory authorities in managing environmental pollution for sustainable period. The first section of the chapter shows the role of Gujarat Pollution Control Board (GPCB) whereas, the second section deals with performance of Central Pollution Control Board (CPCB) in Gujarat and the third one deals with the role of Ministry of Environment & Forests . All tables contained in this Chapter are taken from Annual reports of GPCB, CPCB and the Ministry of Environment and Forests.

Section I

Role of Gujarat Pollution Control Board (GPCB)

The works of the biggest infrastructure project of its kind in the whole country of laying pipelines for effluent collection, treatment, conveyance and disposal project for Ankleshwar, Panoli and Jhagadia industrial estates in Bharuch district are reviewed by the GPCB. The public grievances on pollution, received by letters, telephone, etc. by the Board are promptly responded. The vigilance squad of the Board also takes

up investigations of serious complaints on a priority basis. The system of periodical review was continued, and holding meetings at regional level for expediting clearance is now streamlined. CCA-Common Consent Application- system introduced in April 2003 has now been well received by all. The Board organized seminars on different industrial sectors to address the problems of pollution control and environment management and also for achieving sustained results in preventing and minimizing pollution. Of course, the core activity of the Board by way of enforcing the implementation of the technical and legal parameters continued to receive focused attention.

The Head Office of GPCB performs activities concerning general policies and enforcement of various provisions of the Act as well as general administration and co-ordination with other agencies. The Central Laboratory at Gandhinagar was providing facilities for analysis of samples collected by regional offices besides being involved in development of methods for analysis of water, waste water, gases and hazardous waste samples.

It is a major function of GPCB to screen the applications received from industries. The consolidated CCA (Common Consent Applications) processing and finalization thereof and issuance of common consent and/authorization applications under the Water Act and/Air Act and/HW Rules, 1989 is implemented with effect from April, 2003 onwards. The following table provides the list of applications received under the Water Act, Air Act and under the Hazardous Waste Act. Industries not fulfilling basic requirements were rejected by the GPCB.

Table No. 6:1

Pollution Act-wise screening of applications by GPCB in Gujarat,

Particulars	W	A	Haz	During the year 2005-2006	Cumulative (Up to 31.3.06)
Applications for CCA n hand	1766	1810	1159	2574	10069
CCA granted	1088	144	748	1563	7188
CCA rejected	239	228	108	309	1526
Files closed	2	2	3	4	5
CCA applications returned to applicant(s)	197	207	59	358	1010
CCA applications under scrutiny	240	229	241	340	340

W= under the Water Act, 1974; A = under the Air Act, and Haz = under the Hazardous Wastes (Management and Handling) Rules, 1989. This includes 2057 applications received during the year 2005-06 and 517 applications pending from the previous year 2004-05.

Let us examine screening of applications Act-wise, in the following paragraphs.

(**A) Processing and finalization of consent applications under the Water Act.**

One of the primary functions of the Board is to process and finalise consent applications received from various polluting industrial units under the Water and Air Acts.

In accordance with the provisions of Section 25 read with Section 26 of the Water (Prevention and Control of Pollution) Act, 1974 every polluting agency has to obtain the consent of the board for bringing into use an outlet for the discharge of sewage or trade effluent into a stream or on land.

The statistics pertaining to action taken on consent applications under the Water Act, 1974 is as follows:

Particulars	During the year 2005-06	Cumulative (Up to 31.3.2006)
Applications for consent on hand	1766*	21982
Consent granted	1088	16004
Consent rejected	239	4642
Files closed	2	407
Applications returned to applicant(s)	197	689
Applications under scrutiny	240	240

*This includes 1365 applications received during the year 2005-2006 and 401 applications pending from the previous year 2004-2005.

(B) Processing and finalization of consent applications under the Air Act.

In accordance with the provisions of section 21 of the Air (Prevention and Control of Pollution) Act, 1981 each industry emitting gas (es) has to obtain the consent of the Board. The statistics pertaining to action taken on consent applications under the Air Act, 1981 is as follows:

Particulars	During the year 2005-2006	Cumulative (upto 31.3.2006)
Applications for consent on hand	1810*	18430
Consent granted	1144	14574
Consent rejected	228	2923
Files closed	2	168
Applications returned to applicant(s)	207	536
Applications under scrutiny	229	229

*This includes 1533 applications received during the year 2005-2006 and 277 applications pending from the previous year 2004-2005.

(C) Hazardous Waste Management Act.

As per Hazardous Wastes (Management & Handling Rules) 1989 notified under the Environment (Protection) Act, 1986 every unit generating hazardous wastes and having a facility for collection, reception, treatment, transport, storage and disposal of such wastes should obtain the authorization of the Board. During the year under report the Board continued to bring all such industries and other agencies under the ambit of the regulations. The statistics pertaining to action taken on authorization applications under the Hazardous Wastes (Management & Handling Rules) 1989 is as follows:

Particulars	During the year 2005-2006	Cumulative upto 31.3.2006
Applications for authorization on hand	1159*	10861
Authorization granted	748	7199
Authorization rejected	108	3062
Files closed	3	61
Applications returned to applicant(s)	59	298
Applications under scrutiny	241	241

* This includes 886 applications received during the year 2005-2006 and 273 applications pending from the previous year 2004-2005.

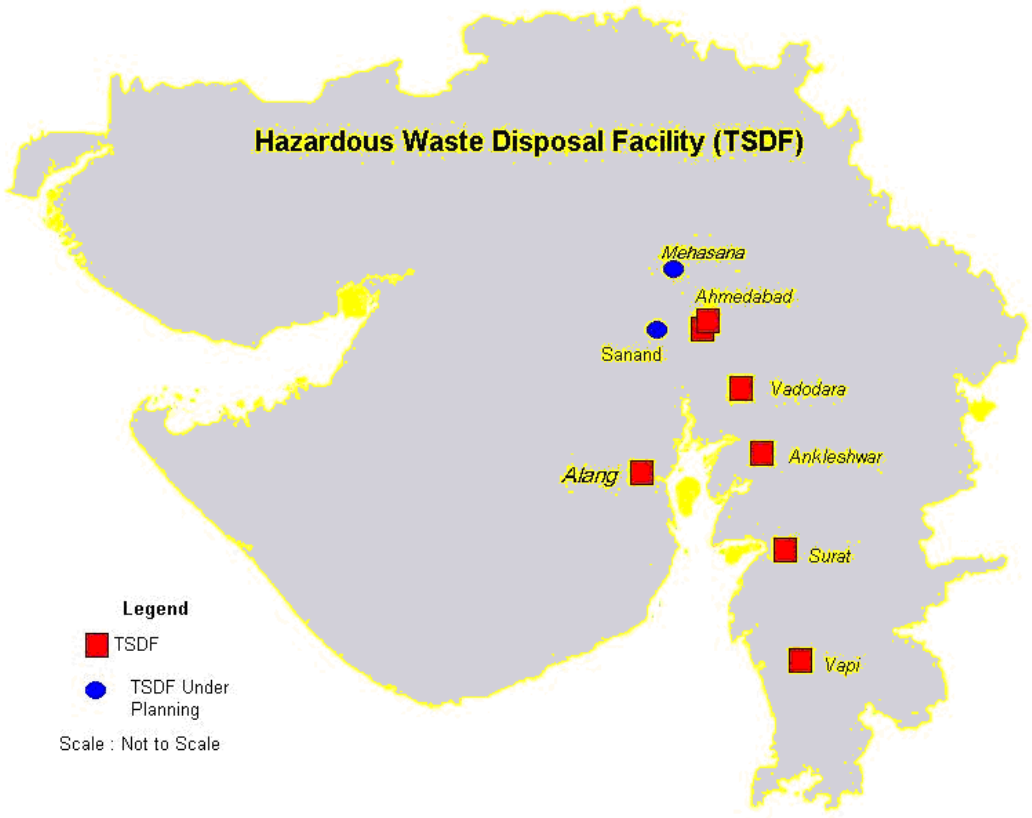

Figure 6.1

(D) The Bio-Medical Waste (Management and Handling) Rules, 1998

As per the Bio-Medical Waste (Management and Handling) Rules, 1998 notified under the Environment (Protection) Act, 1986, the occupier in relation to any institution generating bio-medical waste which includes a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank by whatever name called, as well as an operator of a facility for the collection, reception, storage, transport, treatment, disposal etc. should apply in Form 1 and obtain authorization of the Board, within notified time schedule. The statistics pertaining to action taken on authorization applications under the Bio-Medical Waste (Management and Handling) Rules, 1998 is as follows:-

Particulars	During the year 2005-2006	Cumulative upto 31.3.2006
Applications for authorization on hand	2085*	8246
Authorization issued	1638	6686
Authorization rejected	50	444
Files closed	0	0
Applications returned to applicant(s)	39	658
Applications under scrutiny	358	358

* This includes 1990 applications received during the year 2005-2006 and 95 applications pending from the previous year 2004-2005.

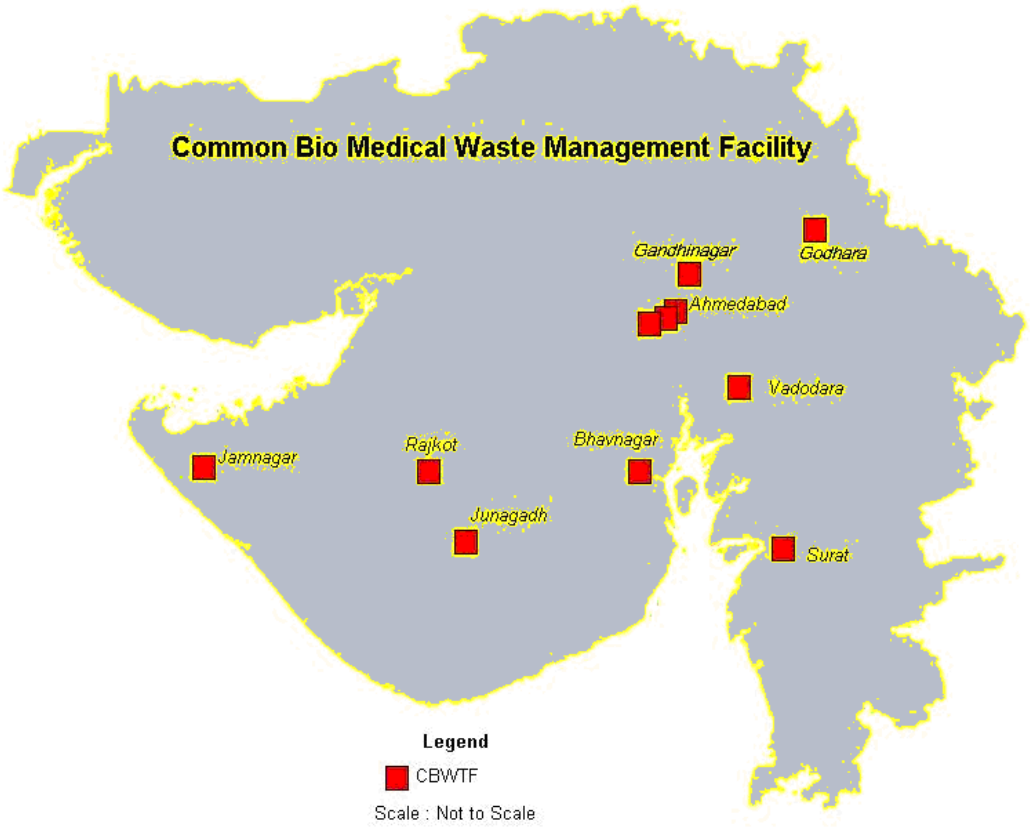

Figure 6.2

(E) No Objection Certificates concerning location clearance

GPCB has issued No Objection Certificates for economic activities concerning specific location of industries/economic activities taking into consideration the provisions of environmental pollution laws.

In accordance with the provisions of section 17 of the Water Act, 1974 and the Environmental Guidelines for Siting of Industries published by the Ministry of Environment and Forests, Government of India, the Board advises concerned authorities and concerned Departments of the Government in respect of the location of an industry which is likely to pollute water or air as a result of various processes/operations taking place therein. The Board critically examines the location clearance cases, and determines various conditions and requirements pertaining to environmental pollution control. These conditions are conveyed to the applicant and on receipt of the commitment by the applicant in respect of fulfilling these requirements the Board issues location clearance certificates. The statistics concerning NOC/location clearance applications is as follows:-

Particulars	During the year 2005-2006	Cumulative (upto 31.3.2006)
Applications on hand	1418*	23302
NOC issued	810	17837
Applications rejected	342	4587
Files closed	4	492
Applications returned to applicant(s)	52	176
Applications under security	210	210

This includes 1170 applications received during the year 2005-2006 and 248 applications pending from the previous year 2004-2005.

Sampling and monitoring under the Water and Air Acts and installations of pollution control measures.

Sampling and analysis under the Water Act.

During the period under report, the Board carried out collection and analysis of 14807 water samples with the help of all its Regional Offices and their laboratories including Central Laboratory at Gandhinagar. These samples also include samples from industrial and domestic effluents, from river and ground water collected under

GEMS and MINARS projects and under the provisions of the Water Act and the EP Act.

Table 6.2

RO, GPCB	Number of Samples Collected and analysed
Central Lab	287
Ahmedabad	3006
Mehsana	402
Vadodara	1651
Surat	2207
Rajkot	1210
Bharuch	1882
Vapi	2923
Jamnagar	604
Godhra	143
Bhavnagar	492
Total	14807

Source : GPCB Annual Report, 2005-06

Sampling and analysis under the Air Act

During the period under report, the Board carried out collection and analysis of 6992 samples from various stacks emitting gases under the Air Act, 1981 with the help of all its Regional Offices and their laboratories including Central Laboratory at Gandhinagar. These samples also include the gaseous samples collected from various plants of thermal power, fertilizers, bulk drug, oil refineries, petrochemicals, pulp and paper etc.

Table 6 : 3

RO, GPCB	Number of samples collected and anaysed
Central Lab	21
Ahmedabad	1075
Mehsana	120
Vadodara	453
Suat	973
Rajkot	566
Bharuch	1414
Vapi	903
Jamnagar	1152
Godhra	28
Bhavnagar	287
Total	6992

Source : GPCB Annual Report, 2005-06

Sampling and analysis under the Hazardous Waste Management Act.

During the period under report, the board carried out analysis of 240 samples of hazardous wastes with the help of all its Regional Offices and their laboratories including Central Laboratory at Gandhinagar.

Table 6: 4

RO, GPCB	Number of samples collected and analysed
Central lab	22
Ahmedabad	111
Mehsana	6
Vadodara	33
Surat	3
Rajkot	1
Bharuch	35
Vapi	5
Jamnagar	1
Godhara	2
Bhavnagar	21
Total	240

Source : GPCB Annual report 2005-2006

Looking to the table , it appears that higher the number of industrial units located in the district, higher the number of sample taken for analysis of the laboratories. Still, it is observed that less number of samples are taken from Vadodara, Bharuch, Suat and Vapi.

Pollution Control Measures by the GPCB

(A) Installation of Effluent Treatment Plants

90 industrial units have installed effluent treatment plants in 2005-2006.These include installation and commissioning of effluent treatment plants by various industries viz. thermal power, fertilizers, bulk drug, oil refineries, petrochemicals, pulp and paper, etc. In addition to these industries, many units have also upgraded and modified their existing effluent treatment plants during the period. The total number of effluent treatment plants installed and commissioned upto 31.3.2006 is 5360.

Couple of industries located in groups or cluster have also initiated activities for the common effluent treatment plants.

(B) Installation of Air Pollution Control Equipment

As a part of action taken by the Board for the implementation of the Air Act, in terms of issuing directives in the form of consent conditions to the various industrial units, during the year 2005-2006 as many as 98 industries have installed air pollution control equipment for the control of emission of suspended particulate matter, Sulphur Dioxide, Ammonia, Chlorine, Hydrogen Chloride, Hydrogen susphide, etc. These include industries like various thermal power plants, cement, fertilizers, bulk drug, oil refineries, petrochemicals, pulp and paper etc. The total number of industrial units having air pollution control equipment as on March 31, 2006 is 4081.

Table 6: 5

Status of CETPs (Common Effluent Treatment Plant) in Gujarat.

Sr.	Location	Management's name	Nos. of Members	Capacity in MILD	Status
1	Naroda GIDC	Naroda Enviro Projects ltd. 512-515, Phasel, GIDC Naroda, Ahmedabad.	242	3	In operation
2	Odhav GIDC (1)	Odhav Green Enviro Project Association, 394, GIDC Oadhav, Ahmedabad.	3	1	In operation
3	Odhav GIDC (11)	Odhav enviro Project Ltd., 60 1.2 in operation 25, GIDC Odhav, Ahmedabad.	60	12	In operation
4	GVMMSUV Odhav	Gujarat Vepari Maha Mandal Sahkari Udhyogik Vsahat Ltd., 181, GVMM Industrial Estate, Odhav, Ahmedabad.	357	1	In operation
5	Vatva GIDC	The Green Environment Services Co-op. Society Ltd. 244-251, Phase II, GIDC Vatva, Ahmedabad.	518	16	In operation
6	Narol-Ahmedabd	Narol Dyestuff Enviro Society 12.0.10 in operation 1083 Near Vishal textile Mill, B/h Narol-Court, Narol, Ahmedabad.	12	0.10	In operation
7	Sanand	Sanand Eco Projects Ltd. (incineration system) Ajanta Industrial Estate, Iyara – Sanand Dist. Ahmedabad.	16	0.20	In operation
8	Nadesari GIDC	Nandesari Industries Association 153/A, GIDC Nandesari District Vadodara	168	5.5	In operation

9	Umraya-Padra	Enviro Infrastructure Co. Ltd. ECP Canal road, Umraya, Ta. Padra District Vadodara	44	2.25	In operation
10	Ankleshwar GIDC	2413/2414, GIDC Estate, Ankleshwar, District Bharuch	224	1	In operation
11	Panoli GIDC	Panoli Enviro Technology Ltd. 619, GIDC Estate, Panoli District Bharuch	101	1	In operation
12	Vapi GIDC	Vapi Waste & Effluent Management Co. Ltd. 4807, Phase IV, GID Vapi, District Valsad.	725	55	In operation
13	Sarigam GIDC	Perfect Enviro Control system Pvt. Ltd. 731/2, GIDC Sarigam, District Valsad.	6	0.4	In operation
14	Sachin-Surat	Globe Enviro Care Ltd. (chemical units) PP 1, Off road no. 2 B/h Kay Tex Mills, GIDC Estate, Sachin District Surat	35	0.5	In operation
15	Sachin GIDC Surat	Sachin Infra Environment Ltd. (process houses) P/2 GIDC Sachin Dist. Surat	55	50	In operation
16	Jetpur	Jetpur Dyeing & Printing Association Kankiya Plot, Jetpur, District Rajkot	1200	5.4	In operation
17	Dhareshwar GIDC, Rajkot	Shri Dhareshwar GIDC Vistar Association, Near Dhareshwar Temple, National Highway, Navagadh.	23	0.068	In operation
18	Veraval	Veraval Industries Association 5/6, GIDC Veraval, District Junagadh.	42	6	In operation

19	Kalipat-Rajkot	Jay Kay Enviro Technologies Pvt. Ltd. Kalipat, Bhavnagar road, Rajkot.	103	0.025	In operation
20	Shapar (Veraval)	Rajkot Electroplating Association Rajkot Shapar (Veraval) Ta . Kotadasangani Dist. Rajkot	23	0.01	In operation
21	CEDS, GIDC Kalol	Kalol GIDC Induistries Association 65/66, GIDC Estate Kalol, District Gandhinagar	21	0.15	In operation
22	CETP Kalol	Kalol GIDC Industries Associaiton			Under progress

(C) Collection of Water Cess

The Water (Prevention and Control of Pollution) Cess, Act,1977 provides for levy and collection of cess from the industries and local authorities for the water consumed by them. With a view to augment the resources of the Central and the State Boards for the Prevention and Control of Pollution, the Government of India have made necessary rules under the said Act which were notified on 26th July, 1978 under section 17 of the Act. The Gujarat pollution Control Board has been declared as an Authority for collecting water cess from the industries and local bodies in the State. Under section 6 of the said Act, powers to levy and effect recovery of water cess have been delegated to the Member Secretary of the Board and powers to remit the recovery to the Central Government under section l6(4) of the Act has been conferred to the Board by the State Government.

Under Section 13 of the said Act, a provision has been made for appeal by any person or local body aggrieved by an order of the cess assessment. For this, an Appellate Committee, headed by the Chairman of the Board has been constituted.

The status regarding the assessment of water cess collection was as follows:

Sr.	Particular	Year		
		2003-04	2004-2005	2005-2006
1	Number of units assessed	3089	2884	3724
2	Number of assessment order issued	5020	6094	6127
3	Amount collected Rs. in lakh	437.94	960.85	950.49

(D) Measures to bring down air pollution in major cities:-

Through the implementation of the Air Pollution Action Plan, it has been possible to bring down SPM (suspended particulate matter) and RSPM (Respirable suspended particulate matter) in the city of Ahmedabad significantly.

(E) SEPP-Spatial Environmental Planning Programme (Zoning Atlas)

This is a National Level programme, which was previously funded by World Bank under Environmental Management Capacity Building (EMCB) project during April, 1997 to June, 2003 through Central Pollution Control Board. It was conceptualized for ensuring protection of environment and its resources through planned and sustainable development. The programme commenced in 1995 with 14 volunteering states including Gujarat. The same is now taken up under the Tenth Five Year Plan as Spatial Environmental Planning Programme (SEPP). The programme initially catered to siting of industries at district level and micro level through preparation of zoning Atlas, Industrial Estate Planning projects, Eco-city plans, etc. However, it has subsequently expanded to cater to preparation of State Environment Atlas, District Level industrial Sitting Guidelines, etc.

Level of activity	Type of Activity	Brief Description
State level	State Environment Atlas	It is a compilation of environment related information including the physical characteristics of the state, sensitive zones and status of environmental quality at the macro level in the form of maps, text and statistical data.
	Industrial Siting guidelines	The document classifies the environment and helps identify probable locations in the state, which have potential for industrial development.
District level	District Environment Atlas	It provides information at the district level about the status of the environment in detail along with the maps and statistical information.
	Zoning Atlas for Siting of industries	It is a tool/guideline developed to interrelate the sensitivity of environment with the pollution potential of industries so as to identify the sites for future development with minimal environmental risks/impacts. Factors like natural resources, topography hydrological pattern, forestry, agriculture, industries, environmental pollution and human habitations are considered, making it an important and useful tool for better environmental protection of the State.
	Industrial Siting Guidelines	The document classifies the environment and helps identify probable locations in the district, which have potential for industrial development.

Disaster Mitigation And Management Plan.

The need for drawing up a Disaster Management Plan has been felt by GPCB for a long time due to a variety of factors. Gujarat has the longest coastline of the country and it has got landfall of Hazira-Bijapur-Jagdishpur pipeline, which encouraged the industrial and harbour activities in the State. Gujarat's most regions are falling in zone V, IV and III of the earthquake classification and have experienced devastating

earthquakes in the recent past. Heavy rain and flood is a recurring phenomenon. Gujarat has been ravaged by cyclones frequently. The environmental hazards associated with these calamities need to be tackled on a specialized footing. Possible hazards are contamination of land and water of the surrounding villages and farmlands around industrial pockets. Above all with a large number of chemical units in the State, there is potential for disasters ever present in processes involving hazardous operations in industries like Pesticides, Dyes, Drugs and Dyes – intermediates, Organic chemicals & Gases, inorganic Chemical & gases and highly biodegradable waste. Huge petroleum/petrochemical works, storages and inflammable products and raw materials have a potential to lead to very serious environmental consequences. Even Municipal Solid Waste and Garbage / sewage left free in to the environment has potential for environmental damage in terms of microbial pollution and pathgenicity. Even geomorphologic alteration due to canals, drainages, pipelines, roads, mining, urban and industrial installation, web of rails, roads and cables can also generate the potential threat with respect to surface runoff during heavy rain situations. Huge operations at sea coast i.e. ports and harbours activities including ship breaking activities and import and export of many reactive chemicals through shipping has also generated inborn hazard and risk in terms of environmental pollution and ecological damage.

Under the provisions of Hazardous Chemicals Storage and Manufacture Rules of the EP Act, it is provided that each of such industries will have to prepare and implement “On Site Emergency Plan” and at district level “Off Site Emergency plan”. This dispensation does not necessarily take care of over all Environmental Pollution and it’s Hazard management. In order to bridge the gap between these two i.e. off site and On site emergency plans, a comprehensive environmental disaster management plan has been prepared by GPCB.

The plan was implemented during last year’s and this year’s floods with close monitoring of highly polluting industrial units, common facilities and conveyance systems. On the spot directions were given for pollution control to common facilities, Industrial units were given demonstrations by the six task force teams which rushed

to various parts of the sate braving the floods. Major chemical installations in the flood affected areas were advised shutdown. Actions were initiated against 200 industrial units under Pollution Control Act and as a result a number of pollution related disasters were avoided.

Water Quality Monitoring Programmes.

GEMS Project

The Board assists the CPCB (Central Pollution Control Board) in implementing the GEMS (Global Environmental Monitoring System) project. The scope of this project includes an assessment of the quality of water of the major rivers of the State, viz. Narmada, Tapi, Mahi and Sabarmati.

As per the guidelines of the CPCB, 9 stations have been fixed, out of which 7 are for monitorintg the quality of surface water and the rest for monitoring of ground water quality. The monitoring results under this project are submitted to the CPCB, New Delhi.

MINARS project

On account of various discharge of waste water in river, the quality is likely to be adversely affected. It is therefore, necessary to monitor the quality of the various river waters. This is a continuous project of previous years as approved by the CPCB and known as MINARS (Monitoring of Indian National Aquatic Resources System) project.

The Board is monitoring the water quality from 39 sampling stations located on various rivers in the State. These rivers include Sabarmati, Meshwo, Anas, Mahi, Panam, Narmada, Damanganga, Kolak, Par, Tapi, Ambica etc. Under this project ground water quality and lake water quality are also monitored periodically.

The ground water quality monitoring stations are located at Ahmedabad and Vadodara. The sampling stations included under the lake water quality project and are located at Kankaria lake and Chandola lake in Ahmedabad and Ajwa lake and Sursagar lake in Vadodara.

It can be observed from table No.6:6 that GPCB has periodically analysed the chemical water quality of major rivers in Gujarat with the help of parametes like PH,

DO, BOD and COD. The table gives annual averages of the rivers mentioned in the table. It is possible that there may be seasonal variations or periodical variations in chemical quality of water of the rivers. It is necessary to have monthly figures of chemical analysis of water of the rivers . Highly polluted water has low economic value. Similarly higher the level of pollution in river water in terms of chemical parameters lower would be the economic value of water . For public health and occupational health, river pollution must be stopped by industries and by the local self-governments as largely they are responsible for river pollution. Chemical analysis contained in the table reveals that Sabarmati river near Vasna Narol Bridge, Khari river near Lali village, Damanganga near Kachigaon Bridge, Kolak river near Potaliya Bridge, Bhadar near Jetpur city are found highly polluted. Utilization of water of the river at these locations is found to be dangerous from health point of view.

Table No. 6 : 6

Status of Water quality of major & Other rivers of Gujarat

(Yearly average 2005-2006)

Parameters

River	Location	P.H	D.O	BOD	COD
Sabarmati	Kheroj bridge	8.04	8.4	04	-
Sabarmati	Hansol Bridge	7.85	6.6	27	57
Sabarmati	Rly. Bridge, Ahmedabad	7.81	6.0	11	35
Sabarmati	Vasna Narol Bridge	7.09	1.5	134	323
Sabarmati	Vautha village	7.60	1.5	15	135
Sabarmati	Miroli	7.33	0.4	77	205
Shedi	Kheda	7.92	7.1	04	20
Shedhi	Mahemdabad – Nadiad Road	8.07	5.7	22	64
Khari	Lali	7.73	2.4	77	222
Mahi	Anandpuri	8.51	8.7	02	03
Mahi	Kadana Dam	8.25	8.5	02	03
Mahi	Virpur	8.37	8.8	02	03
Mahi	Sevaria	8.41	6.3	03	09
Mahi	Vasad	8.49	8.3	02	03
Mahi	Mujpur	8.58	8.9	03	04
Mahi	Umeta	8.71	8.4	03	03
Anas	Kushalghadh	7.72	8.5	02	03
Panam	Lunawada	8.19	8.2	02	03
Dhadhar	Kothwada	7.96	1.1	13	27
Narmada	Garudeshwar	8.39	8.6	02	03
Narmada	Chandod	8.32	8.3	02	07
Narmada	Panetha	8.37	8.4	02	03
Narmada	Zadeshwar	8.39	7.8	02	03
Narmada	Dahej jetty	7.9	6.6	04	29

Amravati	Dadgak	8.31	7.4	01	09
Kaveri	Gumandev	8.05	7.3	01	07
Kaveri	At Kaveri bridge, Billimora	8.00	6.4	05	29
Tapi	Kathor bridge	7.98	7.0	04	19
Tapi	Mandvi bridge	8.12	7.6	04	10
Tapi	Sherulla bridge	8.01	6.6	04	13
Tapi	Kathor Upstream	8.06	7.1	04	14
Mindhola	Mindhola S.H. Bridge	7.92	5.0	06	19
Purna	At Purma bridge	8.04	6.1	05	19
Ambica	At Amalsad bridge	7.95	6.4	06	29
Damanganga	Kachigaon Bridge	7.27	4.7	10	63
Damanganga	GIDC Weir, Vapi	7.78	7.4	1.1	9
Kolak	Pataliya Bridge,	7.43	6.0	5.0	38
Par	Rly. Bridge, Atul	7.77	6.1	6.6	37
Auranga	Lalapur bridge, Valsad	7.77	6.2	5.2	38
Bhadar	D/S of city Jetpur	7.85	6.5	1.9	24

GPCB is engaged in sampling test of pollution in water in rivers, creeks , wells, air pollution and analysis of hazardous waste management at different place in the State. An attempt is made to know the level and extent of pollution in the last five years from the annual reports of the GPCB.

Water Pollution level

Chemical Analysis of water as contained in table 6:7 reveals that gradually all rivers are getting polluted looking to rising pollution load in the rivers. GPCB regional offices took samples periodically and annual average is shown in the table. This means that perennial rivers are getting polluted largely due to industrial pollution and dump by Municipalities in the banks of the rivers. During the interval of five years variations are found in quality of the water of the rivers.

A comparative analysis of 2003-04, 2004-2005, 2005-06, 2006-07 and 2007-08 provides trends and fluctuation in the quality of water in leading rivers at different places in Gujarat. It is necessary for GPCB to control river pollution in the larger interest of affecting people and society. It is necessary to collect data and regulate river pollution on monthly basis. If it is beyond the reach of the board, let it be handed over to private testing laboratories.

Table No. 6 : 7

Status of water quality of Rivers in Gujarat.

(Annual average)

River	Location	PH	D.O.	B.O.D.	C.O.D.
Sabarmati	Hansol 2003-04	-	-	-	-
	2004-05	7.90 to 8.82	6.2	3.4	-
	2005-06	7.85	6.6	27	57
	2006-07	8.12	7.3	3.4	27
	2007-08	7.98	8.0	4.0	16
Sabarmati	Railway bridge 2003-04	7.2 – 8.86	5.7	19	141
	Ahmedabad 2004-05	7.75-86	6.7	3.5	-
	2005-06	7.81	6.0	11	35
	2006-07	7.95	6.0	4.3	27
	2007-08	7.94	6.0	2.0	17
Khari	Lali 2003-04	6.99 – 8.4	00	375	915
	2004-05	7.18-8.21	4.4	86	-
	2005-06	7.73	2.4	77	222
	2006-07	7.97	3.5	50	165
	2007-08	7.47	4.0	39	151
Mahi	Valsad 2003-04	7.23-8.54	6.5	1.0	-
	2004-05	7-41-9.19	7.1	2.2	-
	2005-06	8.49	8.3	02	03
	2006-07	8.26	8.4	2.5	10
	2007-08	8.21	8.35	3.22	13.0
Narmada	Gurudeswar 2003-04	7.14 -8.47	7.3	1.1	-
	2004-05	7.89-8.57	8.0	2.9	-
	2005-06	8.39	8.6	02	03
	2006-07	8.13	8.5	2.1	10.0
	2007-08	8.19	8.96	1.98	10.0
Tapi	Kathor Bridge 2003-04	7.93-8.49	7.0	02	17
	2004-05	8.33	7.8	2.0	15
	2005-06	7.98	7.0	04	19
	2006-07	8.18	7.6	1.9	16
	2007-08	8.25	7.81	2.05	10

Daman Ganga	GIDC Vapi	2003-04 2004-05 2005-06 2006-07 2007-08	7.6 – 8.3 7.90 – 8.21 7.78 7.34 7.94	7.5 7.3 7.4 3.7 7	0.4 1.2 1.1 14.1 0.39	12 9 9 79 9.40
Par	Railway Bridge Atul	2003-04 2004-05 2005-06 2006-07 2007-08	6.9 – 7.5 7.04-7.92 7.77 7.83 7.79	5.1 5.2 6.1 4.4 5.44	3.4 8.2 6.6 9.7 5.13	53 70 37 52 40.08
Bhadar	D/S. of Jetpur	2003-04 2004-05 2005-06 2006-07 2007-08	7.3-8.3 6.72 to 8.14 7.85 7.53 7.65	4.4 4.8 6.5 3.3 5.64	1.6 9.5 1.9 2.8 4.12	3.6 40 24 33 33

Except PH all the parameters on expressed as Mg/L

Source : Annual reports GPCB.

Water Quality Near creeks of of GIDC Estates.

There are creeks in Gujarat, where industrial waste water is disposed. Table No.6 : 8 provides details of creeks located near GIDC estates of Golden Corridor of Gujarat. Parameters like PH, D.O. B.O.D. and C.O.D. are used to know the level of water pollution in the creeks . Amlakhali, Ankleshwer, Kalai Khadi Gundlav and Bill khadi near Vapi, Kalkavda Khadi near Sachin, T. kar khadi, near Khatalwala Sarigam and Baleswar khadi near Baleswar are having the problem of highly polluted water.

Many scientists and researchers have expressed the view that pipeline project needed to be executed by GIDC and industrial estate association for disposal of duly treated water merging with rivers and Arabian Sea in Gujarat. Newspaper reporting revealed that many animals died and people living in the vicinity of the creeks are prone to skin dieses. But the question is who will bear the cost of pollution for such end level water pollution. Still, efforts are made to initiate pipeline project in Ankleshwar.

The figures shown in the table are annual averages but daily, weekly and fortnightly averages of the waste water are highly alarming as mentioned by Greenpiece and Tata Consultancy Ltd. as they have carried out studies pertaining to pipe line projects in Gujarat.

Table 6: 8

Status of water quality of creeks in Gujarat State.

Yearly Average

Name of creek	Location	Year	Parameters			
			PH	D.O	B.O.D.	C.O.D.
1.Amala Khadi	Ankleshwar	2003-04	2.83 to 7.36	00	513	2132
		2004-05	2.20 to 7.39	01	423	1346
		2005-06	7.13	BDL	647	1993
		2006-07	7.33	00	329	1750
		2007-08	7.4	00	247	1020
2. Kolai Khadi	NH 8 Gundla	2003-04	7.67	-	5.3	44
		2004-05	7.32-8.3	-	13	57
		2005-06	8.07	6.6	01	08
		2006-07	7.86	-	9	41
		2007-08	7.45	-	4.12	26.92
3. Bill khadi	NH 8 Vapi	2003-04	7.68	-	27	139
		2004-05	6.86 – 7.56	-	54	208
		2005-06	6.94	-	92	264
		2006-07	7.14	-	135	335
		2007-08	7.07	-	139	406.6

4. Kalkata Khadi	Kanchigam	2003-04 2004-05 2005-06 2006-07 2007-08	7.05 7.27 – 7.80 7.39 7.36	- - - - -	3.7 09 11 21	40 51 53 85
5. Tokar Khadi	Khatalhada Sarigam	2003-04 2004-05 2005-06 2006-07 2007-08	8.07 7.05 8.89 7.77 7.83 7.70	- - - - -	2.6 06 7 6.7 3.37	22 34 34 33 25.24
6. Baleswarkhadi	Baleshwar NH 8	2003-04 2004-05 2005-06 2006-07 2007-08	7.09 7.99 7.92 8.04 7.88	5-0 6.5 6.3 6.1 5.43	04 02 06 3.6 4.12	28 18 23 17 10.0

Except PH All values are expressed as Mg/L
Source: Annual Reports of GPCB, Gandhinagar.

Table No. 6:9 provides details of coastal water monitoring by the GPCB during different time interval, samples collected and analysed. It can be observed from the table that in districts like Bhavnagar and Bharuch GPCB collected more samples than in the districts like Jamnagar, Rajkot ,Vadodara ,Vapi and Surat.

Table No. 6: 10 explains sampling and analysis under the Water Act. It can be observed from the table that figures show declining trend in sampling and analysis. As against this, Ahmedabad, Bharuch and Bavnagar GPCB offices have have taken greater initiative in collection of samples and analysis of water. At aggregate level, total 13156 samples were collected and analysed by all GPCB offices in Gujarat Sate in 2003-2004, which increased to 13802 in 2007-08. Still, during 2006-07 the highest number of samples were collected and analysed under the Water Act by different Regional Offices of GPCB.
These samples are taken from industrial and domestic effluents of waste water released in rivers and ground water collected under the GEMS and MINARS projects and the provisions of Water Act and the EP Act during different years as shown in the table.

Table No. 6:9

Coastal Water Monitoring .

GPCB Office	No. of samples collected and analyzed				
	2003-04	2004-05	2005-06	2006-07	2007-08
Jamnagar	60	61	57	55	
Rajkot	130	84	85	79	
Bhavnagar		70	58	72	
Vadodara	55	60	72	60	
Vapi	60	60	60	60	
Bharuch	72	56	90	120	
Surat	36	36	39	36	
Total	413	427	458	482	

Source : Compiled from Annual Reports of the GPCB , Gandhinagar.

Table No.6:10

GPCB Office	Sampling & analysis of under the water Act.				
	2003-04	2004-05	2005-06	2006-07	2007-09
Central Lab. Gandhinagar	531	279	287	194	91
Ahmedabad	2113	2399	3006	7841	3174
Mehsana	833	692	402	472	461
Vadodara	1388	1565	1651	1742	1518
Surat	2086	1904	2207	1940	2021
Rajkot	789	842	1210	1445	895
Bharuch	2195	1795	18823	2264	2463
Vapi	2353	2510	2923	2697	2065
Jamnagar	719	704	604	505	554
Godhra	111	128	143	153	124
Bhavnagar	38	351	492	593	433
Total	13,156	13169	14807	15828	13802

Source: Compiled from the annual reports of the GPCB, Gandhinagar.

Air Pollution Sampling.

In the case of sampling and analysis under the Air Control Act all offices of GPCB collected and analysed 5927 samples in 2003-2004 as it is seen in table No. 6:11. This figure increased to 6992 during 2005-06, and declined to 5478 in 2007-08 Air Samples from different loctation of cities and towns were taken for chemical analysis of air near highly sensitive areas of air pollution in the State. During 2005-06, the highest number of air samples were taken and analysed from Ahmedabad, Bharuch, Jamnagar, Bhavnagar and Surat Regional offices of the GPCB on annual basis. In the case of Central office, Gandhinagar (including Mehsana, Vadodara, Rajkot, Bhavnaar Godhra regional offices of the GPCB) fewer samples were taken. Variations are found in sampling largely due to availability and rising need of the sample of air pollution at different locations in the state.

Table No. 6 :11

Sampling and Analysis under the Air Act.

GPCB Office	No. of samples collected and analyzed.				
GPCB	2003-04	2004-05	2005-06	2006-07	2007-08
Central Lab Gandhinagar	33	144	21	13	12
Ahmedabad	585	650	1075	719	461
Mehsana	235	232	120	107	216
Vadodara	751	444	453	507	464
Surat	875	832	973	889	851
Rajkot	385	494	566	865	482
Bharuch	1180	1314	1414	1324	785
Vapi	624	769	903	811	819
Jamnagar	1154	1213	1152	1194	1078
Godhara	79	28	28	31	64
Bhavnagar	21	175	287	308	246
Total	5927	6289	6992	6778	5478

Hazardous Waste Management by the GPCB.

Tabel No. 6.11 provides samples collected and analysed in respect of hazardous waste management from 2003-2004 to 2007-08. In all 1135 and 287 samples were collected and analysed by the different GPCB offices of Gujarat in 2003-04 and 2007-2008 respectively. In 2007-08 relatively less amount of sampling and analysis were made from hazardous waste management. It appears that the highest number of samples were collected from Ahmedabad, Mehsana, Vadodara, Bharuch and Godhara Regional offices, whereas, less number of samples collected and analysed in the case of Bhavnagar, Jamnagar, Rajkot and Surat Regional offices. As per Environment Protection Act, GPCB has to protect land from dumping of

hazardous waste near GIDC estates or other sites. Polluted industries have to prepare plan for and implement “On Site Emergency Plan” and at such district level “Off Site Emergency Plan”. Sometimes, such dispensation does not necessarily take care of overall environmental pollution and hazard management. There are critical industries like pesticides, dyes, drugs and dyes – intermediates, organic chemicals and gases, inorganic gases and chemicals and highly biodegradable wastes creating hazardous wastes. Even Municipal solid waste and garbage/sewage left to flow into the environment has potential environmental risks in terms of microbial pollution and pathgenicity. Moreover, web of rails, roads and cables, pipelines, roads, mining, ship breaking, port and related economic activities are full of environmental pollution potential and ecological damage.

Table No. 6 : 12 provides details about sampling and analysis made by GPCB of leading cities in Gujarat for the last five years. The exercise has been undertaken under the Hazardous Waste Management Act. It is noticed from the table that the total number of samples have fallen from 1135 in 2003-04 to 287 in 2007-08. It is the duty of GPCB to control and monitor Municipal solid waste. The World Bank has provided numerous instruments for collection and disposal of waste.

Table 6 : 12

Sampling & Analysis under Hazardous Waste Management Act

GPCB OFFICE	2003-04	2004-05	2005-06	2006-07	2007-08
Central Lab Gandhinagar	41	50	22	42	17
Ahmedabad	368	79	111	30	60
Mehsana	120	18	06	06	13
Vadodara	336	73	33	54	82
Surat	24	04	03	15	91
Rajkot	28	01	01	-	-
Bharuch	130	233	35	31	10
Vapi	38	18	05	07	07
Jamnagar	06	0	01	-	-
Godhara	41	2	02	08	02
Bhavnagar	03	29	21	22	05
Total	1135	507	240	215	287

Source: compiled from Annual Reports of the GPCB Annual Reports, Gandhinagar.

Conclusion

It appears from factual analysis of this section that GPCB has positive and preventive role to control and monitor industrial pollution in Gujarat State. The GPCB has to take over challenges as contained in this section for sustainable environmental management both in urban and rural areas of the state. Looking to the number of rising court cases, the board has to have strict enforcement of stringent rules not only in Golden Corridor but all parts of the State. Still, Ankleshwar and Vapi industrial areas are known for the highest amount of air and waste pollution . Special plans and schemes are required to manage environmental pollution for sustainable growth of Gujarat economy.

Section II

The Role of Central Pollution Control Board.

The Central Pollution control Board (CPCB) at national level provides guidelines, executes national environmental policy and enforces environmental laws at state and union territory levels. It has provided code of conduct for each strata of environmental pollution and has prescribed minimum standards for water, air, river, ocean pollution as well as protection of natural resources and common properties like forest, fisheries, wild life, animals etc. An attempt is made here to analyse the role of CPCB.

The present section explores various activities of the Board. CPCB report 2006-2007 mentions that it has a key role in abatement and control of pollution in the country by generating data, providing scientific information, rendering technical inputs for formation of national policy, programmes, training and development of manpower and organizing activities for promoting (environmental) awareness at different levels of the Government and public at large. The board provides technical assistance and guidance to the State boards in carrying out investigations and research relating to problems of air and water pollution. It advises Central Government in any matter pertaining to environmental pollution quality, plan for nation-wide programme, and prepare manuals, codes, guidelines relating to treatment and disposal of sewage and trade effluent and gas cleaning devices. The board assesses quality of air and water, inspects waste water treatment installations, manufacturing processes etc. so as to take steps for the prevention and control of environmental pollution action through out the country.

Prevention and Control of Pollution.

The CPCB has made special efforts and provisions for prevention and control of various types of pollution at state level. Through the Ministry of Environment and Forests the Board adopted a policy statement for abatement of pollution in 1992 and as contained in new environmental policy of 2006. These policies have provided

several instruments in the form of regulations, legislations, agreements, fiscal incentives and various other measures to prevent and control pollution of air, water, noise and land. For this, various programmes and schemes are introduced. Pipeline projects are started by adoption of cleaner technology, waste minimization and prevention rather than traditional treatment, which has helped conservation of resources, raw material and various industrial processes.

To execute these, the Board took following actions:

1. Development and promotion of cleaner production technologies for air, water and solid waste management.
2. Multi disciplinary and multi-institutional study for Natural Resource Accounting in all over the nation by Asian Development Bank and other global institutions.
3. For waste minimization in small scale industries, the board launched training programmes with National Productivity Council and World Bank. This has trained 118 participants for 84 organizations and enabled them to identify 43 facilitators to promote the concept of waste minimization.
4. Environmental Audit programme initiated at different industries levels. For this CPCB identified 1551 large and medium units in 17 categories of highly polluting industries having higher pollution load.
5. The Board provided technical consultancy and guidance to monitor common effluent treatment plants at the sites of the State Pollution Control Boards.
6. The Board promoted technical studies for coastal zone management and several institutional support for over all environment management in the country. For this, the board has R&D Cell, trainers training programme for officials and NGOs and has identified institutions engaged in environmental management.
7. The board has provided statistics and mapping of zones for various Metro Cities and major cities by preparing Environmental Atlas under the special scheme. Under the World Bank capacity building project, CPCB provides components like zoning atlas for siting of industries, Industrial Estates,

Planning Studies, State-wise Guidelines for Siting industries by SPCBs and environmental urban planning training.

Under the Environmental Pollution Act and directives given by honorable Supreme Court of India, 17 categories of highly polluted industries are identified in Table No. 6: 13. Looking to the table it appears that there are 1551 industrial units of which 153 were closed down and 1284 units have adequate facilities to comply with the standards, whereas, 114 units are defaulters. They dispose toxic waste water or toxic contents in air or solid waste on land .

It can be observed from the table that cement, distillery, Fertilizer, Pharma, Sugar and Dyes and Dyes intermediates have relatively higher number of industrial units. Similarly, in the case of closed units sugar (37), pharma (26), distillery (27), and leather (11) units are found in the list. There are several industrial units which fulfill standards in the same group. There are defaulters like sugar (38), TPP (23) and distillery (27). CPCB and GPCB have taken necessary action against them.

Regarding location of 17 hazardous industries in different states and union territories , table No. 6 : 14 provides the details. Highly industrialized states like Gujarat (177), Maharashtra (335) , Tamilnadu and Andhra Pradesh (173) have a high concentration of 17 highly polluting industries. These industrial units closed down for not adhering to the standards of the CPCB. These include, Andhra Pradesh (29), Bihar (17), Maharashtra (22) and Uttar Pradesh (21). Similarly, there are units of these 17 industries which are complying with the standards.These are located in Uttar Pradesh (189), Tamil Nadu (116), Maharashtra (296) and Gujarat (167). In the case of defaulter industrial units Uttar Pradesh (14), Bihar (10)and Madhya Pradesh (17) are the leading States.

Table 6: 13

Category-wise status of the pollution control at 17 categories of Industries.

Sr. No.	Category	Total No. of units	Units closed down	Units which comply with standards.	Defaulters
1	Aluminum	7	1	6	0
2	Caustic	25	0	25	0
3	Cement	116	8	104	4
4	Copper	2	0	0	2
5	Distillery	177	27	123	27
6	Dyes and D.I.	64	6	56	2
7	Fertilizer	110	10	97	3
8	Iron and Steel	8	0	2	6
9	Leather	70	11	59	0
10	Pesticides	71	6	63	2
11	Petroleum	49	0	49	0
12	Pharma	251	26	224	1
13	Pulp and Paper	96	19	71	6
14	Refinery	12	0	12	0
15	Sugar	393	2	72	23
16	TPP	97	37	317	38
17	Zinc	4	0	4	0

Source : CPCB Annual report : 1999-2000 p.80

Table No. 6 : 14

State-wise Summary Status of the pollution control in 17 categories of Industries.

Sr. No	State/UT	TotalNo. of Units	Closed Units	Units complying with standards.	Defaulters
1	Andhra Pradesh	173	29	142	2
2	Arunachal Pradesh	0	0	0	0
3	Assam	15	02	11	2
4	Bihar	62	17	35	10
5	Goa	6	0	6	0
6	Gujarat	177	4	167	6
7	Haryana	43	3	34	6
8	Himachal Pradesh	9	0	9	0
9	Jammu & Kashmir	8	3	1	4
10	Karnataka	85	9	68	8
11	Kerala	24	6	20	2
12	Madhya Pradesh	78	6	59	13
13	Maharashtra	335	22	296	17
14	Manipur	0	0	0	0
15	Meghalaya	1	0	0	1
16	Mizoram	0	0	0	0
17	Nagaland	0	0	0	0
18	Punjab	45	5	33	7
19	Orissa	23	1	15	7
20	Rajasthan	49	6	42	1
21	Sikkim	1	0	0	1
22	Tamilnadu	119	2	116	1
23	Tripura	0	0	0	0
24	Andaman Nicobar	0	0	0	0
25	UT Chandigarh	1	0	1	0
26	Andaman Nicobar	-	-	-	-
27	DdaraNagarHaveli	-	-	-	-
28	UT Delhi	5	0	3	-
29	UT Lakshadweep	0	0	0	0
30	UT Pondichery	6	1	4	1
31	Uttar Pradesh	224	21	189	14
32	West Bengal	58		33	9

Source:- CPCB Annual Report 1999-200 p.78

Water Quality Monitoring Programme

CPCB in collaboration with SPCBs established 1019 water quality monitoring stations in India. These monitoring stations cover 200 rivers, 60 lakes, 5 tanks, 3

ponds, 3 creeks, 13 canals, 32 drains and 321 wells. Thus CPCB and SPCBs are monitoring water quality of ground water and surface water in India.

As per the decision of National River Conservation Authority, CPCB has directed State Pollution Control Boards and Pollution Control centres that polluting industries must install requisite pollution control systems in a specified time period. As on 30-9-1999, 476 industries have installed the pollution control systems in order to comply with prescribed standards. 130 industries have been closed and 245 industries have to install the system. CPCB strictly regulated time-bound action programme to reduce emission by defaulting industries in the States like Tamil Nadu, Andhra Pradesh and Uttar Pradesh, which are having maximum number of defaulters.

The CPCB is monitoring water quality of national acquatic resources in collaboration with SPCB at 507 locations out of which 430 stations are under Monitoring of Indian National Acquatic Resources (MINARS), 50 stations are under Global Environment Monitoring Systems and 27 stations are under Yamuna Action Plan (YAP).

It is very interesting to note here that out of 507 stations, 414 stations are on rivers, 25 on groundwater, 38 on lakes and 30 on canals, creeks, drains, ponds etc. Here biological quality of water bodies are monitored by the CPCB.

CPCB and SPCBs jointly identified 26 coastal rivers in the peninsular region for assessment of pollution load for restoration of water quality. CPCB identified 24 locations in different states to conduct survey and monitoring of water quality with necessary action plan. In Gujarat, waste water pollution in Ankleshwar and Vapi towns are directly under the control and monitoring of CPCB.

CPCB made efforts to get ISO 14000 standard for eco-friendly production in 2000. Eco-lebelling and eco-packing is encouraged . CPCB identified 119 industries from Utter Pradesh, Bihar and West Bengal which were polluting rivers and lakes. At all India level, from leading 15 states known for pollution, CPCB identified 847 industries which were defaulting and flowing waste water and discharging effluents into the rivers and lakes. Tamil Nadu and Utter Pradesh are the leading states in India where highest number of industrial units are discharging liquid and solid waste

into the rivers and lakes. As a result, biological oxygen dissolved, total suspended solids and fecal coli form counts are not maintained in the rivers and lakes as per set standards.

Performance of common effluent treatment plants measured by the CPCB.

As on 31.3.2006, there were 13 common effluent treatment plants, out of which performance of 9 CETP was measured as a part of monitoring of the CETP. Periodic samples were taken and chemical engineering results are summarized in table No. 6: 15. Significant deviation from the design influent qualities was observed in several cases leading to unsatisfactory performance. In most of the cases, there is no separate collection system for storm water which causes disruption of CETP operations in monsoon season. They are non-compliant to prescribed norms, especially in respect of COP, NH3-N, low BOD/COD ratio and high TDS.

Table No. 6: 15

Performance measured by the CPCB of Common Effluent Treatment Plants in Gujarat during 2005-06.

CPTP, Veraval	PH	TSS	TDS	COD	BOD	-2 SO4	NH3-N	TKN
Inlet	6.5	797	14664	3618	2830	-	224	476
Outlet	7.1	589	13501	575	188	729	47	85
Reduction (%)	-	26%	8	85	93	-	79	82
CETP Ankleshwar Outlet of CETP	7.4	221	20801	2268	360	34669	386	456
CETP, Panoli Inlet	7.4	772	21804	9120	1440	-	1918	-
Outlet	7.4	282	23658	7520	1071	-	1649	-
Reduction (%)	-	63	-9	17	24	-	14	-

Final Effluent Treatment Plant (FETP) Ankleshwar (For the final treatment of the treated effluent from GIDC Ankleshwar, Panoli, Jhagadia)

Monitoring Date	PH	TSS	TDS	CoD	BOD	NH3-N	TKN	
14-11-06	7.3	453	9670	2288	698	13.6	-	
16-11-06	8.5	256	14678	2360	686	6.44	2296	
29-11-06	7.3	375	9130	1689	514	661	-	
30-11-06	7.4	320	2526	600	98	146	-	

CETP VAPI

Location	PH	TSS	TDS	COD	BOD	Phenol	NH3-N	TKN
Inlet	5.9	712	5908	3111	1340	11.8	142	207
Final Outlet	6.3	164	7700	1042	240	5.8	239	-
Reduction	-	77	-30	67	84	51	-68	-

CETP Vatva

Location	PH	TSS	TDS	COD	BOD	-2SO4	NH3-N	TKN
Inlet	6.7	2320	26612	5174	1890	5532	129	157
outlet	7.6	1.2	12335	370	130	3876	67	84
	-	95	54	93	93	30	48	46

CETP, Naroda

Location	PH	TSS	TDS	COD	BOD	-2SO4	NH3-N	TKN
Inlet	6.9	16.5	22978	4118	1125	2070	34	45
Outlet	7.2	270	23864	2746	367	2634	34	-84
Reduction	-	83	-4	33	67	-27	0	-93

CETP Odhav Parameters

Sample	PH	TSS	TDS	COD	BOD	-2 SO4	NH3-H	TKN
Inlet	7.2	2.2	10852	832	196	3266	34	52
Outlet	7.1	86	11864	766	133	3174	5.6	29
Reduction%	-	59	-9	68	32	03	84	44

GVMSAV, Odhav

Location	Parameters							
	PH	TSS	TDS	COD	BOB	-2 SO4	NH3-H	TKN
Inlet	3.3	620	11964	2286	768	2634	95	118
Outlet	7.3	50	4424	216	40	1116	104	123
Reduction	-	82	63	90	95	58	-9	-4

All values in Mg./l except Ph

Source:-CPCB Annual Report 2006-07

Chemical analysis results of inlet and outlet of waste water are alarming at different GIDC estates in Gujarat in the case of small and medium scale industries which are using Common Effluent Treatment Plants. It has posed several challenges to CPCB and GPCB about correct reliability of operation of the plant as well as disposed treated water in open space. These estates and locations are known for higher waste water pollution and air pollution in Gujarat. A special study is required to be conducted on the impact of air and water pollution in these areas.

Municipal Solid Waste Management.

CPCB has provided technical services for municipal solid wastes (MSW) in Delhi and other places for collection, segregation, storage, transportation, processing and disposing of wastes.

Bio-medical waste management.

CPCB renders services to manage 18 bio-medical waste treatment facilities in different states of India. Various bio-medical waste treatment facilities are developed in South Indian States. These include A.P. (14), Tamil Nadu (11), Karnataka (9) and Kerala (1).

CPCB observed that (1) there are no power breaking arrangement at many plants, (2) common sites are not as per guide lines (3) O&M of incinerators are not in proper condition and (4) stock monitoring facilities are not found in order.

The following table provides performance of the common bio-medical waste treatment plants in Gujarat.

Table No. 6 : 16

Performance of common biomedical waste treatment facilities monitored by the CPCB.

Location	Date of monitoring	Stock attached to	SO2(g/NM3)	NOX(PPM)	HCL (mg/Nm3)	PM (ms/Nm3)
M/s. Samvedans	17-10-06	Incinerator	54	32	71.5	121
M/s.Semb Raky Ahmedabad	9-11-06	"	11.7	BDL	9.6	134
M/s. E. Coli Ahmedabad	10-11-06	"	2.7	BDL	51.2	121
M/s. Care Ahmedabad	8-11-06	"	10.9	BDL	1.9	129
Standard Limits			"	450	50	150

Effluent Treatment Plant

Location of plant	Location	PH	TSS	TDS	COD	BOD
M/s. Samvedana Halol	Inlet to ETP	10.0	68	1333	97	9.0
	Outlet of ETP	6.7	04	680	27	2.2
M/s. Semb Ramky Ahmedabad	Inlet to ETP	8.8	198	6761	287	20
	Outlet of ETP	1.6	104	9819	246	14
M/s.Ecoli, Ahmedabad	Inlet to ETP	7.1	117	4293	400	167
	Outlet of ETP	9.2	38	4549	150	19
Standard Limit		6.5-9.0	100	-	250	30

All values except PH are in Mg/L

Source : CPCB Annual Report 2006-07.

Looking to the table, we can conclude that bio-medical waste and municipal solid waste has created issues of safety and security of people and animals. The society has to pay higher cost if polluter does not bear cost of solid and bio-medical wastes . More dedicated sites need to be developed for disposal of those wastes in larger interest of the community and let polluter pay for the costs involved in this exercise.

Table No. 6:17 provides state-wise inventory of hazardous waste generating industrial units in India in terms of number of units and processed quantities of hazardous waste in TPA. A perusal of the table reveals that Gujarat and Maharashtra are the States having the highest number of hazardous waste generating units and quantity in TPA. Supreme Court Monitoring Committee has authorized some of the State Pollution Control Boards and Pollution Committees which are deficient or incomplete for the purpose of effective enforcement of hazardous waste management. CPCB had to re-circulate guidelines pertaining to

1. Guidelines for transportation of hazardous waste.
2. Guidelines for upkeep of disposal sites.

3. Check list for issuance of authorization by SPCBs/PCCs to the hazardous waste generating units.

CPCB periodically carries out random checks in 21 States as per the guidelines of Hon. Supreme Court. A rigorous exercise is undertaken in different States of India by the CPCB to manage hazardous waste generating units. The random checks in 21 states made by the CPCB reveal that Gujarat and Maharashtra are contributing 15% and 18% of total hazardous waste generated at all India level. As against this, Orissa (21) has got the highest number of dumpsites, whereas Gujarat and Maharasthra have 7 and 10 dumpsites respectively. Awareness, investment and public private partnership appear most effective tools for sustainable environment management .

Table 6:17

State-wise Inventory of Hazardous waste generating industrial units.

Sr. No.	State/UT	As per Hazardous waste (Management and Handling) Rules 2003	
		No. of Units	Quantity in TPA
1	Andhra Pradesh	1583	495985
2	Arunachal Pradesh	0	0
3	Assam	53	16038
4	Bihar	34	3967
5	Chhatisgarh	152	73001
6	Delhi	2411	18600
7	Goa	204	10274
8	Gujarat	5739	1276027
9	Haryana	1458	19240
10	Himachal Pradesh	880	33517
11	Jammu & Kashmir	147	41353
12	Jharkhand	352	181227
13	Karnataka	1621	71625
14	Kerala	530	88794
15	Madhya Pradesh	1085	121537
16	Maharashtra	4571	1407480
17	Manipur	0	0
18	Mizoram	0	0
19	Meghalaya	39	29493
20	Nagaland	03	11
21	Orissa	257	83915
22	Punjab	2189	113248
23	Rajasthan	588	3557223
24	Sikkim	0	0
25	Tamil Nadu	2422	190924

26	Tripura	135	264
27	Uttaranchal	51	7759
28	Uttar Pradesh	1777	117572
29	West Bengal	640	236000
30	Andaman Nicobar	0	0
31	Chandhigarh	111	836
32	Daman Diu, Dadra Nagar Haveli	598	30862
33	Lakshadwip	0	0
34	Pondichery	86	34768

Table No.6 : 17 provides state-wise inventory of hazardous waste generating industries spread in different states of India. Looking to the table, it appears that Gujarat has highest number of hazardous waste generating units (5739) which are contributing 12,76,027 TPA waste whereas, in the case of Maharasthra 4571 units are generating 14,07,480 TPA. As against this, state like Rajasthan having only 588 units are generating 35,57,223 TWPA solid wastes. A perusal of the table reveals that Andhra Pradesh, Gujarat , Rajashtan, Maharasthra and Tamil Nadu are the States which need prompt action and preparation of an action plan for solid waste disposal management.

Issues in solid waste management.

Professional Issues:

These issues are pertaining to professional management by the environmental scientists or experts in the areas of solid waste management. The issues can be enlisted as under:

1. Assessment of physical resources both at Macro level and Micro level regarding generation of waste.
2. Human Resources issues both at national level and regional level. It is necessary to identify physical constraints.
3. Selection of site and incineration of waste.

4. Current pattern of disposal and land fill sites. Segregation, classification and disposal of hazardous waste.
5. Method of waste disposal and adhering to environmental standards.
6. Transportation of degraded substances.
7. Reclamation of contaminated land and re-use of the waste.
8. Avoid waste by promoting eco-friendly and less waste generating technology in use at industry level.

CPCB and Plastic Management

CPCB offers help for the management of plastics in our country as it can be recycled and re-used. After consumption of plastics, they are littered and add to the municipal solid waste. Large quantities of plastic waste are found on dump sites, low-lying areas, parks, drains, roadsides, railway tracks, etc. For recycling of different categories of plastics CPCB, GPCB and Pollution Control Committees are monitoring the disposal of plastic waste. CPCB is taking initiatives to develop technologies for recycling of the waste, reuse and disposal of plastic waste. CPCB in collaboration with Jadavpur university, Kolkota has evolved/redesigned an extrude in which the pollutant generated from the extrusion process are comparatively lesser and absorbed in water and the gaseous emission is not released into the atmosphere. Reuse of plastic waste in road construction is considered as it saves fossil fuel and solves the problem of plastic waste. Post consumption plastic waste viz. carry bags, cups, tumblers, spoons, plates, thermo col are collected and cleared through different techniques. For this there are two rules (a) Guidelines on monitoring under Plastic Manufacture Usage and Sales Rules, 2003, (b) Review of status of implementation of Plastic Manufacture Usage Sales Rules, 2003.

Conclusion:

It is observed from the analysis contained in this section that CPCB has positive, preventive and protective role for environmental pollution. However, it provides technical guidance in the field of environmental planning and management to the pollution control boards of different states in India. Issues relating to water pollution

,air pollution, solid waste management and environment awareness are prime functions of the Board. To prepare an action plan to save the earth from global warming appears big challenge. CPCB has to provide guidelines to the SPCBs for sustainable environment as it has bigger economic implications for economic activities. The Government, CPCB, SPCB, NGOs, industrialist and industries associations need to render help to pollution regulating authorities in the wider interest of the society.

Section III

Role of Ministry of Environment & Forest

There are two ministries looking after sustainable environment in Gujarat. The first one is Ministry of Environment and Forests, New Delhi and the second one is Deptt. of Forest and Environment, Gandhiangar. An effort is made to highlight the combined role of the Ministries for supervision, monitoring, environmental impact assessment, management of flora and fauna, ecosystem and ecological economics. The Ministry also co-ordinates the functions of United Nations Environment Programme (UNEP), South Asia Co-operative Environment Programme (SACEP) and International Centre for Integrated Mountain Development (ICIMO). It has also been entrusted with the issues relating to multinational bodies such as Commission on Sustainable Development (CSD), Global Environment Facility (GEF), Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Co-operation (SAARC) on matters pertaining to environment.

The broad objectives of the Ministry are -

1. Survey of flora and fauna.
2. Prevention and control of pollution.
3. Afforstation and regeneration of degraded areas.
4. Protection of the environment .
5. Ensuring welfare of animals.

Moreover, the Ministry is also responsible for the following functions-

1. Management of environment and ecology including coastal waters, coral reefs and mangroves but excluding marine environment on the high seas.

2. Management of natural resources, forests, bio-diversity conservation, lakes and wetlands.

3. Conservation, management and development of abatement of pollution in rivers, delta and coastal zones.

4. Environmental Impact assessment of location of new industrial estates or economic activities. R&D in Environmental education and training.

5. Conservation of forests, wild life, protection, planning and research. Botanical and Zoological Surveys of India.

6. Declaration of National Environmental Policy and National Forest Policy.

7. Management of Desert and desertification along with issues of global warming.

8. Directives to the Central Pollution Control Board and State Pollution Control Boards for enforcement of environmental laws and regulations.

9. Activities of wild life sanctuaries, National parks, special Economic Zones, and to promote R&D in areas of environmental and Forest related issues.

10. To evaluate contribution of various sources of air quality, source, apportionment study (SAS) in liaison with National Environmental Engineering Institute Nagpur,The Energy & Research Institute, Delhi,Automation Research Association of India (ARAI), Chennai and IITs.

The Ministry also issues circulars for setting up Environmental standards both for acceptable levels as well as permissible levels, for the discharge of specific wastes. As the country develops, varying standards may be set as per National Environmental Policy, 2006. The Ministry also notifies general as well as industry specific emission and effluent standards for various categories of industries under the Environmental Protection Act, 1986. During the year 2008-09, the Ministry finalized notification of Petroleum and oil refineries, Sulphuric acid Plants, Common

hazardous waste, incinerators, sponge iron plants and coffee industry. The National Environmental Appellate Authority was established in order to entertain appeals of industries. A centrally sponsored scheme has been initiated for small scale industries to set up and upgrade Common Effluent Treatment plants so as to cover all States of India. Innovative Scheme of finance is introduced in which state subsidy is 25% of the total project cost, central subsidy is 25% of the project coast, contribution of entrepreneurs is 20% of the project coast and rest is loans from the financial institutions like IDBI, ICICI and State Sponsored Corporations. However, looking to the rapid industrialization process, the availability of funds is low to update technology at CETPs level. The Ministry has commissioned several projects for the improvement of water pollution, air pollution, solid waste management and reduction in energy utilization. The following table provides the facts about the role of the Ministry.

No.	Area of Consumption	% Reduction in consumption.
1	Reduction in water consumption	10-35%
2	Reduction in electricity consumption	15-20%
3	Reduction in fossil fuel consumption	10-20%
4	Reduction in raw material & chemical consumption.	10-20%
5	Reduction in waste water generation	10-30%
6	Reduction in air emissions	5-10%
7	Reduction in solid waste generation	5-20%
8	Yield Improvement	2-5%

Source : Annual Report: Ministry of Environment & Forest, New Delhi 2006-07.

Looking to the density of population in India, such reduction is very low as compared to other developed countries of the world. Our GNP will be reduced if environmental loss is deducted. For this, clean technology for waste minimization projects is

encouraged. Moreover, several projects are sponsored and encouraged by the Ministries for better environmental and occupational health.

Clean Developement Mechanism (CDM)

National CDM authority evaluates and recommends CDM projects for the approval of the host country, in order to achieve sustainable development by promoting environment friendly investment from the industrialized country, government and businesses. There are 772 projects approved by the national CDM authority in the field of bio-mass, solid waste management, energy efficiency, renewable energy projects etc. It is expected that such projects may generate 433 million certified emission reduction (CERs) by the year 2012 if all projects are successfully registered and executed.

The Ministry of Forests & environment has introduced several committees such as Committee on Impact of Climate Change, PM's Council for climate change, inter-governmental panel on climate change and regulatory and fiscal measures. The Ministry also provided National River Conservation plans for 27 rivers of the country. National Ganga River Basin Authority is empowered to plan, finance, monitor and coordinate for conservation of Ganga river. The authority has both regulatory and developmental functions. The Ministry also looks after National wetland conservation programme for policy guidelines, undertakes priority wetland and monitors implementation of conservation programme. National wetland committee approved 103 projects in 2007-08 and 115 projects in 2008-09. Experts'Group on conservation and sustainable utilization of Natural resources was formed by the Ministry. The Ministry executed National Afforstation and Eco-development Board for ecological restoration of degraded forest areas, and adjoining lands in a cost effective system to sponsor research and extension to dissemination of new technologies. The board creates awareness and fosters people's movement for promoting afforstation and eco-development in various states of India.

The following table provides progress of National Afforestation Programme.

Year	No. of New FDA projects approved	No. of New JFMCs involved	Project areas approved	Funds Released (Rs. Cr.)
2000-02	47	1843	71068	47.53
2002-03	237	8197	404799	151.26
2003-04	231	7902	282536	207.98
2004-05	105	3404	106743	233.00
2005-06	94	2362	54432	248.12
2006-07	15	494	0	292.75
2007-08	53	3979	493061	392.95
2008-09	13	6536	170435	345.62

Source: Ministry of Environment & Forest , New Delhi, Annual Report 2004-09

A perusal of table shows that in initial years the number of projects was very high with relatively low amount of money released by the Ministry, whereas, in the last three years the low number of projects have relatively higher amount of money released by the Ministry.

National Green Corps.

Year	National Green Corps
2003-04	78250
2004-05	68125
2005-06	67943
2006-07	87353
2007-08	91447
2008-09	111609

Source : Ministry of Environment & Forest, New Delhi, Annual Report 2008-09 p. 203.

The table provides the fact that the Ministry has trained a large number of children known as National Green Corps under the programme. The children are trained in

issues relating to environment. Courses on awareness pertaining to City, State, Country and global level awareness are conducted. During 2008-2009, 1, 11, 609 eco-clubs were supported across the country with a sanctioned amount of Rs. 29.835 crore. The table provides number of eco-clubs supported from 2003-04 to 2008-09 in the field of environmental awareness programme.

The Ministry has also supported National Environmental Awareness Programmes. The following table provides the number of organizations which took part in such programmes.

Year	No. of participating organizations in National Environmental Awareness programme,
1986-87	115
1991-92	555
1996-97	2610
2001-02	5285
2006-07	1784
2007-08	9938
2008-09	10642

Source : Ministry of Environment & Forests, New Delhi ,Annual Report 208-09 p. 203.

National Environment Policy (N.E.P.)

The Ministry of Environment & Forests, New Delhi declared National Environment Policy, 2006 which is the first comprehensive document at national level for sustainable development in the country. The document is a revised version of earlier policy. It has been formulated in consultation with national level experts, industry associations, academic and research institutes, NGOs and public. The policy contains a number of new initiatives for environmental protection, preservation and conservation. It is full of action plan showing role of the government, diverse actions of actors and stakeholders at all levels. NEP 2006 is appropriately integrated and

mainstreamed in different industry sectors, and State development plans during the XI plan period. For effective implementation of NEP 2006 a separate division in the Ministry of Environment and Forests is co-ordinating and implementing the Action plan. The policy has been widely circulated and is available on Ministry's Website www. envfor. nic.in .The Ministry organized National Workshop for Action plan and implementation in Jan, 2009.

It can be observed from the foregoing discussion that the Ministry has made sincere efforts for sustainable development. It is expected that expenditure incurred under the different schemes is useful to society.

Conclusion

This chapter has examined positive and preventive role of GPCB. CPCB and Ministry of Environment and Forest are engaged in taking regulatory measures for environmental pollution in general and industrial waste water pollution in particular. The industrial policy of Government of India and the government of Gujarat have not included action plans for the management of environmental pollution in the State. As a result both the Governments have to update and revise environmental policy periodically. Regulatory authorities should play a constructive role in helping the management of environmental pollution. It is equally necessary to have strict enforcement of environmental laws.

Chapter-7

Observations, Conclusions and Environmental Economic Policy

Chapter-7

Observations, Conclusions and Environmental Economic Policy

Introduction

In the present chapter an effort has been made to report the highlights of this research. For this, the first section of the chapter shows general observations about economic growth and sustainable environment in India in general and Gujarat in particular. The second section reveals chapter based findings whereas, the third and final section of this chapter offers environmental economic policy options in the form of suggestions based on this study.

Laws relating to environmental protection in India

Indian constitution gives the citizens the right to clean air and water and environmental protection. The government plays an important role in safeguarding the rights of the citizens. Environmental laws have evolved over a period of time and new institutions and policies have come into existence during pre–independence period. The Indian Penal Code, 1860 defined the offences relating to public health ,safety ,convenience, decency and morals. Punishment for the violation of the provisions of the Act is provided in sections 268,269,272,277,278,284,285.286,428,429 of Chapter XIV of the Code. These provisions deal with the matters relating to public nuisance, adulteration of food and drinks, drugs, vitiating the atmosphere to affect the health and well being of human beings and animals ,poisonous substances and explosive matters. Other specialized acts were also enacted to check the pollutants and waste materials in rivers, sea shores, marine life and preservation of environment and forests.

At local levels the Local Self Governments were given powers to deal with the matters relating to pollution, industrial effluents, and sewage. During pre independence days the problem was not serious because of low rate of population

and lesser number of industrial units. The economy was largely based on agriculture and a large number of population lived in rural areas.

In 1950 India adopted the federal form of government. The central and state governments have been given the authority to legislate and administer on different subjects. These subjects are placed in Union list, State list and Concurrent list.

Union list …. This list contains the subjects relating to atomic energy, mineral resources, agreements with foreign countries, shipping and navigation in inland waterways,maritime waters,airways,certain industries of importance, oilfields and mineral oils, mining activities,inter state rivers, fishing beyond territorial waters etc.

State list. This list contains subjects relating to public health and sanitation, agriculture, prevention of animal diseases, water, irrigation, drainage and storage,land,fisheries.

Concurrent list…This list contains subjects relating to prevention of cruelty to animals, adulteration of food stuff and other eatables ,drugs and poisons ,contagious diseases ,factories, boilers, archaeological sites etc.

Parliament and state legislatures can enact laws in respect of concurrent list. However in case of both making laws on same subject, the union laws will prevail .Thus The Constitution gives a dominant role to the Central Government on matters relating to environmental protection. Part IV of the Constitution deals with the Directive Principles of State Policy and provides that the state shall take steps to organize village panchayats and endow them with such powers and authority as may be necessary to enable them to function as units of self government. This has empowered the panchayats and municipal bodies to play an important part in regulating and enforcing environmental laws .

Legislations

The Indian Parliament has enacted the following legislations relating to environment and its protection :

- The Factories Act ,1948
- The Prevention of Food Adulteration Act ,1954

- The River Boards Act ,1956
- The Mines and Minerals Act ,1957
- The Ancient Monuments and Archaeological Sites and Remains Act ,1958
- The Atomic Energy Act, 1962
- The Insecticides Act ,1968

These acts provide for the treatment of effluents, gases, liquids, fumes and other bye products in an industrial or research organization. During the period 1947-1970 , government policies laid emphasis on economic growth ,development and balanced regional development . Environmental considerations took a backseat during this era.

Section I

General observations

1. Looking to the problem created by global warming, the global level agencies, Asia level agencies and national level agencies engaged in reduction of emission will have to prepare special plans to save people, natural resources, cleaner production and increase per capita availability of resources to the poorest of the poor people in India.
2. If industrialists are not ready to pay or bear the cost for their pollutants then considering cost-benefit, society will have to bear higher social cost. It means rich will be richer and poor will be poorer if environmental pollution problems are not tackled with the right approach.
3. Water pollution in Gujarat has affected poor people- those who are deprived of safe and clean drinking water. Such process has created water borne diseases in India in general and Gujarat in particular.
4. To tackle problems of water pollution, air pollution, traffic and noise pollution and solid waste pollution, efforts are required from people, industrialists, environmental activists, institutional efforts and awareness programme to be executed by the environmental ministries.

5. Environmental legal provisions are existing in paper only. The law is not enforced by the pollution regulatory agency in order to give justice to affected parties like poor people. Justice can be bought by the corporate bodies or industrialists but never in favour of poor people in Gujarat and elsewhere.
6. Experiments and experiences of anti-pollution practices show that polluter will have to pay and bear the cleaner production negative externalities expenditure. World Trade Organization has provided for multilateral trade among the member countries. It has insisted for cleaner production, eco-labeling, eco-friendly production for trade-led growth.
7. Gujarat Pollution Control Board (GPCB) and Central Pollution Control Board failed to manage environmental problems in the case of liquid waste and solid waste by local self government as well as from industries. River pollution and ocean pollution are found largely due to this reason.
8. Environmental impact assessment for industries must have stringent rules before commencement of new industries either in GIDC estates or in private plots. It is necessary to have urban land-use planning, keeping in mind environmental issues.
9. Global warming and climate change are affecting inhabitants in the rich and poor countries. Rich countries produce bulk of pollutants, whereas, global warming is hurting people living in poor countries. It is causing the melting of the Himalayan glaciers which may create huge water shortages in India and China. Scientists predict that Ganga glacier may melt before the end of the 21st century. For this, U.K. Prime Minister Mr. Gordan Brown has proposed that rich nations should create a $ 100 billion fund to help poor countries deal with climate change (The Economic Times 13/7/09 p. 10)
10. Looking to waste water pollution by nature and industries, green house gases emission and CO2 emissions, there is an urgent need for

global environmental policy as well as policy actions at all India level for all states for sustainable level of environmental management. The Government of Gujarat must pay special attention for enforcement of legal provision strictly for industrial air and waste water pollution in the State.

Section – II

Chapter based conclusions

1. There is a constant need to have research in areas of environmental economics in general and waste water pollution in particular. Areas of research mentioned in this chapter draw attention of economists, management experts and environmental administrators. Research Institutes, Universities and individuals need to concentrate on them . It is necessary to have generous funding to undertake such research. (Chapter I).
2. The analogy of commons advocated by Ecologist Garvet Hardin revealed that as human population increased, there would be pressure on finite resources at both the local and global levels largely due to inevitable result of over exploitation and ruin of natural resources like water, which is termed as tragedy of commons. Increased and rising rate of population brought strain on limited resources, which jeopardizes sustainability (Chapter 2).
3. There is a need to protect, to preserve and to conserve natural resources like water. As such, global warming is going to affect everyone negatively by drying of ponds, tanks, rivers. Now natural resource like water has a cost and price both for sustainable management (Chapter 2).
4. Economics of environmental management emphasizes to maintain common ecosystem consisting of air, soil, water, nutrients, and particular species of animals, birds, insects, micro organisms, trees

and other plant life. Cutting down of trees would adversely affect flow of water ways, soil, animals, birds and human beings. It is necessary to have environmental justice and set of framework to understand them (Chapter 2, 3).

5. MOUs signed by the Government of Gujarat for industrial development in the summits of 2007, 2008 and 2009 reveal that rapid industrialization process in Gujarat will continue. And hence environmental pollution will also continue due to rising rates of emissions and wastes generated from existing and new industries. The industrial pollution due to its nature has potential to cause irreversible reactions in the environment and hence is posing a major threat to sustainable industrial development as well as sustainable environmental management. Moreover, some areas or ecosystems are more susceptible to the adverse environmental impacts than others. Unplanned and haphazard location of industries permitted by Commissioner of Industries and GIDC in Gujarat might substantially increase the risk to the environment in general and green house gas and waste water pollution in particular (Chapter 2,3,6).
6. A concept of sustainable growth and sustainable environmental management is linked with more than 12% rate of growth of industries along with 14% rise in State Domestic Products with no responsibility on government or pollution regulatory agency to bear the cost of environmental pollution. Corporate governance must include ethics in production for sustainable environmental pollution management (Chapter 2 ,4).
7. United Nations Environment Programme (UNEP) has expanded area of global environmental pollution management. Only 11 countries had environmental regulating agencies in 1972 when UNEP was established. Now 106 countries have such agencies after ten years, of which 70 are in developing countries (Chapter 2 ,3).

8. Factories are dumping thousands of tones of hazardous solid waste in the open areas which has affected not only the fertile land but also polluted ground water. Environmental issues must be kept in mind even at the time of constructing landfill sites in Gujarat. Mehsana to Vapi industrial area is largely affected due to this reason. Disposal of untreated mercury contaminated effluent from caustic manufacturers has contaminated large tracks of land in Golden Corridor area of Gujarat State. This has been reported by the Union Ministry of Environment and Forests to the World Bank in 1997. (Chapter 2).
9. Looking to the causes of environmental degradation, market failures are leading to environmental degradation not only in Gujarat but all over the world. Efficient functioning of markets, leads to clear and secure property rights over all resources. There are no significant negative externalities of environment as healthy competition prevails in the market. As against this, unpriced resources lead to thin market where externalities remain present. (Chapter 3).
10. Economic policy failures are normally leading to environmental degradation in the case of natural resources like water. This has happened largely due to inefficient public projects with low return, failure to internalize significant environmental externalities, failures to intervene in failing markets in order to cost fully justified by expected benefits and wrong action taken by authorities. (Chapter . 3).
11. Industrialization, urbanization and rising pollution has resulted in aggregated earth pollution. For this, global level agencies, national level and State level organizations will have to execute Agenda 21 so as to achieve sustainable development throughout the world. A process of “demographic dynamics” will control size of population at each country level and development can be sustained by using sensible planning and suitable technology to cope with rising pollution (Chapter 4).

12. For reducing global pollution load, transformation of earth on massive scale is required not only in reduction of size of population but also to maintain earth's climate, clean production, clean and sufficient amount of water per head and to maintain soil to manage sustainable food stock for food security. Forest cover needs to be increased so as to maintain sustainable climate and natural resources at individual country level. (Chaper 4).

13. The growing world population, urbanization and rapid industrialization concern both on implications of water pollution and threat to water supplies from industrial accidents. To eradicate long term effects of pollutants and substances that affect human health, it is advocated to develop less polluting industries. Agricultural reforms help reduce contamination of natural resources. Public health and occupational health policy reforms may provide sufficient water and food, water for positive health and quality of water to manage bio-diversity. For this, it is necessary to have effective checks on chemical industry and force it to dispose polluted water duly treated as per approved standards.(Chapter 5).

14. Experiments and experiences to manage sustainable environment at economy level in India need to follow Thailand., Japan, France and Germany to save and conserve huge amount of water resources. This exercise may make fresh water free from lead, metals, salt, cyanide, nitrate and other toxic elements. Ultimately, potential human health affects can be protected from the risk of cancer, reduced quantity and quality of semen, impaired behavioral and mental functions in children, immune system and thyroid in children. For this, 10 positive actions for reducing industrial water pollution must be given due weightage. (Chapter 4.)

15. SDP growth rate and industrial growth remained very high in Gujarat as compared to any other state in India. The State has organized global summits for investment in Gujarat. The Gujarat experiment shows

industrial liberalization policy provided vital boost to industrial growth but very limited vision and provisions for sustainable environment management efforts. However, it is not advisable to close down industrial units having large investments, sizable output and employment avenues. Gujarat Chamber of Commerce and Industry, GIDC Industries Estates Associations and GPCB need to find out sustainable solution for environmental problem. (Chapter 5,6).

16. Studies carried out by TCS, NEERI, ORG maintained that if industry will not bear point level pollution cost in total production, social cost of environmental pollution caused by the industry may be many times higher. In the case of GIDC Ankleshwar, point level waste water pollution is Rs. 5 per KL if it is included in total cost, otherwise social cost of hazardous waste water would be more than Rs.45/- per KL of water. It appears that legal cost in court cases is cheaper than non-profit investment in environmental technology and treatment of waste to the industries considering the size of court cases (Chapter 5).

17. Gujarat Pollution Control Board has screened applications for common consent and authorization under the Water Act, Hazardous Wastes Management Handling Rules and Bio-medical Wastes Rules, 1999. Regional offices took sampling and monitoring under the water and air acts and initiated installation of pollution control measures. Total number of effluent treatment plants installed and commissioned was 5360 as on 31.3.2006. Total number of industries having air pollution control equipment was 4081 as on 31.3.2006. There are 27 Common Effluent Treatment Plants in operation for treatment of waste water under supervision of GPCB. There are seven hazardous waste TSDF by industrial associations and NGOs and 14 plants by individual industry in Gujarat State. Still it is not sufficient looking to degree and extent of pollution load (Chapter 6).

18. GPCB collected water cess worth of Rs.11.5 crore during 2007-2008. Sincere efforts are made to bring down air pollution in big cities of

Gujarat. CPCB installed air pollution control plant to manage air pollutants like SO2, RSPM, and SPM. Moreover GPCB provided State Level and District Level Environmental Atlas, industrial guidelines and provided a comprehensive environmental disaster management plan. GPCB is also monitoring water quality of rivers, tanks, etc. (Chapter .6)

19. Central Pollution Control Board (CPCB) examines impact assessment and provides NOC for location of new industrial units. It also analyzes samples of waste water, river and tank water and ambient air quality monitoring. CPCB provided Spatial Environmental Planning Programme (Zoning Atlas) for 14 States in India. It is also executing guidelines provided by the Central Ministry of Environment and Forest (Chapter 6).

20. CPCB has undertaken an exercise of identification of environmental challenges, strategic planning as well as integrated implementation strategy in Gujarat. The board provided authorization to 152 local bodies in Gujarat for municipal solid waste collection, segregation, storage, transportation, processing and disposal of the waste. In the case of PM , emission in excess of 500 Mg/Nm3 was observed in 10 to 15% cases, which was earlier observed in 40% cases. In most of the cases PM range of emission was found to be 150 to 350 MG/Nm3 by the board. Air pollution is monitored in Ahmedabad, Vadodara, Ankleshwar, Suat and Vapi industrial estates near bridges, traffic signals, traffic islands and many flyovers. 220 air pollution units were identified in Surat, 108 in Vapi GIDC, 349 in Rajkot, 71 units in Vadodara and 329 units in Ahmedabad to regulate air pollution action plan in Gujarat State by the Board (Chapter 6).

Section III

Environmental Economic Policy

This researcher can suggest the following environmental economic policy and course of action for sustainable environmental pollution Management:-

1. All industries will have to follow “pollute and pay” principle of environmental economics for disposal of waste water, greenhouse gases and solid waste at individual industry as well as individual GIDC estate level in Gujarat.
2. GIDC has not provided effluent disposal facilities in all GIDC industrial estates in Gujarat. Infrastructure for functional industrial estates includes facilities of liquid and solid waste facilities for the units located within GIDC estates.
3. GIDC estate agency and industries association at estate level will have to make short run and long term planning for environmental management as a group effort to mitigate environmental pollution both point level and end level created by the industries.
4. Industries are using skilled manpower like CA, MBA, Engineers along with several financial and fiscal concessions provided by financial liberalization and economic reform process for the last two decades. This is high time to impose environmental cess on industry at the rate of at least 2% of value added so as to fund environmental management in the State. It is equally necessary to have education cess on net profit of industries so as to fund for skilled manpower in the State.
5. There is a need for Master Plan by the Government of Gujarat for industrial pollution measures and need for potential investment for each of the 10 segments of industrial pollution in the State.
6. Scientific utilization of rain water in Gujarat is equally necessary in order to cope with water crisis in the State along with regulation of

clean water in perennial rivers like Sabarmati, Narmada, Mahi and Tapi. Industries must be forced to re-use and re-cycle waste water at least three times so as to solve the problem of scarcity of water in the State. This is right occasion to increase the price of fresh water for industrial purposes provided by GIDC and local self government as fresh water is cheaper than recycled retreated polluted water at industry level.

7. Under the aegis of Industries Department, Gujarat Global investment summits were organized in 2007, 2008 and 2009. MOUs of sizeable investments are made for further investments in Gujarat. FDI with new number of projects is likely to take place. This is the time to have agreements and MOUs for environmental technology and environmental management in Gujarat for sustainable growth of industries and to achieve the highest growth rate of GDP.

8. Gujarat has 1600 KM long coast line. It is necessary for pollution regulatory authorities like CPCB and GPCB to control, regulate and manage waste water pollution of small rives, perennial rivers and ocean.

9. Similarly at each GIDC estate level solid waste management facilities need to be developed so as to check land degradation with hazardous sold waste disposed by the industries .

10. Industrial policy of the State Government must include environmental Code of Conduct on the part of people, industrialists and pollution regulatory authorities. Ministry of Environment and Forest both at centre and State level must chalk out plans for sustainable environment management.

11. Central Government asked the Govt. of Gujarat to implement Rs.300 crore Environmental Management Capacity Building Technical Assistance Programme with the assistance received from the World bank in 2001. Gujarat Ecology Commission prepared Master Plan in terms of priorities, strategy, integrating environmental process with

the planning process and development activities. Similarly, the State requires more than double the amount of investment for another project concentrating on industrial pollution, water pollution, CO2 emission , soil degradation, bio-diversity protection, coastal and marine environment, desertification as a long run strategy and to cope with global warming. It is estimated that the cost of reducing global warming is worth US $ 18,000,000,000,000,000 (US $ 18 quadrillion). The World Bank has estimated the same at $ 32 trillion at 2002 World GDP (The Economic times, 29th October, 2003).

12. The State Government and industries associations should try to encourage and motivate industries for Clean Development Mechanism as a market solution to global warming and greenhouse gas emissions. As such, climate change has disastrous results and there are no trade offs. Scientists have argued that a country like India has no resources to manage Clean Development Mechanism. It is necessary for both the State and the Centre to make provisions in their future budgets about this problem.

13. The State eco-panel asked Ministry of Forest & Environment to prepare action plan of Industrial Development vis-à-vis sustainable environmental management for 2020.

14. It is argued that the performance of Gujarat Pollution Control Board is not upto the mark and it has acted against sustainable environment at the cost of public health. Responsibility of management of common effluent treatment plants should not be handed over to the association of industries, those who are polluters. Water samples are taken at the convenience of industries and results of water analysis appear to be doubtful in the case of waste water pollution by the industries in Golden Corridor of Gujarat State. GPCB must concentrate in R&D in the field of environmental pollution.

15. A Central Committee should evaluate the performance of GPCB periodically and if there are loopholes, accountability and responsibility

should be fixed. Punishment and reward system needs to be introduced by the Board. After the verdict of the Supreme Court in 2003, Central Team from New Delhi visited Gujarat to evaluate Pollution Control Action Plan of GPCB (Gujarat Samachar, 4th November, 2003 p. 5). Such action plan was placed before Bhurelal Committee and the State had to appoint Task Force under the Chairmanship of Chief Secretary and GPCB had to prepare Vigilance Teams for industries and process houses. Such exercise needs to be continued during XIth five year plan for sustainable environment management.

16. Centre for Development Alternative concluded in the research study funded by Gujarat Ecology Commission that mangrove trees were cut on coastal districts in Kutch and Jamnagar (worth Rs.45 crore in the last seven years). Now it requires Rs. 118 crore for afforstation in 300 sq. KM coastal belt (Gujarat Samachar 25th December, 2008 p. 16). This means that industrialization process and human activities have adversely affected coastal areas. Public awareness programmes, audio-visual environmental pollution education and strict enforcement of environmental laws is recommended for sustainable environmental management .

Future Areas of Research

On the basis of this study, this researcher is inspired to express following future areas of research pertaining to sustainable environmental management.

(1) Urbanization, traffic regulations and air pollutions in leading cities of Gujarat.

(2) Redesigning, innovations in functional approach of Gujarat Pollution Control Board for sustainable Management of environmental pollution in the State.

(3) Role of NGOs, Environmental activists for sustainable environmental pollution management in Gujarat.

(4) Innovative municipal solid waste management in Gujarat.

(5) Waste water pollution and affluent disposal in class – I and Class II cities of Gujarat.

(6) Management of Environmental Pollution in Coastal Zone of Gujarat State.

(7) Economics of Forest Development for sustainable growth in Gujarat.

(8) Evaluation of Impact Assessment made by Ministry of Forest and Environment for industrial clearance at State level.

(9) Cost and price of river and ocean pollution management in Gujarat .

Conclusion

On the basis of this research, the present researcher is inclined to conclude that 21st Century has brought awareness about the likely dangers of environmental degradation. Environmental pollution and sustainable management of pollution are widely recognized by administrators. People, scientists and Indian political leaders must recognize overwhelming scientific evidence that points to the major environmental perils humanity faces. All over the world, it is recognized that more public money is required for basic environmental research for the development of new technologies addressed to environmental risk. Global level inter-governmental, national level and inter-state environmental co-operation is required to be developed for an emerging market economy like ours.

The effects of climate change could lead to as much as a 5% drop in the GDP of countries in South Asia and Africa, including India, a World Bank report has warned . The report said the effects of a 2 degree Celsius rise in temperature due to global warming could put up to 400 million people at risk of hunger and leave up to 2 billion people lacking enough water resources. Even 2 degree Celsius warming above preindustrial temperatures – the minimum the world is likely to experience – could result in permanent reductions in GTDP of 4.5% for Africa and South Asia.

The developing world will suffer about 80% of the damage from climate change despite accounting for only around a third of greenhouse gases in the atmosphere, the report added. Climate change is an urgent issue and the needs are enormous and we are waiting and hoping to see an international agreement in Copenhagen.

Following the release of the World Bank report, Caroline Pearce, policy advisor to international aid agency Oxfam, said that developed countries " are leading the world into disastrous future. They can sit back and watch poverty and global temperatures spiral; out of control or they can reduce their emissions and can hand over significant new money to help poor people adapt to climate change."

Water is a prime necessity of human life. We need its conservation, protection and preservation. Government pollution regulatory authorities, scientists, administrators, environmental activists and environmental Lawyers should play a positive role in the areas concerning water pollution, green house gas emission and other forms of environmental pollution in industrially fast developing state like Gujarat. Future areas of research mentioned in this chapter must be recognized and further research work needs to be undertaken by professional research institutes.

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