UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS
(M.B.A. Programme 2005-06)

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Sustainability Issues and Challenges – A Case Study of BBN Industrial Corridor

Ljubljana, September 2006. **Nagin NANDA**

Author's STATEMENT

I **Nagin NANDA** hereby certify to be the author of this Master's Thesis that was written under the mentorship of **Prof. Dr. Marko JAKLIČ** and in compliance with the Act of Authors' and Related Rights – Para.1, Article 21. I herewith agree this thesis to be published on the website pages of the Faculty of Economics.

Ljubljana dated September 09, 2006.

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Nagin NANDA

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ABBREVIATIONS

S. N.	Name	Abb.	S. N.	Name	Abb.
1	Arsenic	As	23	Decibel	dB
2	Australian Aid	AusAID	24	Degree Celsius	^{0}C
3	Baddi-Barotiwala-Nalagarh	BBN	25	Dissolved Oxygen	DO
4	Barium	Ba	26	Economic Instruments	EI
5	Bio-chemical Oxygen Demand	BOD	27	Designated Best Use	DBU
6	Built Operate & Transfer	BOT	28	Environment Control Unit	ECU
7	Cadmium	Cd	29	Effluent Treatment Plant	ETP
8	Carbon dioxide	CO_2	30	Emissions Trading Program	ETP
9	Carbon Mono Oxide	CO	31	Environmental Adjusted State Domestic Product	ESDP
10	Central Pollution Control Board	CPCB	32	Environment Protection Agency	EPA
11	Centre for Science & Environment	CSE	33	Environment Protection Training & Research Institute	EPTRI
12	Chemical Oxygen Demand	COD	34	Environmental Impact Assessment	EIA
13	Chloroflorocarbons	CFC	35	Export Promotion Industrial Park	EPIP
14	Chromium	Cr	36	European Union	EU
15	Clean Development Mechanism	CDM	37	Government of India	GoI
16	Cleaner Production	CP	38	Gross Domestic Product	GDP
17	Central Eastern European Countries	CEEC	39	Gross National Product	GNP
18	Command & Control	C&C	40	Hazardous Wastes	HW
19	Common Effluent Treatment Plant	CETP	41	Hectare	Ha
20	Copper	Cu	42	H.P. State Environment Protection & Pollution Control Board	HPSEP & PCB
21	Corporate Social Responsibility	CSR	43	Himachal Pradesh	H.P.
22	Cubic Meter	m^3	44	Hydrogen Sulphide	H_2S

S. N.	Name	Abb.	S. N.	Name	Abb.
45	Hydrofluorocarbons	HFCs	68	Milligram per liter	mg/l
46	Indian Penal Code	IPC	69	Million Liter Day	MLD
47	Indian Standards Institute	ISI	70	Ministry of Environment & Forests	MoEF
48	Iron	Fe	71	Minimum National Standards	MINAS
49	Khad/Khud	Creek	72	Municipal Solid Waste	MSW
50	Kilograms	kgs	73	National Ambient Air Quality Standards	NAAQS
51	Kilogram per day	kg/day	74	Net State Domestic Product	NDSP
52	Kilolitre per day	kl/d	75	Nickel	Ni
53	Kilometer	Km	76	Nitrogen Oxide- Oxides of Nitrogen	NOx
54	Kiloliter per day	KL/D	77	Nitrous Oxide	N_2O
55	Lead	Pb	78	Northwestern	NW
56	Energy equivalent noise level- unit: dB	Leq	79	Organization for Economic Co-operation and Development	OECD
	decibel	dB			
57	Life Cycle Assessment	LCA	80	Percentage	%
58	L90 and L10		81	Perfluorocarbons	PFCs
59	(-) Log of Hydrogen Ion Concentration	pH	82	Polluter Pays Principle	PPP
60	Marginal Damages	MD	83	Public Interest Litigation	PIL
61	Marginal Cost of Abatement	MCA	84	Public Private Participation	PPP
62	Mean Sea Level	MSL	85	Public Private Participation	PPP
63	Methane	CH_4	86	Purchasing Power Parity	PPP
64	Mercury	Hg	87	Research & Development	R&D
65	Meter	m	88	Square Kilometer	Sq. Km.
66	Microgram per cubic meter	ug/m^3	89	Sulphur dioxide	SO_2
67	Millimeter	mm	90	Suspended Particulate Matter	SPM

S. N.	Name	Abb.	S. N.	Name	Abb.
91	Sulphur hexafluoride	SF_6	98	United Nations Industrial Development Organization	UNIDO
92	The Energy Research Institute	TERI	99	United Nations Framework Convention on Climate Change	UN FCCC
93	Total Coliform/Faecal Coliform	TC/FC	100	Victim Pays Principle	VPA
94	Total Catchment Management	TCM	101	Value Added Tax	VAT
95	Tradeable Emission Permits	TEP	102	Waste Minimization	WM
96	Treatment Storage Disposal Facility	TSDF	103	Zinc	Zn
97	UN Commission on International Trade Law	UN CITRAL			

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Chapter-1
Introduction

1.1 THE RESEARCH PROBLEM

1.1.1 The Problem Statement

Industrial activity although embodies the diversity and energy of human pursuits and industrial areas in many ways are remarkable engines of economic and social progress, yet they also play a central role in degrading the physical environment and shaping the social environment in which most of region's people live or would soon live. Dysfunctional environment has high costs, which makes more difficult the economic growth needed to improve the living standards and thus help perpetuate inequalities. Therefore, the haphazard industrialization can cause serious environmental degradation if adequate care is not taken (The Global Environment Outlook, GEO Yearbook 2004/5 URL: http://www.unep.org).

Himachal Pradesh one of the geographically important states located in the northern India nestled in northwestern Himalayas forms the catchment of major rivers of the region on which the agrarian economy of the entire region is dependent upon. The Baddi-Barotiwala-Nalagarh (BBN) industrial corridor, which has been chosen as a study area for my Masters' Thesis, is located at the foothills of Shivalik range in District Solan, Himachal Pradesh. The state government in order to fast track economic development offers number of subsidies, economic and tax incentives to the entrepreneurs to woo them for setting industrial units in the state. Besides, the area also has certain logistic and locational advantages, which have encouraged the entrepreneurs to set up a large number of industrial units in the state (Industrial Policy, 2004, Govt. of H.P.). Resultantly, about 200 large and medium industries and 850 small scale units employing 46,000 people (Deptt. of Industries, H.P.) and with a varying degree of pollution load pertaining to air; water and land have come up in the area and many more are in pipeline.

The industrial corridor forms a part of the catchment of river Sirsa and lies in a longitudinal valley between the Shivalik hills. The catchment of the industrial corridor is drained by four major drains, which finally drain into river Sirsa that is the major life supporting perennial river and the mainstay of agrarian economy of the entire region. The people of the area depend mainly for their agricultural and domestic needs on the river Sirsa. The river along with its catchment is also a major source for recharging of all aquivifers and ground water in the area (Topographic Survey-Nalagarh, 2000, EPTRI).

Any unsustainable activity or intervention in the watershed of this river system has an impact on area's ecology and environment (Tiwari, D.N., 1994). Most of the industrial units and habitation coexists in the sub-watersheds of these four drains, which ultimately drain into the river. The combined waste from all these drains comprising of industrial, civic and bio-medical waste finally reaches the river that is the lifeline not only of the people of area but also of neighbouring

state of Punjab. Further, the impact on ambient air quality, soil and land degradation puts the entire area in the category of *'critically polluted'* (Zoning Atlas- Solan, 1997, HPSEP&PCB).

The area with logistic advantages and economic incentives offered by the state government for industrialization also has a potential to transform the area into an environmental nightmare if effective and timely measures are not taken. Further, exponential growth in population that occurred during the past decades has made a frontal assault on almost all facets of environment. The impact of population pressure due to migration from adjoining areas and other regions in search of jobs is more pronounced in urban settlements and rather worst in areas with mixed land use as in the study area, where an urban settlement is, a by product of industrial endeavour (State Human Development Report, 2002). This situation sets into motion a vicious circle wherein poverty emerges out of over population and vice versa; therefore, *'poor people become both agents and victims of environmental pollution'* as stated by Mrs. Indira Gandhi, the then Prime Minister of India at the Stockholm Conference, 1972.

The exponential growth in population, haphazard industrialization, weak regulation, industrial/urban pollution, inadequate land use planning, lack of proper technology, *'end-of-pine'* treatment approach coupled with environmental ignorance can environmentally degrade any area. As a result of these factors in operation, there has been a quantum increase in the generation of all forms of pollution viz. municipal, bio-medical and the industrial wastes including hazardous waste, air and water pollution, all of which requires an immediate attention for pollution abatement, control and mitigation (AusAID Report, 2001, HPSEP & PCB).

The dimension of the problem has now acquired a colossal shape with effects that are not confined to short term but extends to long term and is bound to adversely aftermath the environment and ecology in the times to come. Such industrial development is unsustainable with practices that could irreversibly harm the environment with the result that effort both in physical and financial terms would be far more for mitigation than the profits yields expected through the industrialization process. The escalating population, their congregations and the unsustainable industrial activities/practices present before the government challenges to provide better shelter, sanitation, clean air, pure drinking water, health and safety services, education, employment to its populace in a manner that caters not only to the present but also the future generations (Environmental Policy 2002, Govt. of H.P.).

Further, there also a need for business units to behave ethically and contribute to the economic development while improving the quality of life of the workforce, their families, local community and society at large. The challenge is to integrate social and environmental concerns in business operations and in their interaction with stakeholders on a voluntary basis as there is today a growing perception that sustainable business success and shareholder value cannot be achieved solely by maximizing short-term profit, but instead through market-oriented yet responsible behaviour. For ensuring sustainability, the need is to integrally enhance all capital assets viz. environment and ecology, society, economy, human resources and infrastructure.

However, knowing the pitfalls we still fall prey to our greed and undertake the development in a manner and fashion that play a central role in degrading the physical and social environment in which we live or would live. Mr. Ola Ullsten, Co-Chair, World Commission on Forests & Sustainable Development, Former Prime Minister of Sweden states in *One Planet, Many People: Atlas of Our Changing Environment, (UNEP) - 'How our growing number of people and their consumption patterns are shrinking our natural resource base. The challenge is how we satisfy human needs without compromising the health of ecosystems. One Planet Many People is an additional wake-up call to this need.'*

There is no denying that some facets of the problem have been attended to in the past but the situation would have been entirely different, more positive and healthy had all the stakeholders worked in a unison manner with big picture in focus and strategies framed accordingly for effective and sound environmental management. Accordingly, the Graphical Model-Research Problem has been framed and is given in Fig.-1.1.

1.1.2 Research Proposition

To study the sustainability issues and challenges in BBN Industrial Corridor, to analyze practices which have led to the present unsustainable scenario, to analyze existing mechanism for environmental management and regulation, to analyze shortcoming of same and based on this analysis make recommendations for sustainable management and development of area in a manner that serves as a model for all such areas with a similar type of malaise. It is also proposed to have a look at env. management and regulation practices being followed world over, based on that as well as keeping in view the local conditions make recommendations for the area.

1.1.3 Research Questions

The important research questions are:

- What is the state of environment of study area w.r.t. ambient air, water and land? How the practices followed have led to present unsustainable scenario and how can this be explained? And how can the impact of unsustainable practices are measured in the area?
- What are the status, efficacy and adequacy of existing pollution control devices?
- What are the shortcomings of existing regulatory framework and surveillance set-up?
- How can business integrate social and environmental concerns in their operations? When and in what ways Corporate Social Responsibility (CSR) activities jointly serve economic and social interests and become strategic?
- Can environment and development coexist and go together?
- What challenges unsustainable practices pose before the government and how an area is managed sustainably?

1.1.4 Research Objectives

The objectives of the research are:

- To study the state of environment of area with respect to ambient air, water, and land;
- To measure the impact of unsustainable practices on environment;

- To study, explain and analyze the practices being followed in the region which have led to the present unsustainable scenario;
- To comment on the status and adequacy of existing pollution prevention, abatement, and control devices and mechanisms being followed by the industry in the region;
- To comment on the adequacy and shortcomings of regulatory framework and existing surveillance setup;
- To study the strategic CSR and its integration in business operations;
- To establish that environment and development can coexist and there exists a false dichotomy between them;
- To visualize the practices that can contribute to sustainable development and accordingly make recommendations for sustainable management and development of the area.

Hitherto businesses operated in a scenario wherein it was to service its own strategic interests of creating value through producing goods and services that society demands, thereby generating profits for its shareholders as well as welfare for society particularly through an ongoing job creation. However, new social and market pressures are gradually leading to a change in values and in horizon of business activity. Therefore, an attempt would also be made

- to know as to when a firm jointly serves its own strategic business interests and societal interests, as without clear-cut strategic benefits that may accrue to organization, it is not likely that management would invest in CSR practices and rather view it as a one time charity exercise for cosmetic purposes as stated by Lee Burke & Jeanne M. Logsdon, *'How Corporate Social Responsibility Pays Off'*, Long Range Planning, Volume 29, No. 4, pp. 495 to 502, 1996.

1.2 CRITICAL LITERATURE REVIEW

1.2.1 Background Statement

As has already been stated the industrial corridor, which forms a part of catchment of river Sirsa and lies in a longitudinal valley in the Shivalik hills, is drained by four major drains that finally drain into river Sirsa that is the major life supporting of region on which agrarian economy of region is dependent. The river along with its catchment is also a major source for recharging of all aquivifers and ground water and any unsustainable activity impacts area's ecology and environment. Most of the industrial units and habitation coexists in the sub-watersheds of these four drains and the combined waste from these drains comprising of industrial, civic and bio-medical waste finally reaches the river that is also the lifeline of the people of the area, resultantly, the impact has put the entire area in the category of *'critically polluted'*.

1.2.2 Previous Work

A critical review of literature is necessary for a thorough understanding of and insight into previous research that relates to research questions and objectives viz. *'what are the most important theoretical and practical contributions in the field till date and who the most important contributors'.* Although BBN area is one of the flagship industrial areas of the state, it has lately assumed critical status due to all around environmental degradation. Different agencies

viz. Industries, Housing, Urban Development, Public Works and Irrigation & Public Health Departments of the state government started making efforts towards developing the area, which were not focused and contained contradicting priorities. Perhaps the Mother Nature gave a warning signal when a large-scale mortality of fish fauna started occurring repeatedly in the river Sirsa. Thereafter, an effort for search for sustainable solutions started. The first such initiative took place in 2000-2001 when the state's environmental protection agency viz. the H.P. State Environment Protection & Pollution Control Board and AusAID through U.R.S. Pty. Australia, collaborated and brought out a report- *'Waste Water Collection Treatment & Disposal for Baddi Barotiwala Area H.P. India'*. This was the first status survey of the area.

Integral to this perhaps was the study conducted by the Environment Protection Training & Research Institute (EPTRI), Hyderabad, India (2000), *'Topographic Survey & Hydro-geological Investigations at Majra Village, Nalagarh'*. Another study worth mentioning is 'Zoning Atlas for Siting of Industries, District Solan' (1997), conducted by the Spatial Environmental & Planning Unit of the state wherein the recommendations were made on siting of industries though at a macro-level scale of 1: 125,000. Besides, the state board has also been generating for more than a decade *'Time Series Data on River Water Quality Monitoring Results'* for major rivers of the state including river Sirsa. All these efforts at least provided some direction to chalk out strategies to counter environmental pollution and degradation.

The watershed approach has been adopted for development and management of natural resources in India for the past many years now (Negi, S.S., 2000-a). Hitherto, the efforts have been *'department centric'* with some activities taken up for watershed management in a watertight compartment rather than with a *'catchment centric'* approach, wherein the environmental status of the catchment decides which activities are taken or not taken for development and management of natural resources. One such effort is ecological interventions made under the World Bank funded Integrated Watershed Development Project, Kandi Project started in 1993 and other projects/schemes but they were more or less forestry oriented schemes and not very encompassing and holistic.

Some inferences have also been taken from Total Catchment Management (TCM) concept introduced in New South Wales, Australia in 1984 as a state policy to coordinate natural resource management using whole catchment as the basis for planning and management. The Catchment Management Act, 1989 provided legislative framework to a statewide operational framework. TCM in its widest context seeks to achieve a sustainable balance between human existence, endeavour, and nature. TCM is a coordinated and sustainable use and management of land, water, air, vegetation and other natural resources on water catchment basis so as to balance resource utilization and conservation (Catchment Management Act, 1989- Section-4). This has successfully been tried in Hawkesbury-Nepean Catchment, Australia.

1.3 MODEL

As stated, escalating population, their congregations and unsustainable industrial practices present before the government challenges to provide better environment to its populace in a manner that caters not only to the present but also future generations. The solution to the problem requires an analysis of state of environment and prevalent environmental practices of study area, by way of parameters (dependent variables) viz. Dissolved Oxygen (DO), Bio-chemical Oxygen Demand (BOD), pH, Chemical Oxygen Demand, Total Coliform/Faecal Coliform (TC/FC) etc. which help facilitate the formulation of strategy and mitigation plan that would involve management intervention by way of environmental tools and recommendations for sustainable management of area. These would also contribute to sustainable management and development so that all five capital assets are integrally enhanced.

Besides creating innovative proactive solutions to the societal and environmental challenges there is a need for collaboration both with internal and external stakeholders. Rightly so, there exists a false dichotomy between development and environment as in every realm of economic activity, development is not only possible but also sustainable. An attempt would be to look at the problem from a different perspective wherein the focus would be not to produce *'less'* but to produce *'differently'*, manage the area holistically through sustainable practices and stakeholders participation and by use of innovative tools. An offshoot of continuous commitment by all stakeholders to behave ethically and contribute to overall development of region while improving the quality of life not only of workforce and their families but also of local communities at large would be with respect to such key elements such as: health and safety, environmental protection, human rights, human resource management practices, corporate governance, community development, and consumer protection, labour protection, supplier relations, business ethics and stakeholders rights.

It would also attend to the perpetual interstate problem of transfer of hazardous pollutants both in liquid and solid form through river Sirsa which flows inter-state to neighbouring state Punjab, which has remained largely unresolved because of attention of policy makers planners, regulators and executive agencies to focus on environmental solutions on *'unit'* basis rather than having a larger picture viz. *'catchment'* in mind and attending to problem after it has occurred – *'end-of-pipe' solution*, rather than preventing it in the first instance.

1.4 RESEARCH STRATEGY

In accordance with the research proposal, research questions, and research objectives as specified in the previous paras, the general plan was drawn up. In the thesis, the reliance has primarily been placed on the secondary data, which has been procured from a number of sources and agencies. The reliance has been placed on scientific database of the state's environment protection agency and other regulatory and developmental agencies, besides semi-structured discussions with the stakeholders at the local level and also by attending meetings of industries association etc.

Out of the different research strategies available, *'case study'* approach fits in appropriately with research proposal, research questions, and the research objectives as narrated in preceding paras. The *'case study'* as a strategy involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence. This has enabled me in gaining a rich understanding of the context of research and processes being enacted. Further, the case study strategy has also generated answers to the questions 'why' as well as 'what' and 'how'. Although 'what' and 'how' are more of a concern of the *'survey strategy'*, which I have not directly undertaken my self, but the advantages of survey as a strategy nevertheless flows from the secondary data from different scientific studies under taken by various agencies of repute from time to time. Again the time horizon chosen has a longitudinal perspective, as the environmental parameters need to be studied and analyzed over a period of time to be able to come to a worthwhile conclusions and recommendations (Saunders M.N.K et al., 2003). The data so collected from different agencies has been analyzed and compared with the existing standards as prescribed under the Environment (Protection) Act, 1986 and rules made there under and commentary on the state of environment has been made in the light of existing pollution prevention, abatement and control scenario. This has given *'descriptive'* and *'explanatory perspective'* to the research strategy because the causal relationships have been established between different variables after portraying the state of environment of the region.

1.5 MEASUREMENT ISSUES

The research proposal involves general description of study area in terms of regional setting, industrial scenario in the state, Solan district at a glance, focus area with a focus to demography, physical characteristics, physiography/slope, soils, climate, drainage and watershed, hydro geomorphology, groundwater, flora & fauna, land-use/land cover, existing industries/mines and minerals. This also involves study of state of environment of the area over a period of time w.r.t. air, water and land environments so as find what are the environmental issues and prevalent environmental status of area including pollution load and the carrying capacity of the area and especially of river Sirsa. In order to ascertain pollution load w.r.t. municipal, bio-medical and industrial wastes including hazardous waste, air and water pollution, various environmental parameters viz. DO, BOD, pH, COD, TC/FC etc. against time (Time Series Analysis) were studied. The data so collected analyzed and compared with the existing standards as prescribed under the Environment (Protection) Act, 1986 and commentary on the state of environment has been made in the light of existing pollution prevention, abatement and control scenario. The discussion has also been made on strategic CSR, new tools and efforts for environmental management, economic instruments (EIs), prevailing international scenario etc. and finally recommendations for sustainable management of area have been made.

1.6 DATA COLLECTION & SAMPLING

1.6.1 Data Collection

In thesis, the reliance has been placed primarily on secondary data of quantitative nature that includes both raw and compiled data, which was procured from a number of sources and agencies. Further, *'documentary data'*, *'survey based data'* and those compiled from *'multiple*

sources' has been taken. The care has been taken to ascertain that there is a reasonably good *'fit'* so as to answer research questions in a logical, scientific and rational manner. As I am working with the State Human Rights Commission, the access to database had not been a problem. Further, recently passed Right to Information Act, 2005 by our parliament also came in handy.

The reliance was placed on scientific database of state board and other regulatory/developmental agencies of government viz. Industries, Planning, LSG, Urban Development, Forests, Environment, Irrigation & Public Health, and the Council for Science, Technology & Environment etc. The secondary data pertaining to *'continuous surveys'* and those surveys repeated over time and *'ad hoc surveys'* which are usually one-off surveys and more specific in their subject matter has been relied upon. Further, *'multiple-source'* secondary data were useful. Besides semi-structured discussions with the stakeholders at the local level viz. government agencies, NGOs, community, employees union, local self-government, companies' management etc. were undertaken as well. Besides, important national and international journals, reports, periodicals etc. have also been studied along with websites of the UN agencies, the World Bank, OECD, EPA especially w.r.t. the international environmental management practices. Reliance has also been placed on important reference books on environment written by authors of repute.

Primarily, secondary data has been relied due to its fewer resource requirement in terms of money and time, unobtrusive nature, possibility for longitudinal studies, triangulation and cross verification as dependent scientific variables being studied are linked with each other as well. The care has been taken to reduce, if not eliminate, all disadvantages that are associated with secondary data collection. Only those data that fits in well with research questions and research objectives have been used. As there are number of sources for secondary data, the care has been taken to ensure that quality data is used keeping in view the state of art equipment, technical skills of scientific personnel, organizational culture, sprit of excellence of organization etc.

An important aspect here while dealing with the secondary data has been in evaluating the suitability of data for my thesis. Since there are number of sources of secondary data, this is of even more important. Here range of validity and reliability criteria are to be kept in mind while evaluating the secondary data. While evaluating the secondary data sources, overall suitability, precise suitability and cost and benefits have been kept in mind. I have checked if with the data set can I answer my research question, and meet research objectives; do I require them; does it cover the population that is the subject of my thesis; can unwanted data be separated, are data up-to-date. In addition I have also probed into reliability of data; credibility of data source; methodology used and described; measurement bias (Saunders M.N.K et al., 2003). Last but not the least, cost benefits issues have also been considered as well.

1.6.2 Sampling Plan

The perusal of database of state board has revealed that the sampling plan consisted of taking waste water samples in four creeks and river Sirsa as per the protocol prescribed under the Environment (Protection) Rules, 1986 in such a manner that it captures the water environment of

the area in totality. The sampling of wastewater has been undertaken on a quarterly basis keeping in view the dilution factors available in river Sirsa in different seasons. In addition sampling included ambient air, hazardous waste, biomedical waste, and sampling of underground water etc. As per the state board, the sampling plan has been prepared through involvement and agreement by environmental experts-*'Judgment Sample'*.

1.7 DATA ANALYSIS

Quantitative data is a product of research strategies as referred to earlier. This data has been analyzed and interpreted with the help of quantitative analysis techniques. In my thesis it ranges from creating simple tables through establishing statistical relationship between variables. The data analysis has been preceded by a consideration to *'data type'* and *'data layout'*. I have also used *'quantifiable'* data pertaining to environmental parameters that are 'continuous' in type. Primarily, *'data matrix'* has been used for *'data layout'* purposes. After doing the data entry and checking for errors I did my data analysis by 'exploratory data analysis' approach. This includes specific values, highest and lowest values, and trends over time, proportions and distributions. The most appropriate in my thesis are tables, contingency tables, bar charts, multiple bar charts, line graphs, multiple line graphs, pie charts etc. Out of these in line graphs, the dependent variable have been plotted against the time (Time Series Analysis) and compared over the time period against the standards as prescribed under the law. This is also a *'control chart'* approach of data analysis wherein one compares the environmental parameters against the fixed standards.

1.8 SCIENTIFIC CONTRIBUTION

It has been stated in the problem statement and background information that environmental scenario in the region is grim. The escalating population and their congregations and the unsustainable industrial activities/practices has presented before the government challenges to provide clean environment to its populace in a manner that caters not only to present but also future generations. Based on analysis and interpretation, the scientific recommendations have been made in the thesis for the sustainable management of the area that it serves as a *'model'* for environmental management of all such areas in the country with a similar type of malaise. This includes formulating a new strategy for managing the area as a composite unit i.e. *'catchment'* with new and innovative technologies and participatory approaches including economic instruments rather than focusing primarily and only on obsolete *'end-of-pipe'* pollution abatement and control solutions and policing/regulatory surveillance mechanism. Considering that there exists a false dichotomy between development and environment and in every realm of economic activity; development is not only possible but also sustainable, the key, therefore, is not to produce *'less'* but to produce *'differently'*, manage the area holistically through sustainable practices, innovative tools and participatory approaches.

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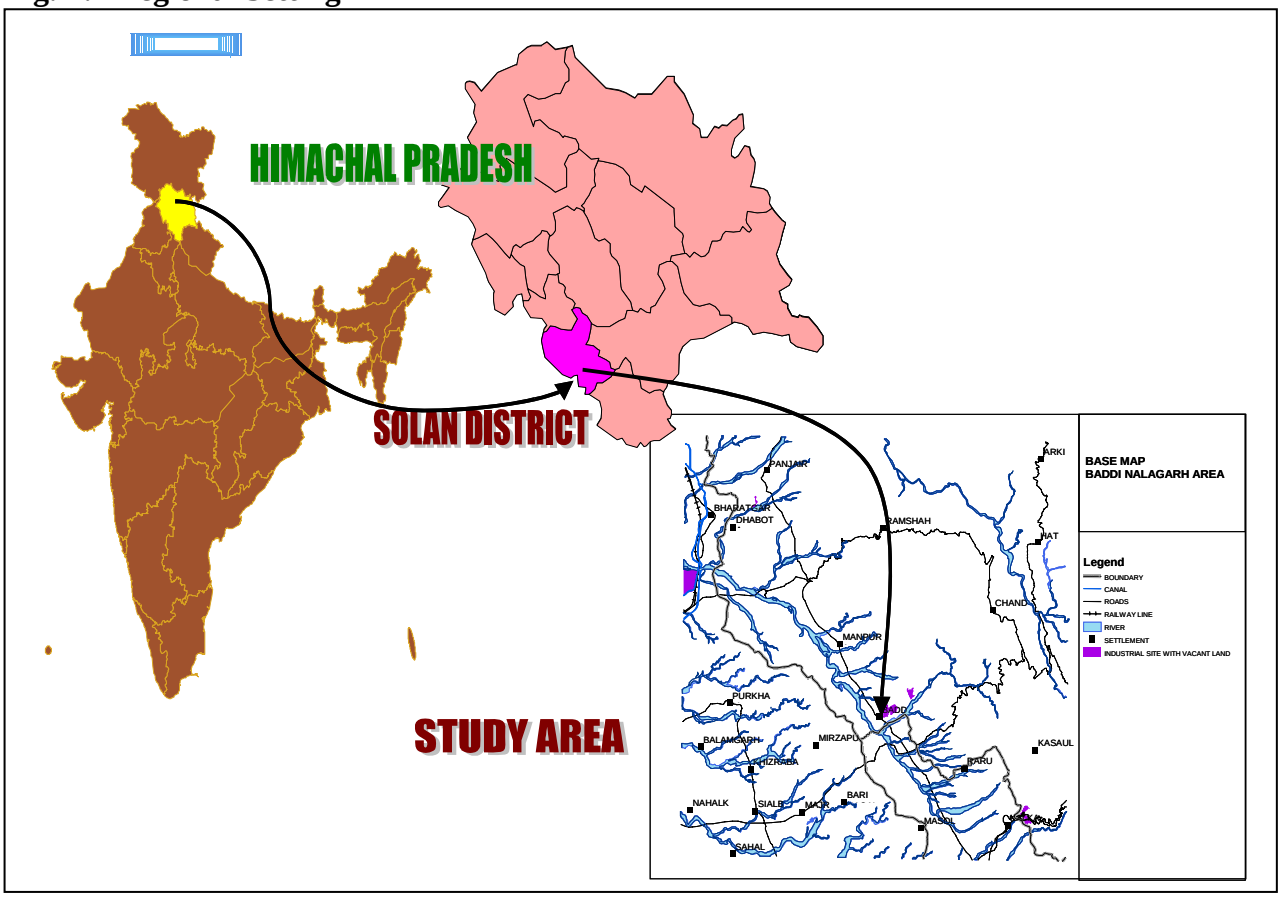
Chapter-2
The Study Area

BBN being a flagship industrial area of the state wherein a lot of ecological and environmental problems exists was selected as the case study area. In order to effectively study such area, it is imperative that the area is described in totality.

2.1 REGIONAL SETTING

The study area viz. Baddi-Barotiwala-Nalagarh, district Solan is located in foothills of Shivalik ranges of Himachal Pradesh. Lying in the lap of Himalayas, the state comprises of diverse terrain ranging from plains, sub-mountainous areas to higher ranges, leading to diverse and varied climatic zones. Himachal Pradesh is located between latitude of 32°22' 40" and of 30°12' 40" North and a longitude of 75°47' 55" to of 79°04' 20" East (Statistical Handbook 2000, Himachal Pradesh). The state of Jammu & Kashmir bounds the state in the North, Tibet region in the East, Punjab on the West, Haryana to its South and Uttaranchal to its Southeast (Fig.2.1). The state with a population of 6,077,248 occupies an area of 55,673 Sq. Kms. which constitutes 1.69% of total area of India and around 10.54% of Himalayas.

Fig.-2.1 Regional Setting



2.2 INDUSTRIAL SCENARIO IN HIMACHAL PRADESH

Himachal Pradesh is mainly an agrarian state with more than 80% of the population engaged in primary sector followed by service sector (Statistical Handbook 2000, Himachal Pradesh). From a relatively backward and predominantly agrarian state at the time of statehood in 1971, it has steadily progressed and especially in industrial sector by establishing 450 medium and large-scale units and about 32,709 small-scale industrial units covering a wide spectrum of industries with an investment of about Rs. 4,255.78 crores generating employment for about 1.86 lacs persons. (URL: www.himachal.nic.in, Deptt. of Industries). In order to promote industrialization, the state has setup number of Industrial Estates and Industrial Areas in almost all the districts. The industrial growth has taken place in Solan, Sirmaur and Una districts primarily in Shivaliks and its foothills with industries such as pulp and paper, textile dying, bulk drugs/pharmaceuticals, chemicals, electroplating, leather, etc. The areas like Kinnaur, Chamba, Kullu have witnessed growth in hydropower generation in addition to tourism, which has been growing by leap and bounds in areas like Kullu, Manali, Chamba, Dalhousie, Shimla, Chail etc. Further, the state has also witnessed growth in air-polluting units like stone crushers, brick kilns, cement plants and other mineral based industries/projects related to mining. Besides, agro-based industries, fruit based industries; handloom and cottage industries have also been thriving well (URL: www.himachal.nic.in, Dept. of Industries).

2.3 SOLAN DISTRICT AT A GLANCE

Solan is one of the industrially advanced districts in the state. The concentration of various types of industrial units as well as consequent employment generation has been highest in the state. The first industrial estate was set up in 1961-62 in Baddi in the Nalagarh Block followed by Barotiwala both of which still remain the two most important industrial estates not only in the district but also in the entire state with manufacturing facilities ranging from pulp and paper, textile dying, bulk drugs/pharmaceuticals, chemicals, electroplating to leather etc. Industrial town of Parwanoo established in 1975, specializes in manufacturing items like tractors, automobile bearings, wristwatches, fruit products (Statistical Handbook-2001, District Solan).

2.4 FOCUS AREA

The focus area of the case study is located in BBN industrial corridor. The study area forms a part of the catchment of river Sirsa in Solan district of the state. It lies in a longitudinal valley between Shiwalik hills. The catchment of the industrial corridor is drained by four major nallas (creeks), which finally drain into river Sirsa viz. Housing Board Nalla, Gulerwala Nalla, Sandholi Nalla, and Sitomajri Nalla. The river Sirsa is a major life supporting perennial river of Shivaliks ultimately joins river Sutlej near Ropar, Punjab. The river also along with its catchment is a major source for recharging of all aquivifers and ground water in the area.

Any activity and intervention in watershed of this river system has bound to have effect on ecology and environment of the area through which it traverses. Most of the industrial units are located in the sub-watersheds of these four nallas which ultimately drain into river Sirsa. The waste from all these nallas finally reaches river Sirsa. The people of the area depend mainly for

their agricultural and domestic needs on the river Sirsa. Nalagarh town headquarter of the Nalagarh Block, located in the northern part of the study area is an important urban settlement of the BBN industrial zone.

The area being located in one of the most industrialized district of the state is well connected to other parts of the region by means of good road network. The national highway 21-A, which traverses the area, connects the BBN industrial zone to the neighbouring states of Haryana and Punjab. The national highway-21 passes through the southeastern parts of the study area, near Kalka, Haryana. In addition to these, there are state highways passing through the area and this further enhances the mobility and connectivity of this valley with the surrounding districts. The state highways # 9, 16 and 42 connect Nalagarh with the adjacent states of Haryana and Punjab.

As stated, the major river traversing the study area is Sirsa, which originates in the hills of the state and then travels through this inter-montane valley into the adjoining Punjab. Another river that flows through the north-eastern parts of the study area is Gambher. In addition to these, a number of seasonal streams and nallas flow from the mountains on to the valley floor. These streams carry the surface runoff of the catchment to river Sirsa. Due to industrialization of this valley, some of the nallas have virtually transformed into effluent channels.

The altitude of the track varies from 300 to 2,100 m above MSL. However, major portions are below 1,500 m. Slopes vary from gentle to steep. At lower elevations, the terrain is flat to undulating whereas it is steep to precipitous in the catchment of Gambher khad along the river Sutlej. The general direction of the main hill range is northwest to southeast whereas many side spurs run in all directions. The Shiwalik hills in the west are immensely rugged and forms ravines, which is locally known as khols.

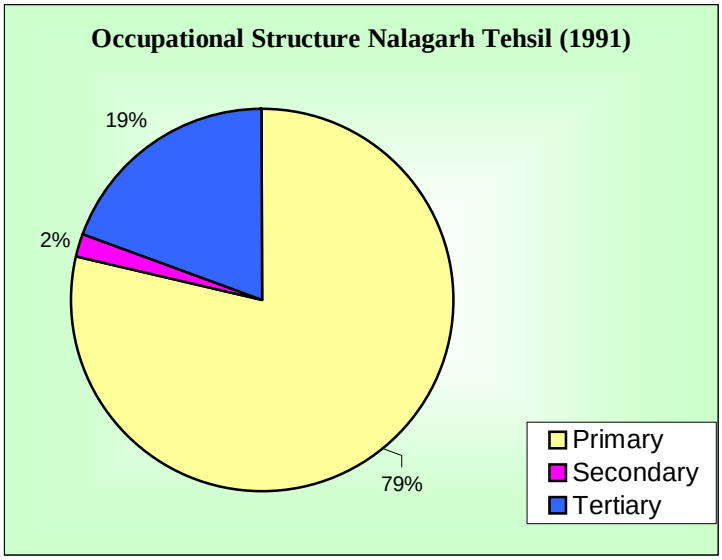
2.4.1 Demography

The study area is located in the Nalagarh Tehsil of Solan district. Part of its falls under Nagar Panchayat Baddi, which being highly industrialized area in the state, has been categorized as a Class-III town. The population break-up as per the District Census Handbook, Solan, 2001 is given in the Table- 2.1.

Table- 2.1 Population Breakup

Name	Population	Persons	Male	Female	Literacy Rate	Sex ratio
Nalagarh Tehsil	Total	1,54,881	88,386	66,495	71.22	752
	Rural	1,22,856	66,383	56,473	67.38	851
	Urban	32,025	22,003	10,022	85.32	445
Baddi (NP)		22,592	16,929	5,663	84.84	335

Fig.-2.2 Occupational Distribution



Pie chart Fig.-2.2 depicting the occupational distribution shows that the maximum numbers of people are engaged in the primary sector and the area comprises mainly agricultural land. Only 2% of the population is in secondary sector, which is higher than other Tehsils in the state due to two industrially advanced areas of Baddi and Barotiwala. Rest of the working population is in the tertiary sector. Due to population growth on account of industrialization, the government bestowed upon Baddi the status of Nagar Panchayat in 2001. The sex ratio of the area clearly states the dominance of male population in the area who has migrated from all over the country in search of work. The literacy rate in Baddi is 84.84%, which is counted as high on account of industrialization. The population explosion occurred during the past has made frontal assault on almost all facets of environment as poverty emerges out of over population. Such mixed urban settlements further experience the impact of population pressure due to migration from adjoining areas in search of employment. The escalating population and congregations presents before the government number of challenges which have now acquired such a dimension wherein the effects are not confined to short term but have extended to long term and are bound to adversely and irreversibly aftermath the environment and ecology in the times to come.

2.4.2 Physical Characteristics

The main geological formations in the tract are viz. Jutog formation; Shali formation; Shimla group of rocks; Balani formation; Infra krol formation; Karol formation; Sabathu formation; Terraces and Alluvial Deposits and Shiwalik group (Wadia D.N.,1975). Out of these, Shiwalik group is explained hereunder.

- **Shiwalik group:** These are divided into four different stages as described below:
  - **Kandlu stage:** It is named after the name of village Kandlu. This stage forms the lower stage of Shiwaliks exposed in the area. This stage occurs in the anti-clinal valleys east of Nalagarh town.
  - **Nalagarh stage:** Kandlu stage is over lain by Nalagarh stage which comprises of sandstone largely micaceous and forms major features, running north from Nalagarh town. The top zone of this stage consists of maroon clays and buff sandy clays alternating rhythmically with a few fossil fragments in place.
  - **Satluj stage:** It overlies the Nalagarh stage and has exposed sandstone in northwest of Rewalsar. The massive beds of sand stone up to 16 m and more in thickness are inter-

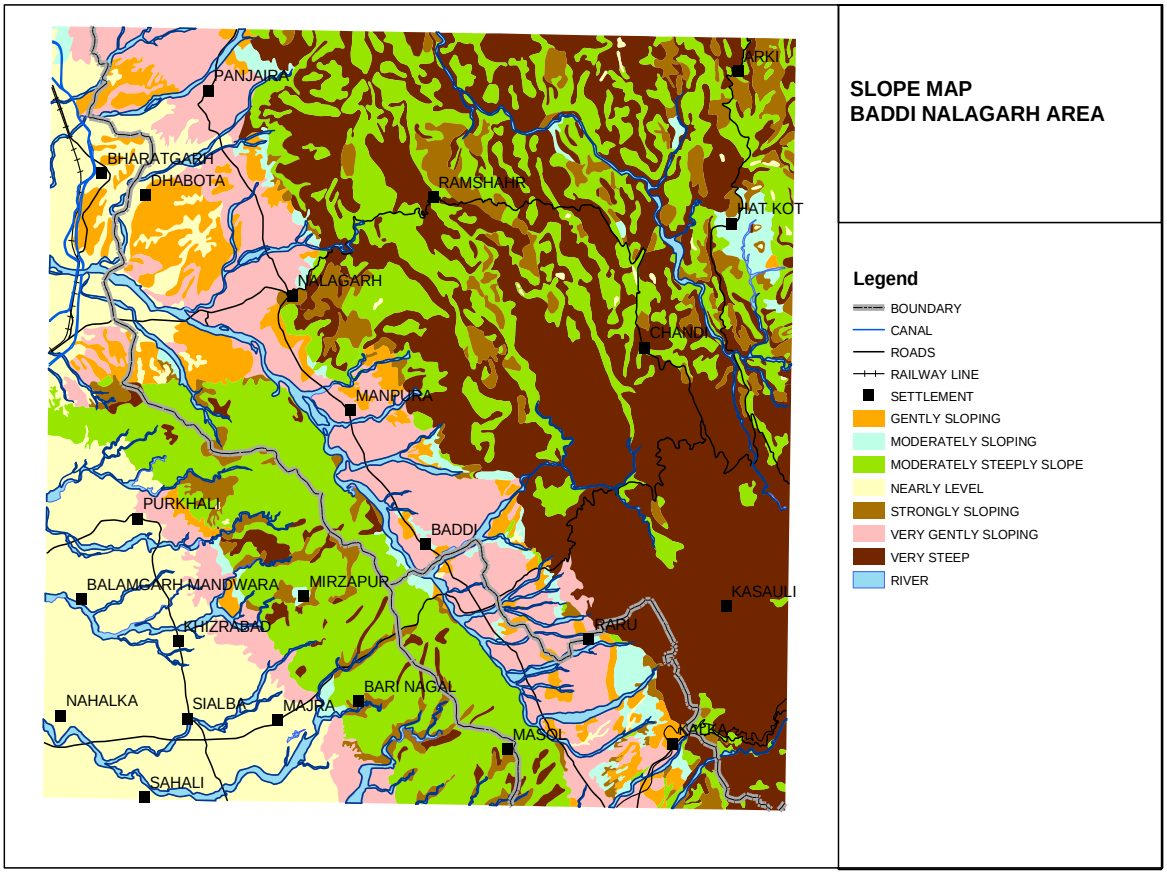
bedded with bright clay bands. The sandstone is gray or of light brown colour forming the topmost horizon of the lower Shiwaliks.

- **Middle Shiwaliks:** These consist of whitish coloured sandstone and bright coloured clay. In the east they are cut by Gambhar Thrust, which has brought older rocks over them. Their western boundary is also affected by a fault in this area.

2.4.3 Physiography/Slope

The slope represents the topography and study of this aspect is very important in assessing the impact of industrial pollution with respect to dispersion of pollutants and suitability of site for developmental endeavour. The slope map of the area and the region is shown in Fig- 2.3. The area possesses a varied topography. The map reflects that the slopes range from as low as 1% to as high as 35%. The sites are contained within an inter-montane valley with slopes varying between 1-3%. The settlements like Nalagarh, Baddi and Kalka are located within this valley. River Sirsa, which is the lifeline of study area, flows through this inter-montane valley. The valley has a northwest southeast trend and gradually it opens out into a piedmont plain in the northwestern direction (northwest of Nalagarh) where the slopes range from 1-3% (IEP Study, 2001).

Fig- 2.3 Slope Map of the Study Area



Source: Spatial Environmental Planning Centre, H.P.

This inter-montane valley is bordered on either side by high physiographic zones (slopes between 10-35%). Towards the east of this valley, the slopes are very steep and the range varies between 15-35% and beyond. These are mountainous tracts constituting of very high slopes and both reserved and protected forests cover most parts of it. In the extreme east, near Hatkot, the slope varies between 10-15% and in between these hilly tracts are areas of low-lying plains where the slopes range between 1-3% depicting an undulating topography. Such topographic expressions are also found in the north-eastern parts of the area. In the west too, steep slopes bound the valley and these hilly tracts stretch across the borders of the state into the adjacent district of Ropar, Punjab. Beyond these steep slopes, in plains of Punjab, the slopes vary from 1-3%. In the north-western part, which is also, a part of Ropar district, the topography is almost flat and the slopes vary here from 1-4%. In the southeast, the slopes vary from 2-4% within the inter-montane valley, the town of Kalka is located in this part and further east of Kalka.

2.4.4 Soils

The soils can be broadly classified as per the State Land-use Board. The soils in this tract vary from sandy loam to clayey. They are generally dry, shallow and deficient in organic matter. However, on the dip-slopes the soil depth is good unlike on the scarp faces and along top of ridges and spurs in the Sirsa valley, the soil is deep alluvium. As per the soil type/classification the valley area supports agriculture as an economic activity. It is not that no other developmental activity can be undertaken in the region but the need is to priorities different pursuits, in accordance with carrying capacity, which usher in sustainability rather than create conditions for irreversible environmental damages.

1. **Soils of side/reposed slopes- Typic Udorthents**: These are medium deep-to-deep, well drained, thermic, loamy-skeletal soils on steep slopes with loamy surface and severe erosion associated with medium deep, well drained, calcareous fine-loamy soils with loamy surface and moderate erosion. These soils occur to the south of river Sirsa valley.
2. **Soils of the fluvial valleys- Typic Ustifluvents:** Shallow, well drained, hyper-thermic, sandy soils on very gentle slopes with sandy surfaces and moderate erosion, associated with shallow well drained, coarse loamy soils with loamy surface and moderate erosion.
3. **Soils of piedmont plains- Udic Ustochrepts:** These are deep well drained, hyperthermic, coarse loamy soils on very gentle slopes with loamy surface and severe erosion, associated with medium deep, well drained, coarse- loamy surface and moderate erosion.

2.4.5 Climate

BBN area falls under semi-arid area as per the District Statistical Handbook, 2001, Solan, H.P. The climate is mostly sub-tropical. Winter, summer, rainy, and the autumn seasons are well marked. Rain is received during the rainy and the winter seasons but bulk of it is received during the rainy season. Generally, the rainy season commences from the first week of July and continues up to the last week of August. Winter rains generally commence from the last week of December and continues intermittently up to the end of February. October, November and March to June are relatively dry months. Maximum temperature in the area goes up to 45^0 C in the month of June and minimum temperature goes as low as 2^0 C. max. average rainfall in the area is

448.2 mm in the month of July. The rainfall data as per the Economic & Statistical Handbook, H.P. is given in Table- 2.2.

The data given indicate that there is a lot of seasonality in rainfall. The rainfall is mainly concentrated in monsoon months of July to September, leaving most of the year in dry conditions. In view of above there is a possibility of shortage of surface water in this region. The yearly distribution of rainfall also suggests that the rainfall in the region is around 1200 mm and that the rainfall has been generally consistent over the years.

Table- 2.2 Monthly Average Rainfall in the Study Area

Month	Average Rainfall	Average Temp. in ^{0}C		Wind Speed (Km/hour)		Relative Humidity	
		Maximum	Minimum	Morning	Evening	Morning	Evening
January	22.02	20.20	7.10	3.30	10.10	84.50	61.20
February	26.07	22.90	9.10	6.90	17.00	75.90	51.40
March	49.06	27.50	13.80	7.70	19.00	67.30	43.90
April	20.11	34.20	18.90	10.60	17.50	47.70	28.40
May	54.06	37.80	22.90	13.40	16.30	45.60	28.50
June	167.13	38.50	25.60	14	16.50	59.40	37.70
July	448.20	34.20	25.40	9.80	11.50	79.20	63.00
August	248.64	33.10	25.00	6.40	10.10	83.90	69.70
September	122.03	33.40	22.80	7.30	13.40	79.40	59.80
October	66.70	32.10	16.70	5.10	10.90	71.90	48.00
November	9.68	27.10	11.30	2.70	8.40	78.10	52.10
December	27.00	21.90	7.90	4.80	9.30	76.30	53.80
Total	**105.05**	**30.24**	**17.20**	**7.90**	**13.30**	**70.80**	**49.80**

Source: Economic & Statistical Handbook, H.P.

The figure clearly indicates that there is a vertical distribution of rainfall in the area. The rainfall is directly proportional to elevation of the area. Droughts are frequent from middle of April to the onset of monsoon. There is deficiency of water for cattle and human population. The ponds go dry and water has to be carried out from long distances particularly in lower tracts. Only a few places in higher hills have perennial springs. The predominant wind direction is NNW in the area. In view of above, it can be summarized that dependency on ground water both for domestic and agriculture are very high apart from industrial use. The quantity and distribution of rainfall or the availability of water is an important factor determining an economic activity. Any activity, which places acute demand on water (water polluting industries), creates environmental stress in the region. All factors such as physiography, soil type, water availability and distribution etc. are inter-related in determining the nature and type of activity in the region. The shortage of rainfall puts dependency on ground water both for domestic and other uses.

2.4.6 Drainage and Watershed

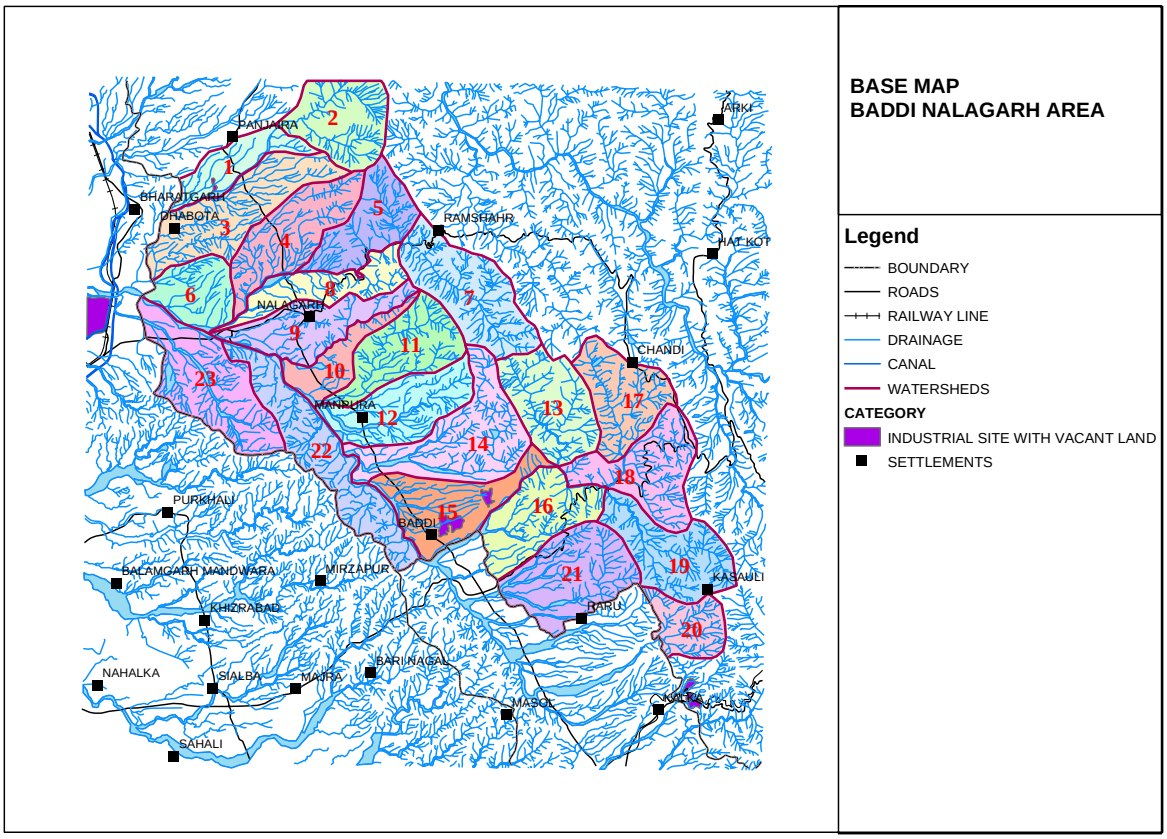
The study of watersheds and drainage lines of a region are very important for assessing surface water pollution sensitivity. The study of these natural features becomes more important in case of mountainous areas as most of the rivers and streams are in their upper courses and the discharge of untreated effluents in the upper stretches is likely to cause pollution in the downstream areas. The tract is a part of catchments area of tributaries of the Shiku, Mahadev ki Khad, Koaj, Kundlu Ki Khad, Ratta Nalla and Phalli Khud. Out of these, first five are perennial streams. Majority of these streams have discharge only during the rainy season. The volume of the flow and its duration depends upon rainfall received by the region.

As has been stated that the major river traversing the area is river Sirsa, which originates in the hills of the state and later it joins river Satluj in Ropar district. Another river that flows through the northeastern parts of the region is river Gambhar. In addition to these, a number of seasonal streams debouch from the mountains on to the valley floor. These nallas carry the surface runoff to river Sirsa. Due to industrialization, some of these seasonal drains have transformed into effluent channels. The Balad Nadi and Ratta Nalla, in the southern part and Kundulu-ki-Khad in the northwestern part of the area are the only natural tributaries of river Sirsa (IEP Study, 2001). Drainage map of the region predominantly showing the study area is given in Fig- 2.4, page- 18.

In the present case, the region is composed of structural, denuded and residual hills with undulating plains. Two major rivers- Sirsa and Gambher serve it, in addition to these there are numerous nallas and streams, which emanate from the surrounding hills. In the northeastern part of the region, Gambher is the main river. The only natural tributary of river Gambher is Kum Khad.

River Sirsa, with a mainstream channel length of 41 Km. flows almost through the central part of the area i.e. through the inter-montane valley, originates in the southeastern hills of the state and then flows into Haryana, where the Sitomajri Nalla joins it. The river then again flows into Himachal Pradesh wherein several seasonal nallas dissecting the valley floor join it at almost right angles. The catchment area of river is 672 Sq. Km. The river catchment lies below snowline and mainly draws its flow from the precipitation during rainy season. The industrialization is primarily confined to a river stretch of 23.0 Km (2.0 Km in Haryana and 21 Km in H.P.), starting from upstream of confluence point of first point pollution load i.e. Sitomajri Nalla to downstream of Nalagarh Bridge. These nallas are Sandholi drain, Housing Board Nalla and Gullerwala Nalla. Balad Nadi, at the head of which EPIP-1 is located and Ratta Nalla at the head of which EPIP-2 is located, are the two major tributaries of river Sirsa in the southern and central part of the study area. River Kohanan joins river Sirsa further downstream of Nalagarh near Dhabota in the northwestern part of study area. Nalagarh, Baddi, Barotiwala and Kalka are the major settlements located in the watershed of river Sirsa.

Fig- 2.4 Drainage Map of the Study Area



Source: Spatial Environmental Planning Centre, H.P.

There are numerous nallas and smaller streams embarking from the mountains and joining river Sirsa and river Gambher. The drainage density as well as drainage frequency is quite high in the eastern, southeastern and northeastern parts of the region. The high drainage frequency and density coupled with low infiltration rates especially in the hills cause high runoff in monsoons, which reach river Sirsa through nallas and streams. The perusal of drainage and watershed map shows that the valley area comprising of sub-watershed no. 9, 10, 12, 15, 16, 21 and part of 14 are areas predominantly supporting the agriculture activity, which is gradually being encroached upon by the industrial enterprises leading to unsustainable scenario (IEP Study, 2001).

2.4.7 Hydro-geomorphology

The hydro-geomorphology gives detailed information regarding the formation of various geomorphic units, landform features, composition of these features and groundwater prospects in the study area. It thus provides the necessary information for taking decisions regarding protection of resource areas and siting of industries that are likely to pollute groundwater. The hydro-geomorphic units within the region can be categorized into three types as per their origin. They are a) Fluvial origin b) Denudational origin and c) Structural origin.

a) Fluvial Origin: The word 'fluvial' derived from the Latin word *'fluvius'* means 'river' and thus pertains to the work of a river. However, in the context of landscape development, it also includes the water dominated, preconditioning of rock debris by weathering and mass wasting. In the region, the hydro geomorphic features that have a fluvial origin are viz. i) Channel bars, ii) Floodplains, iii) Erosional valleys, and iv) Ravinous lands.

b) Denudational origin: These features are usually formed on account of degradation or removal of volume of rocks through specific time interval. Denuded geomorphic features thus reflect the progress of sequential evolution of landscapes. In the area, most of the features have originated from the process of denudation and have very poor to nil prospects of groundwater reserves. These denuded features comprise of i) Denudational Hills, ii) Residual hills, iii) Inter-monatane valley, and iv) Piedmont plains.

c) Structural Hills: Structural Hills of structural origin are also found within the region. These are linear to arcuate hills with definite trend lines constituting of quartzite of Dagshahi formation. The structural hills are not good reservoirs of groundwater.

In these mountainous tracts, groundwater is the prime source for residential, commercial and industrial purposes. Wells of various types, such as the open dug wells are found in the inter-montane valleys, in the upper and lower piedmont plains in the northwestern and southwestern parts of the region where there are gentle slopes with good to moderate prospects of groundwater. Dug cum bore wells are more common in the denuded hills of the state. Though there are numerous lineaments found scattered all over the region, there are very few natural reservoirs of groundwater as in most cases the lineaments are found at considerable depth and are overlain by impermeable strata which hinder unscrupulous exploitation of groundwater. This is especially true in case of high physiographic areas.

2.4.8 Groundwater

Groundwater is extensively used within the study area for all purposes, i.e. industrial, commercial and residential. Groundwater is the sole source for drinking water as the surface water quality is not very conducive for drinking purposes. River Sirsa is getting polluted down stream of four nallas, which are used mostly for discharge of industrial effluents, and sewage that finds its way into it. In the high physiography areas too, springs are the source of drinking water. Ground water depth varies from 25-35 feet. Soil in the area being sandy to clayey loam encourages high infiltration rate. The study area lies under high ground water potential, leading to high ground water use thereby catering to portable water supply needs of population. This fact alone is very critical because any pollution in the areas ultimately reaches ground water. The prevalence of open dug wells and dug cum bore wells emphasizes the widespread use of groundwater within study area. Due to the growth of industrial activity the ground water levels have been put to tremendous strain (Hydro-geological Investigations, Nalagarh, EPTRI, 2000).

The rainfall, temperature and withdrawal of ground water influence the ground water level. If the groundwater withdrawal exceeds groundwater recharge, the water table is depleted and no

replenishment takes place. To observe the trends of ground water level fluctuation water level data of the Central Ground Water Board observatory wells for the last 20 years in area was studied. Ground water is being used mainly for irrigation, and now to large extent for industrial and domestic purposes. The ground water level in Baddi and Nalagarh area is reasonably shallow. Depth to water level varied from 5.5 to 6.3 m below ground level. Long term water level fluctuation of Kerachak and Baddi shows rising trends on an average of 0.11m per year for last 20 years except for some isolated patches near Palahi- Jagatpur where the average decline is 0.05 m per year. Although due to constant and very heavy rainfall, the groundwater recharge is more or less good over the past few years but is now showing alarming trends due to over extraction by industrial activity. The seriousness of scenario can be gauged from the fact that 18,377 KL/D groundwater is extracted by the existing industries and 1,942 KL/D groundwater is extracted for the domestic purposes and it is going up. If this continues there is a likelihood of area facing acute water shortage problems in the times to come.

2.4.9 Flora

Flora- General description: The altitudinal differences coupled by the aspect and biotic influence have caused diversity in the vegetation type in the region. The climatic differences in the tract, which are tropical in lower elevation and sub tropical at higher elevation, result in development of two main types of forests namely Tropical Dry Deciduous Forests and Sub Tropical Pine Forests (Forest Working Plan, Nalagarh). The microclimatic changes due to the aspect and exposure of local changes of rock and soil however are found projected in the lower zones and vice versa. In the lower elevation khair, bamboo with other broad-leaved species like chhal, simbal, jhingan etc. are met whereas in upper elevation chil is the main species.

Following forest types confirming to Champion and Seth Classification-Revised Survey, 1968 occur:

A. Group 5 Tropical Dry Deciduous Forests:

Sub-group 5B-Northern Tropical Dry Deciduous Forests.

1. Type 5 B/C2 Northern Dry Mixed Deciduous Forests
2. Type 5 B/C2 DSI Dry Deciduous Shrub Forests.
3. Type 5 B/C2 E9 Dry Bamboo Brakes.

B. Group 9 Sub-tropical Pine Forests:

1. Type 9/C/1a Lower or Shiwalik Chirpine Forests.
2. Type 9/C/1b Upper or Himalayan Chirpine Forests.
3. Type 9/CI/DS2 Sub-tropical Euphoria Shrub Forests.

C. Group 12 Himalayan Moist Temperate Forests:

1. Subgroup 12/ CI Lower Western Himalayan Ban oak (*Quercus incana*) Forests.

2.4.10 Land-use/Land cover

In spatial planning, the land use map is the most important tool for ensuring sustainability (IEP Study, 2001). It gives an idea about the availability of land, its present use and future development potential. The study of the present land uses also enables us to understand the

impact of the anticipated industries upon the surroundings and accordingly decisions regarding the type of industries to be allowed within the region can be taken. It also helps us to conceptualize a definite land use control plan for environmental management within the zone of influence. The land use map (Fig- 2.5 refer page- 22) shows the following features: a) Forests, b) Wastelands, c) Agriculture, d) Water bodies, e) Industrial areas f) Roads/railways g) Built-up-land.

a) Forests: Approximately 30% of the region is covered under forests, and most of which are concentrated in the state. The forests cover the steep slopes on either sides of the inter-montane valley. Legally, they can be divided into two broad categories:
i) Reserved Forests: The reserved forests are found in a stretch on the denuded hills, in the western parts of the inter-montane valley. They are also found in the central parts of the study area, close to the sites of EPIP-1 and EPIP-2 (on the steep slopes, east of the inter-montane valley). Reserved forests are also located in the southeastern parts of the study area.
ii) Protected Forests: The protected forests, within the study area, are concentrated in the state only and spread all over the denuded and residual hills in the northern, northeastern, eastern and southeastern parts of the study area.

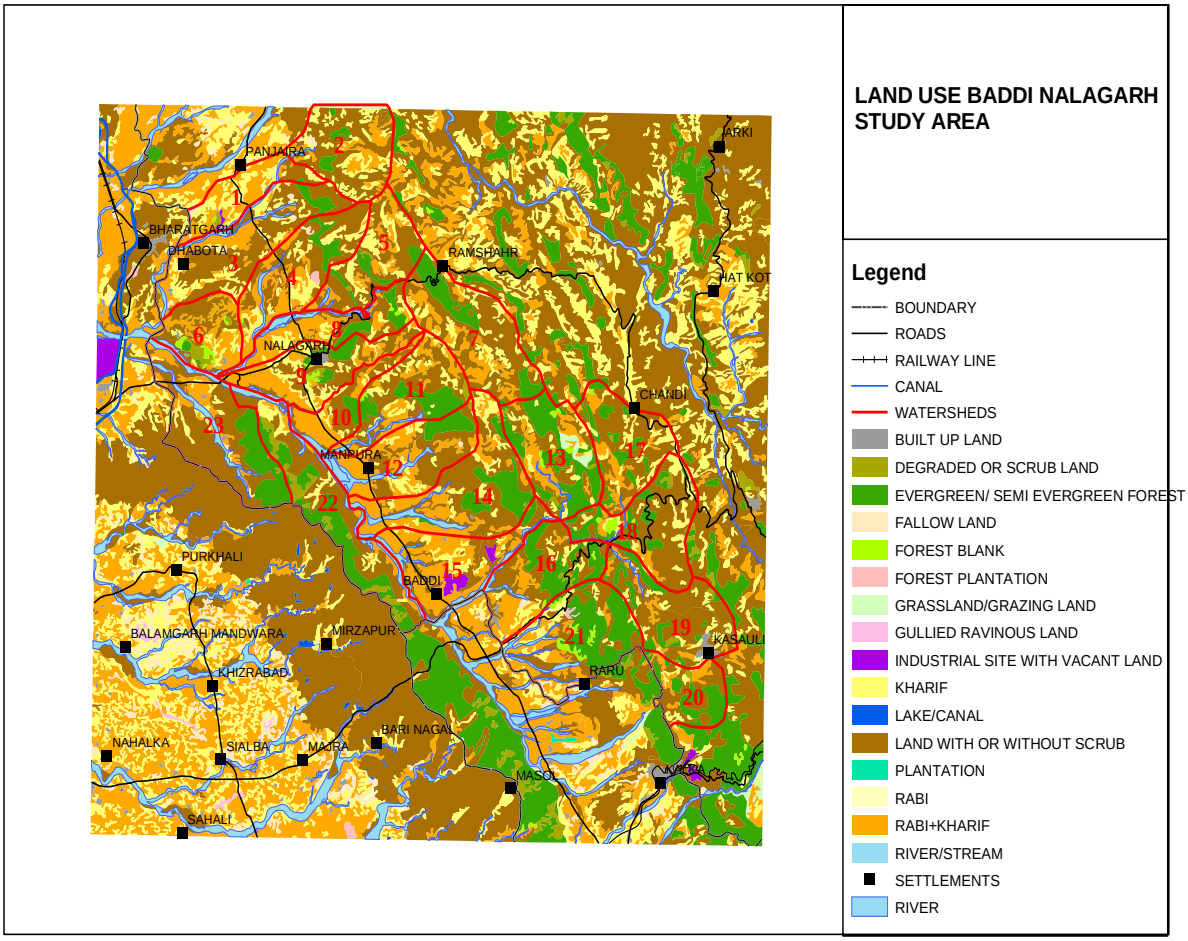
b) Wastelands: Wastelands are usually degraded lands, which are not agriculturally productive. Wastelands are formed on account of inappropriate management of soils and water. These are also formed both due to natural and anthropogenic causes. There are only two categories of wastelands found within the study area. They are land with or without scrub and gullied and ravinous land. Prima facie this category of land has the potential of being used for purposes such as setting up of industrial estates, afforestation activities, supportive urban infrastructure development. The decision to prioritize should be based on environmental cost benefit analysis rather than the whims of the different players of developmental sector. It is of two type viz. i) Land with or without scrub and ii) Gullied and ravinous land.

d) Water bodies: Sirsa as stated is the main river within the area, which originates in the state and travels through the inter-montane valley to join river Sutlaj in Punjab. This has been discussed in detail in the earlier paras. The growing industrial activity in the region is putting pressure on water resources both surface and ground water not only in terms of use but also in increasing contamination risks.

c) Agriculture: Agricultural land constitutes the major portion of the region. However, it is concentrated mainly within the inter-montane valley and the piedmont plains in the northwestern and southwestern parts of the region as the topography is conducive for practicing agriculture. The doubled cropped lands are concentrated within the valley. Agriculture is also practiced in the northwestern part and agricultural fields are found in patches scattered in the northern, eastern and northeastern parts of the region. The single cropped lands are found scattered all over the area. They are found mostly interspersed with the double-cropped lands in the eastern parts of the area. Single cropped lands are found in the upper inter-montane valley and in the north, on the upper piedmont plains (Annual Report, 2004, Deptt. of Agriculture). The pressure on land for industrial activity is fast resulting in a scenario wherein, the agriculture land is being increasingly

put to use for industrial activity causing changes in demographic pattern and resulting in evils of industrialization threatening the sustainability of the region.

Fig- 2.5 Land use Map of the Study Area



Source: Spatial Environmental Planning Centre, H.P.

e) Industrial areas: The BBN zone is increasingly getting industrialized and there are three industrial estates existing in the area- Baddi, Barotiwala and the Parwanoo industrial estates. There are about 200 large and medium industries and 850 small scale units employing 46,000 people (Deptt. of Industries, H.P.) and with a varying degree of pollution load pertaining to air; water and land have come up in the area and many more are in the pipeline.

f) Roads/railways: The area is well connected to other parts of the country by means of road network. The National Highway-21 A traverses through the area connecting the BBN industrial zone to Haryana, Punjab. The National Highway- 21 passes through the southeastern parts of the region, near Kalka, Haryana. In addition, there are state highways passing through the study area. As the sites are contained within a valley, they are not well connected by rail network.

g) Built-up-land: The land use map shows very few settlements (District Statistics Hand Book, 2001). Due to unfavorable terrain conditions, the settlements are sparse and scattered. The

valley contains two major settlements- BBN. In the southeastern part of the area, Kalka is the most important settlement. The land use pattern of the study area is as listed in Table- 2.3. The area under industrial, commercial and residential activities have increased significantly in the lower catchment during the last two decades. The study area has about 25% of agriculture land, which is quite high as compared to the state as it is a fertile valley. Lately on account of industrialization there is a mark shift wherein the agriculture land is getting converted for industrial development. Due to the extensive industrialization in the area, land under industrial use increased from 0.43% to 9.76% in the Baddi-Barotiwala area.

Table- 2.3 Land Use Pattern in the Study Catchment

S. No.	Particulars	Land (Hectare)	Percentage of Total
1	Total Cultivated Land.	18,124	25.66
2	Waste Land.	16,820	23.82
3	Forests.	10,204	14.45
4	Fallow Land.	3,019	4.30
5	Permanent Pasture and Grazing.	17,432	24.68
6	Other (industrial, commercial, residential).	5,006	7.09
7	**Total:**	**70,605**	**100**

Source: District Statistics Hand Book, 2001

2.4.11 EXISTING INDUSTRIES/MINES AND MINERALS

The BBN industrial corridor is situated on the NH 21-A in Solan district. The industrial growth has been rapid due to numbers of incentives extended by the state and central governments such as central excise exemption, sale tax exemption and income tax holiday etc. The availability of the uninterrupted and cheap electricity and proximity to the major towns of adjoining states of Punjab, Haryana and UT Chandigarh also attracted the entrepreneurs to set up the industries in the area. The existing industries depict the development of secondary sector within the study area. In case of BBN industrial estates, the industries mostly show a linear pattern of development as they have mostly developed along NH-21A, especially in the northwestern parts. However, in the central parts, the industries have clustered mainly on account of three reasons viz. terrain, accessibility and proximity to discharge points. Most of the industries have clustered in the inter-montane valley, close to the national highway, along the seasonal nallas that are used for discharge of effluents. There are three major industrial areas located within the central, northern and southeastern parts of the region. Baddi and Barotiwala industrial areas are located in central, Nalagarh in nortnern and Parwanoo industrial area is located in the southeastern part.

The Baddi-Barotiwala-Nalagarh industrial corridor supports about 200 medium and large, and 850 small scale units, employing a work force of more than 46,000 persons. In addition, the state government has developed two more Industrial Parks (EPIP-1 & II) over an area of 450 acres (IEP Study, 2001). The government has extended the income tax holiday and exemption in central excise duty up to 2010. It is also providing capital subsidy over the next 10 years. The

above schemes are available both for the new industries as well as for expansion of existing units. The thrust of the government is to have more industries in the state for economic growth and to provide employment opportunities to unemployed youths. In addition to these, there are several large-scale industries and clusters of small-scale industries concentrated in the northwestern parts of the region. There are several stone crushers and brick kilns present within the study area. The stone crushers are present mainly in the beds of river Sirsa and along NH 21-A. They are concentrated in the central parts of the study area within the inter-montane valley, close to the Baddi industrial area, in the northern parts of the study area near Dhabota and in Punjab, along the state highway. There are a total of 26 stone crushers in the region, out of these 9 are located in the Baddi-Barotiwala region and the remaining 17 are in the Nalagarh region. The brick kilns are found mostly in a scattered manner. Some of them are present within the valley near Ratta Nala and Baddi area. They are also found on the predominant plains of Punjab in the southwestern parts of the region along the state highway- near Sialba and Purkhali. Besides above, the brick kilns also exist in the north-western parts of the study area in adjoining state Punjab.

2.5 HUMAN ENVIRONMENT

The rapid industrialization has caused serious environmental degradation in the area. Initially when the energy of human pursuits was focused in the primary sector i.e. agriculture there was symbiotic relationship amongst different pillars of sustainability viz., environment, sociology, economy, infrastructure and human resources. Resultantly, sustainability existed in somewhat purest sense in our rural areas. Later on, with our quest for industrialization /development/economic growth led us to the situation wherein we failed to integrally enhance these five assets of sustainability, resultantly we created number of social and environmental problem for ourselves. The physiographic considerations along with other factors should have been kept in mind for propelling the engines of development rather than having a single-minded pursuit for industrialization. The land capability classification and the resultant use it can be put to should have been the prime consideration for siting of the development activity.

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Chapter-3
Corporate Social Responsibility & Sustainable Development

3.1 CORPORATE SOCIAL RESPONSIBILITY

3.1.1 Background Statement, Problem & the Challenge

As stated, the state located in northern part of India; forms the catchment of major rivers of northern India on which the agrarian economy of entire region is dependent. The BBN industrial corridor is a flagship industrial area of the state wherein exists about 450 large and medium and 3,194 small scale units with a varying degree of pollution load pertaining to air, water and land. Most of the industrial units and habitation coexists in the sub-watersheds of the four drains in the industrial region, which ultimately drain in to river Sirsa. The combined waste from all these drains finally reaches the river. With unsustainable practices in the area, there has been a quantum increase in generation of municipal, bio-medical and the industrial wastes including hazardous waste, air and water pollution which has put the entire area in the category of 'critically polluted'. With the dimension of problem and effects that are not only confined to short term it is bound to adversely aftermath environment and ecology in the times to come, such industrial development is unsustainable with practices that could irreversibly harm the environment with the result that effort both in physical and financial terms would be far more for mitigation than the profits yields expected by the industrialization. The escalating population and their congregations and the unsustainable industrial activities/practices present before the government the challenges to provide clean environment to its populace in a manner that caters not only to present but also future the generations.

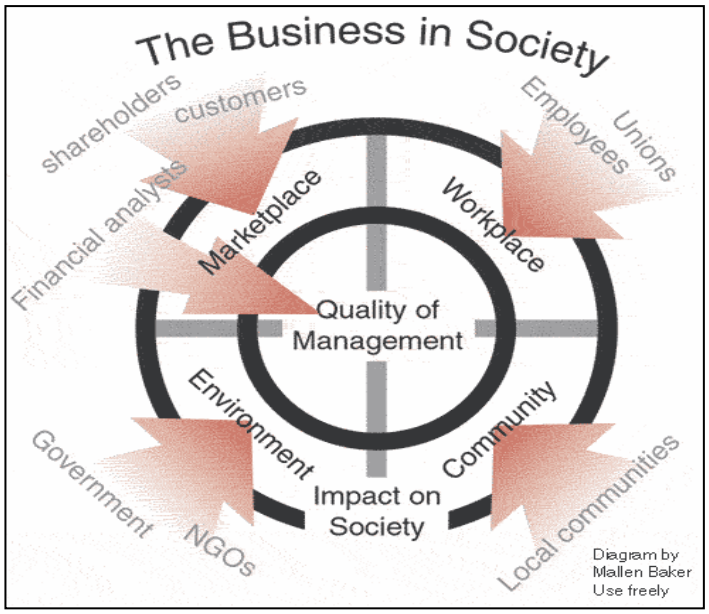
3.1.2 Changing Paradigms

Although the main function of an enterprise is to create value through producing goods and services that society demands, thereby generating profit for its owners and shareholders as well as welfare for society, particularly through an ongoing process of job creation. However, new social and market pressures are gradually leading to a change in the values and in horizon of business activity. There is today a growing perception among enterprises that sustainable business success and shareholder value cannot be achieved solely through maximizing short-term profits, but instead through market-oriented yet responsible corporate behaviour. So the business community has to behave ethically and contribute to economic development while improving the quality of life of the workforce, their families, local community and society at large so that all capital assets are integrally enhanced. The challenge is to integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis. As a part of state policy, the UK Government sees CSR as the business contribution to sustainable development goals. Essentially it is about how business takes account of its economic, social and environmental impacts in the way it operates – maximizing the benefits and minimizing the downsides. In UK, Malcolm Wicks is the new

Minister with key responsibilities for energy, sustainability and the environment, including CSR which is an indication of new wave and changing paradigms.

3.1.3 Business Environment

These pressures form the part of the external environment viz. task environment and societal environment, which consists of variables that are outside the organization and not typically within the short-run control of the top management and form the context within which the business unit exists and operates. Out of these, the task environment includes those elements viz. shareholders, governments, suppliers, local communities, competitors, customers, creditors, labor unions, special interest groups, and trade associations that directly affect and are affected by an organization's major operations. Whereas, the societal environment includes more general forces viz. economic, socio-cultural, technological, and political-legal forces in relation to firm's total environment -those that do not directly touch the short-run activities of the organization but that can, and often do, influence its long run decisions (Fig.-3.1).



The internal environment consists of variables that are within the organization itself but not usually within the short run control of the top management. These variables form the context in which the work is done. They include corporation's structure, culture, and resources. A primary goal in strategic management is usually to combine these internal corporate variables to give the firm a distinctive competence, enabling it to attain a sustainable competitive advantage- and thus generate profits. Companies need to answer two aspects of their operations viz. The quality of their management- both in terms of people and processes (the inner circle Fig.-3.1) and the nature of and quantity of their impact on society in the various areas. Outside stakeholders in present times are taking an increasing interest in the activity of the company.

3.1.4 The CSR Concept

Traditionally in the United States, CSR has been defined much more in terms of a philanthropic model. Companies make profits, unhindered except by fulfilling their duty to pay taxes. Then they donate a certain share of the profits to charitable causes. It is seen as tainting the act for the company to receive any benefit from the giving. The European model is much more focused on operating the core business in a socially responsible way, complemented by investment in communities for solid business case reasons. According to World Business Council for Sustainable Development (URL: http://www.wbcsd.org/) this model is more sustainable because:

1. Social responsibility becomes an integral part of the wealth creation process - which if managed properly should enhance the competitiveness of business and maximize the value of wealth creation to society.
2. When times get hard, there is the incentive to practice CSR more and better - if it is a philanthropic exercise which is peripheral to the main business, it will always be the first thing to go when push comes to shove.

But as with any process based on the collective activities of communities of human beings (as companies are) there is no *'one size fits all'*. In different countries, there will be different priorities, and values that will shape how business act. The World Business Council for Sustainable Development in its publication *'Making Good Business Sense'* by Lord Holme and Richard Watts used the following definition: *'Corporate Social Responsibility (CSR) is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large'*. Companies are aware that they can contribute to sustainable development by managing operations in such a way as to enhance economic growth and increase competitiveness whilst ensuring environmental protection and promoting social responsibility, including consumer interests. The sustainable development is all about integrally enhancing five capital assets viz. economy, sociology, environment, human and infrastructure.

In addition to integration into corporate structures and processes, CSR also involves creating innovative and proactive solutions to societal and environmental challenges, as well as collaborating with both internal and external stakeholders to improve CSR performance. Generally speaking, CSR is about how companies manage the business processes to produce an overall positive impact on society. CSR also overlaps and often is synonymous with many features of other related concepts such as corporate sustainability, corporate accountability, corporate responsibility, corporate citizenship, corporate stewardship, etc. It is a tool whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis. While CSR does not have a universal definition, many see it as the private sector's way of integrating the economic, social, and environmental imperatives of their activities. As such, CSR closely resembles the business pursuit of sustainable development and the *'triple bottom line'*. In addition to integration into corporate structures and processes, CSR also involves creating innovative and proactive solutions to societal and environmental challenges, as well as collaborating with both internal and external stakeholders to improve CSR performance.

IBM and Motorola are among the *'most respected'* as CSR leaders besides being successful- and these are companies have been much more strongly associated with the CSR movement. Sir John Browne of BP is widely respected as having led BP into a strong position as one of the world's leading companies - and few have done more than BP to come to terms with the emerging issues that fundamentally challenge its purpose in being. Companies like Johnson & Johnson-also in the *'most respected'* leagues, survived potential crises precisely because they took a swift and

principled approach when it mattered most. Jack Welch of General Electric has gone on record as saying that he believes *'the time has passed when making a profit and paying taxes was all that a company had to worry about'*. The market capitalisation of a company often far exceeds the *'property'* value of the company. For instance, as much as 96% of some leading and known brands are made up of *'intangibles'* - a major part of which rests on the reputation of the company. Only a fool would run risks with a company's reputation when it is so large a part of what the shares represent.

3.1.5 CSR Benefits

CSR commitments and activities typically address aspects of a firm's behaviour (including its policies and practices) with respect to such key elements as: health and safety, environmental protection, human rights, human resource management practices, corporate governance, community development, and consumer protection, labour protection, supplier relations, business ethics, and stakeholder rights.

3.1.6 Empirical Relationship

But the lack of knowledge on clear-cut empirical relationship between social responsibility and the bottom line creates a situation wherein CSR can be thought to be irrelevant for the successful corporate performance. *Now under what circumstances a firm does jointly serves its strategic business interests and the societal interests of its stakeholders?* Without the clear-cut strategic benefits that may accrue to the organization, it is more likely that top management would not invest in CSR practices and view it as charity exercise. Now the question is *how*, *when* and in *what* ways CRS activities jointly serve economic and societal interests. It happens so when CSR becomes 'strategic' according to Lee Burke & Jeanne M. Logsdon, in his article *'How Corporate Social Responsibility Pays Off'*, Long Range Planning, Volume 29, No. 4, pp. 495 to 502, 1996**.**

3.2 STRATEGIC CSR

CRS is 'strategic' when it yields substantial business related benefits to the firm, in particular by supporting core business activities and thus contributing to the firm's effectiveness in accomplishing its mission. Value creation is viewed as the most critical objective for the firm and its strategic decision making process. There are five dimensions of corporate strategy viz. centrality, specificity, proactivity, voluntarism and visibility (Lee Burke et al., 1996) which are both critical to the success of the firm and useful in relating CSR policies, programmes and processes to value creation by the firm.

- **Centrality:** It is measure of the closeness of fit between a CSR policy or programme and the firm's mission and objectives. Actions or programmes having high centrality receive priority within the organization and yield future benefits, ultimately translated into profits for the organization. Merck's decision to develop/distribute Mectizen- river blindness drug gave it a dimension of centrality. Other examples include: funds spent for drug research and testing, design, testing and manufacture of air bags for automobiles etc.

- **Specificity:** It refers to firm's ability to internalize the benefits of CSR programme, rather than simply creating collective goods, which can be shared by others in the industry, community or society. Example: philanthropic contributions, externalities and public goods, R&D, effective PCDs, cogeneration technology/CP/waste minimization etc.

- **Proactivity:** It refers to the degree to which behaviour is planned in anticipation of emerging economic, technological, social or political trends and in the absence of crisis conditions, e.g. employees' education and retraining programmes, effective PCDs, new smoke screen technologies to meet prospective regulations, planning for CFC substitutes.

- **Voluntarism:** It indicates the scope of discretionary decision-making and the absence of externally imposed compliance requirements. Example: airline exceeding FAA inspection and maintenance requirements.

- **Visibility:** It denotes firm's observability of a business activity and the firm's ability to gain recognition from internal and external stakeholders. It has both positive and negative consequences for the firms. (+ve) Forms of visibility include: favourable media mention, strong earning announcements, stock price run-ups, successful new product launches. (-ve) Forms include: fraud investigations, indictment or sentencing company officials, drug side effects, toxic contamination of waste disposal sites.

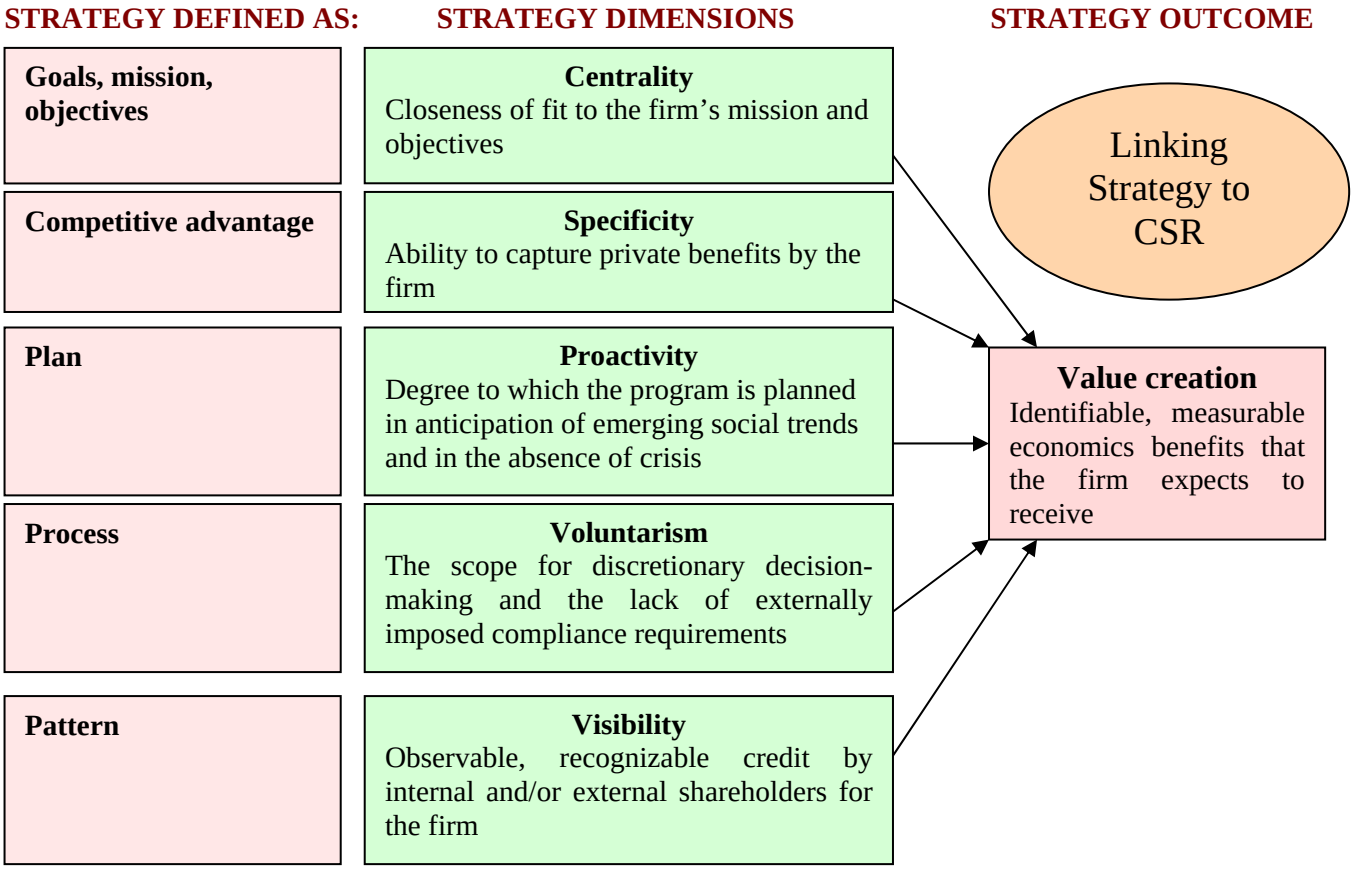
3.2.1 Value Creation as Strategic Outcome

The ultimate measure of strategic benefits from CSR activities is the value they create for the firm. Value creation refers to the readily measurable stream of economic benefits that the firm expects to receive. If we recognize the long-term investment characteristics of CSR then normal business decision rules would select CSR activities, which yield the highest total payoffs in terms of collective benefits to the firm and its shareholders and fall within the range indicated for strategic CSR (Fig-3.2, page- 33).

Therefore, the firms by correct perception and analysis of task and societal environment can convert threats in opportunities and weakness into strength by linking strategy to CSR and jointly serve societal and economic interests (Lee Burke, et al., 1996). In the study area the strategic CSR as a strategy is missing except for some units, therefore, factories need to integrate this as a business strategy by followings the tenets of cleaner production, waste minimization etc.

In this way the private sector would be able to integrate the economic, social, and environmental imperatives of their activities in business and practice the tenets of sustainable development and pursue the *'triple bottom line'* besides harnessing other benefits viz. reduced costs; increased business leads; increased reputation; increased staff morale and skills development; improved relationships with the local community, partners and clients; processes, products and services innovation; and managing the risks the company faces.

Fig-3.2 Strategic CSR



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Chapter-4
Environmental Status of the Area

4.1 HAZARDOUS WASTE, MUNICIPAL SOLID WASTE AND BIO-MEDICAL WASTE- THE QUANTUM

The preparedness for managing the hazardous waste, municipal solid waste and bio-medical waste in the country can be gauged from the fact that no reliable figures are available about the quantum of these wastes. As regards the hazardous wastes, the MoEF informed the Apex Court in January 2000 that the total quantum of hazardous wastes generated was 9 million tones per annum. In February 2000, the figure was brought down by MoEF to 8 million tones per annum, whereas in May 2000, it was further brought down to 4.4 million tones. Now the question arises as to what is the correct figure, any future strategy would be meaningless. The situation w.r.t. the quantum of MSW is no different. Some statistics reveal that there are more than 13,000 units generating solid waste in India and the amount generated is 4.4 million tones per annum whereas some state that the average generation of municipal solid waste in India is approximately 100,000 ton per day from 4,378 cities. Further, as per the Health Ministry Estimate, Govt. of India the infectious bio-medical wastes generated from hospitals in India vary from 0.25 to 0.5 million kgs per day. Although no reliable data exists, one fact should not be forgotten that we are sitting on the heap of garbage ticking like a time bomb and if not managed properly the situation would worsen and explode in the times to come.

4.2 THE TERI REVIEW

- In India we have an annual growth of around 5% in waste generation. According to The Energy & Resource Institute (TERI) in the last five years, the total generation of waste has gone up from 47 million tones in 1997 to 60 million tones in 2002, representing an annual growth of around 5%.
- Total waste generation was at 6 million tones at the time of Independence. The figure is likely to increase 5 times by 2047. India will require 1,385 Sq. Km. of land to dispose and secure this waste.
- Even more frightening, is the fact that over 58% of total farm land in the country is today affected by either water-logging or salination, up from around 34% during independence. If nothing changes, 80% of land will be degraded by 2047.
- Air pollution resulted in 2.5 million premature deaths in 1997. For economy as a whole, if the impact of poor air and water on health, and therefore productivity, is added to the loss due to soil degradation, the annual loss could be as high as 10% of GDP each year.
- Per capita water availability in the country has fallen 62% since independence, and by 2047, seven of India’s 20 agro-ecological zones are likely to face water scarcity.

- Just 70% of the population in Class-I cities has access to basic sanitation, and just 30% of waste water is treated in these cities. The remaining untreated sewage from urban areas finds its way into the rivers and the water we drink and bathe in.

4.3 THE ENVIRONMENT

The term *'environment'* is considered as *'a composite term for conditions in which organisms live and thus consists of air, water, food, and sunlight, which are the basic need of all living beings and plant life, to carry on their life functions'*. In other words environment consists of both biotic and abiotic substances including energy. The abiotic, nonliving or physical environment includes all nonliving factors of biosphere and is sub-divided onto three categories viz., lithosphere, hydrosphere and atmosphere. The biotic component of environment consists of flora and fauna including humans. The energy component of environment includes all forms of energy such as solar energy, geo-chemical energy, thermal energy, hydel energy etc. The factors such as topography, climate, edaphic and biotic affect the environment. The environment has been defined in number of ways:

- Environment is the sum of all social, economical, biological, physical or chemical factors, which constitute the surrounding of man, who is constituent, creator, and molder of this environment.
- Environment refers to the sum total of conditions, which surround a man at a given point of time in space and time.

Environment is thus a dynamic entity and keeps changing, some time slowly, sometime rapidly or drastically. Their environment affects all organisms including humans and any changes brought about in it may benefit or harm the living organism living in it. Therefore, every living species of plants or animals influences its environment and in turn get influenced by it, resultantly, the environment pollution. Environment includes water, air, and land and the inter relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organisms and properties (Environment (Protection) Act, 1986. Further, the *'environment pollution'* means presence in environment of any *'environment pollutants'* which in turn means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to it. Therefore, the objectives of environment management need to be viz. maintenance of environmental quality; balancing the ecosystem; restricting and regulating the exploitation of natural resources; protecting the environment from degradation; renewing natural resources and reducing natural disaster; adopting engineered technology without crating adverse effect on the environment; and formulating laws and regulation to control pollution (Das R.R., 2005).

4.4 THE ENVIRONEMTAL ISSUES

The problem of water and air pollution in the area has assumed alarming proportions in recent years due to several contributing factors such as unplanned industrial and civic growth, lack of civic amenities, inadequate waste management viz., industrial waste and urban waste, health, safety and sanitation. As per the environmental legislation, the state boards and other agencies

are required to ensure maintenance of pristine environmental quality. This means that all industrial units install and operate required effluent treatment and emission control systems to achieve the required standards as prescribed under the law. The state board, as part of its surveillance responsibility has to regularly monitor these for performance. The discharge of untreated or partially treated effluent from residential and industrial areas, the municipal, commercial and industrial solid wastes, and liquid discharges not conforming to the prescribed norms, results in pollution. Resultantly, the water quality of river Sirsa, and nallas draining into it, has shown deterioration. Also, the river Sirsa passes through other neighboring states, which too have been raising concerns. The regulators and developmental agencies have been striving to overcome this problem, but nothing substantial has come out of the efforts made so far, as these were largely disjointed and fragmented.

4.5 THE AIR ENVIRONMENT

The air constituting atmosphere is mixture of gases. The presence of one or more contaminant such as dust, gas, mist, odour, smoke, smog, or vapour in outdoor atmosphere, in quantities, of characteristic, and of duration so as to be injurious to human, plant and animal life or to property which unreasonably interfere with life and property is known as air pollution (Rao C.S., 2002) The *'air pollutant'* as per the Air (Prevention & Control of Pollution) Act, 1981 means *'any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or properties or environment'*. The air pollution is caused either due to natural or due to anthropogenic causes. The natural causes responsible for air pollution are viz. volcanic eruption releasing SO_2, H_2S, CO etc; forest fires; marsh gases; decay products of natural organic and/or inorganic substances; dust; pollen, spores etc. – aeroallergens. Further, the anthropogenic causes responsible for air pollution are viz. increase in population; deforestation; industrial, vehicular, and domestic emissions; burning of fossil fuels; agriculture activities etc. These activities cause basically two types of contaminations in the air i.e., particulate which remain suspended in the air and gaseous, and which change the normal gaseous composition of air (Sharma V.K., 1994).

The air quality is generally described as combinations of physical and chemical characteristics. The physical characteristics include such factors as temperature, density, water content and air movement in the troposphere. The chemical characteristics comprise the concentration of various gases and pollutants. The natural forces are responsible for physical changes whereas, chemical changes are brought about mainly by human activities. The ambient air quality depicts the level of pollution and therefore is indicative of air pollution.

4.5.1 Ambient Air

a) Standards: The ambient air comparison has been as per the National Ambient Air Quality Standards (NAAQS) as fixed by MoEF, GoI under Environment (Protection) Rules, 1986.

b) Status & Sources of Pollution: The air pollution in this area is due to the agglomeration of various air polluting units like the clusters of paper mills, brick kilns, stone crushers, clusters of industries with furnaces and growing vehicular pollution load etc. The air pollution sensitivity at

the site and in its surrounding areas in the area has been categorised as *'high'* as per state board's Zoning Atlas for Solan district. The main sources of pollution in study area are categorized as:

- **Brick Kilns:** The area has a number of brick kilns scattered all over the study area.
- **Stone crushers:** The stone crushers in the area have created a problem of high SPM in this region with most of the stone crushers located near the habitation or road.
- **Industries with furnaces:** The pollutants from the chimneys of industries in the industrial areas also contribute considerably to the problem of air pollution.
- **Vehicular pollution:** Being an industrial area that has witnessed exponential growth in recent times, resulting into heavy flow of traffic in this region, hence vehicular pollution.

c) Ambient Air Quality Status Polluting Sources: On account of the fact that due to change of status of land use in the area from agriculture to industry, the stone crushers and brick kilns were the first to come as one of the first subsidiary industrial activity by way of providing construction material for development of industrial infrastructure, therefore, the stone crushers are one of the principal contributors to air pollution in the area. This has resulted in a situation where at many places the stone crushers and brick kilns are intermixed with human habitation. Further, there are many compact zones in the study area as well where these exist as a cluster. The study of their impact can not be ignored even if it is not as significant at this juncture as the concentration of SPM is on the rise and these are the principal contributors for the same along with other sources.

As per the available air quality data for stone crushers in and around BBN area, SPM values monitored at various stone crushers ranged between 1,042.86 ug/m^3 to 3,990.53 ug/$m^3$with peak value obtained at one of sites to be 13,012.98 ug/m^3. All values were found much above the prescribed norms, which is a matter of concern. However, the gaseous data for SO_2 & NOx was found to be within the prescribed norms. Further, to ascertain the effect on ambient environment, the general air quality of BBN was studied. The available data of the state board shows that in Nalagarh area, all the SPM values ranged between 49.85 ug/m^3 to 173.43 ug/m^3 and were within the prescribed standards for residential area. However, in Baddi-Barotiwala area, the values observed were from 154.53 ug/m^3 to as high as 495.07 ug/m^3. Almost 60% of the values were found to be exceeding the limit of 200 ug/m^3 fixed for residential area. However, the data for gaseous parameters like SO_2 & NOx was found to be well with in the prescribed level.

Besides, the stack monitoring results carried out by the board during May 2004 and 2005 of brick kilns of area also show unsatisfactory performance vis-à-vis the standards for medium and large brick kilns of 750 mg/Nm^3 barring two instances. Comparing the observed values of ambient air with the NAAQS, it is found that the SO_2 and NO_x levels are within the permissible limits at all stations whereas the SPM levels are found to be high at most of the stations. In the industrial areas at Baddi, Barotiwala and Nalagarh, the SPM levels are high or are approaching the permissible limits. The SPM values were critical at Nalagarh Bus Stand. The impact of air pollution in surrounding areas shows the impact of industrialization due its proximity to stone crushers and brick kilns. The SPM results are more than as permitted for the rural area. Further, vehicles also contribute to the ambient air environment (Transport Survey Report, 2003).

4.5.2 Noise

a) Standards: The comparison has been made as per the standards as fixed by MoEF under Environment (Protection) Rules, 1986 (Schedule-III).

b) Status: The ambient noise level monitoring of Nalagarh, Baddi, Barotiwala industrial areas was conducted by the state board in November 2001 and January 2003 to assess the noise level of this industrial belt.

c) Conclusions: In industrial town Baddi, the noise levels in the industrial zone were within prescribed limit, but in the sensitive zone i.e. ESI Hospital, which is located within the commercial area, the Leq (Energy equivalent noise level- unit: decibel- dB) values were found above the prescribed limits with 35.4% and 33.5% violation during the day and night time. The L90 and L10 values observed during the daytime are 57.8 dB and 68.8 dB and during night-time 44.0 dB and 55.7 dB, respectively show variation in the noise level. In Barotiwala town, the noise level in the industrial area was observed with in the prescribed limit, but at the bus stand, Leq was above the prescribed limit with 15.23% violation during the daytime. The L90 and L10 values i.e. 64.9 dB and 73.0 dB shows high variation in the noise level, which can be attributed to the flow of vehicles in the vicinity. In Nalagarh town, near Civil Hospital area, percent violation observed was 26.2% and 32.5% for day and night, respectively. The L90 and L10 for the daytime were 52.6 dB and 61.1 dB, respectively showing high variation in noise level.

The perusal of ambient air quality data shows that the situation with respect to air pollution is though within control and air pollution is not a critical aspect in environmental management of the area but still it showed increasing trends especially in sensitive areas. However, the need is to keep a close watch on the growth of air polluting industries viz., induction furnaces, stone crushers, brick kilns etc. Also, it would be prudent to delineate the area with respect to air pollution control sensitivity depending on the carrying capacity.

4.6 THE WATER ENVIRONMENT

Water is the most precisions resource on this earth on which all living organisms are dependent. The term *'pollution'* as defined under the Water (Prevention & Control of Pollution) Act, 1974 means *'such contamination of water or such alteration of the physical, chemical, or biological properties of water or such discharge of any sewage or trade effluent or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and heath of animals or plants or of aquatic organism'.* The water pollution is mainly caused by the natural and anthropogenic processes. The natural process of water contamination involves the dissolution of naturally occurring materials like salts, chemicals and minerals etc. and decomposition of soluble products of plant and animal origin. All these are carried along with the rainwater into recipient water bodies and finally to the oceans.

The present problem of water pollution has, however, emerged due to the activities of modern industrial civilization and same is true for the BBN as well. The pollution in the area takes place due to discharge of domestic wastewater, sewage, municipal wastes, industrial wastes, washouts of agricultural land, and soluble decay materials from solid wastes in the natural water bodies. The water-soluble contaminants from air and land also finally find their way in water and pollute it. Leached soluble materials too find their way even to the ground water resources.

The water pollution can be classified into four categories viz. physical pollution; chemical pollution; biological pollution; and physiological pollution of water (Sharma B.K., 2001). The physical pollution of water brings about changes in water with regard to its colour, odour, density, taste, turbidity, and thermal properties. Some of the important industries of the area producing physical pollution of water are paper and pulp, textiles, and tanneries etc. The chemical pollution of water in the area is due to the presence of inorganic and organic chemicals such as acids, alkalis, toxic inorganic compounds, dissolved inorganic compounds, suspended inorganic compounds, suspended organic compounds and dissolved organic compounds.

The most common form of pollution of water due to organic chemicals in the area is because of the presence of proteins, fats, carbohydrates, etc. (HPSEP & PCB-AusAID Report, 2001). These organic chemicals get access to water bodies either through sewage or through industrial wastes. Important industries of the area that contribute such chemicals are dye, drugs, insecticides, pesticides, detergent and chemicals. Toxic inorganic compounds are generally to be present in the industrial waters of industries like fertilizers, coke ovens, alkali-producing units etc. Some important toxic inorganic compounds are free chlorine, chloramines, H_2S, NH_3, soluble sulphides, and salts of metals such as Pb, Ni, Cu, Cr, Hg, As, Zn, Ba etc. The chemical pollution of water causes changes in acidity, alkalinity, dissolved oxygen etc. in the water. It may be caused either by the organic pollutants or inorganic pollutants or by both.

Biodegradable organic pollutants includes- proteins from domestic sewage; fats from sewage, soap production, food processing, and wool processing; carbohydrates, sugars, starch etc. from sewage, textiles mills, and paper mills; polymers, resins, coal, oil, and various organic substances found in domestic and industrial wastes etc. Non-biodegradable organic pollutants include those pollutants which persist in the aquatic system for a long time, e.g. pesticides, fungicides, herbicides, etc. The use of these organic compounds, as in study area, in protecting agriculture products also poses a serious water pollution problem, because these toxic chemicals ultimately find their way into nearby watercourse. Several gases, toxic metals and compounds have been included in inorganic pollutants because they also seriously degrade water quality.

Biological pollution of water in the study area is due to presence of pathogenic bacteria, certain fungi, pathogenic protozoa, viruses, parasitic worms. Important sources of bacteriological pollution are domestic sewage and industrial waste. Solid excreta from human bodies and decomposable organic matter of sewage are the best medium for development of bacteria in

water. Several chemical agents found in trade effluent such as Cl, SO_2, H_2S, ketones, phenols, amines, mercaptans and hydroxy-benzene cause the physiological pollution of water.

The water pollution is broadly divided into two categories on the basis of sources and storages of water- Ground water pollution and Surface water pollution. The extent of ground water pollution depends upon viz. rainfall pattern, depth of water table, distance from the source of contamination and soil properties such as texture, structure and filtration rate. The underground sources of drinking water, especially the study area are highly polluted on account of pollution from following sources viz. domestic wastes, industrial wastes, agricultural wastes, runoff from urban areas and soluble effluents (HPSEP & PCB-AusAID Report, 2001). A PIL is pending for decision in the state High Court regarding pollution of wells by the local tannery.

The domestic wastes and methods of their disposals are of primary concerns in study area. Prime factors responsible for deteriorating water quality include pathogenic organism, oxygen demand, nutrients and solids from domestic wastes. The solid wastes are the potential sources of contamination as they are partially burned and partially incorporated into the soil and pose serious danger to ground water. Many industries of the area produce industrial wastes containing toxic heavy metals along with hazardous organic and inorganic effluents. These chemicals contaminate the ground water and severally pollute it. Agricultural wastes include fertilizers, pesticides, insecticides, herbicides, processing wastes and animal's wastes. Leachates from the agricultural land containing nitrates, phosphates and potash, move downward with the percolating water and join the aquifers below posing a danger to the ground water.

Runoff effluents from the urban areas contain large concentration of oils, greases, nutrients, heavy metals and detergents. The detergents being soluble can pass through the soil and pollute ground water. Raw sewage dumped in shallow soak pits and seepage from polluted pond or nallas also pollutes ground water. The rainfall also picks-up substantial contaminants from dust and air and finally joins the aquifers below. The infiltration of liquid containing toxic pollutants causes pollution in sandy soils and well water. Several soluble effluents pollute ground water critically. The extant of pollution is more in sandy soils and humid regions having high water table conditions.

Other sources of ground water contamination in the area are- waste water treatment lagoons; transport accidents; seepages pits; urban and rural garbage; earthen septic tanks; refuse dumps; barnyard manures; leaching and downward movement of pollutants etc. The ground water pollution causes irreparable damages to soil, plants and animals including man. The polluted ground water is the major cause for the spread of epidemics and chronic deceases such as typhoid, jaundice, dysentery, diarrhea, tuberculosis and hepatitis. Besides, the use of polluted ground water for irrigating agriculture fields severely damages crops and decreases grain production, besides, acutely affecting soil fertility and eventually affecting plant metabolism and gradually the whole ecosystem.

The nature and extent of surface water pollution depends upon viz. hydrological characteristics of diluting biocides and the extent of self-purification; vegetation, soil type and degree of weathering rocks; waste water disposal systems and techniques for treatment of domestic and urban sewage including pre-treatment of industrial waster water; physical, chemical and biological characteristics of wastewater entering the surface water; health and hygiene of the communities residing near surface water. Surface water pollution is relatively a new phenomenon associated with industrial activity. Following are the sources for surface water contamination in the study area viz., 1) compounds which imparts colour, odour and turbidity e.g. oils, greases, phenols, toxic metals and organics 2) substances which precipitates to form objectionable deposits or float on the surface as oil, scum or debris 3) toxic substances, which affects physiology of all organisms 4) substances which result in enhancing the growth of undesirable aquatic life such as N and P 5) heavy materials (metals) 6) chlorinated compounds, chloroform and chloramines 8) ozonization etc. The chief sources of surface water pollution in the area are atmospheric gases, surface runoff, industrial, municipal and agricultural wastes, decomposed plant and animal matter.

The disposal of wastewater is a matter of great public concern in the area (HPSEP & PCB-AusAID Report, 2001). Industrial activities generate a large number and variety of waste products, which after some sort of a treatment are generally discharged into water streams. The nature of industrial wastes depends upon industrial processes in which they originate. The problem of adequately handling industrial waste water is much more complex than sewage because industrial wastewater vary in nature from relatively clean rinse water to waste liquors that are heavily laden with organic or mineral matter or with corrosive, poisonous, inflammable, or explosive substances. Organic compounds, however, constitutes a large proportion of these wastes which are destroyed only slowly by bacteria and unpleasant odour and taste are produced.

The Central Pollution Control Board has fixed ‘Primary Water Quality Criteria’ for inland surface water, Designated Best Use (DBU) which is given in Table- 4.1.

Table- 4.1 River Water Quality Standards

Designated Best Use	Class of Water	Criteria
Drinking water source without conventional treatment but after disinfections	A	Total coliform organism MPN/100ml shall be 50 or less. pH between 6.4 and 8.5. Dissolved oxygen 6 mg/l or more. Biochemical Oxygen Demand 5 Days 20^{o}C for 3 mg/l or less.
Outdoor bathing (Organized)	B	Total coliform organism MPN/100 ml shall be 500 or less. pH between 6.5 and 8.5. Dissolved Oxygen 4 mg/l or more. Biochemical Oxygen Demand 5 days 20^{o}C 3 mg/l or less.

Designated Best Use	Class of Water	Criteria
Drinking water source	C	Total coliform organism MPN/100 ml shall be 5000 or less. pH between 6 to 9. Dissolved Oxygen 4 mg/l or more. Biochemical Oxygen Demand 5 days 20^{o}C 3 mg/l or less.
Propagation of wild life	D	pH between 6.5 and 8.5, Fisheries. Dissolved Oxygen 4 mg/l or more. Free Ammonia (as N) 1.2 mg/l or less.
Irrigation, Industrial cooling, controlled waste	E	pH between 6.5 and 8.5. Electrical Conductivity at 25^{o}C micro mhos/cm, max 2250 Sodium absorption ratio- Max 26,Boron- Max 2mg/l.

Source: MoEF & CPCB

4.6.1 The Status

4.6.1.1 Surface Water: Sirsa, the main river within the study area is a part of the Satluj river system. The direction of flow in the river is from the SE to the NW. Several minor tributaries and nallas flowing from the adjacent hilly tracts of the state contribute to the flow of river Sirsa. The major tributaries of this system are Balad Nadi at Baddi and Chinki Khad near Nalagarh. In the Baddi-Barotiwala region, the Chota Kafta nalla, Pula nalla, Sandholi nalla etc. are the minor tributaries that bring water to this river. These minor tributaries are natural seasonal drains, and they usually bring the run off from the mountains into the river Sirsa during the monsoon season. However, due to industrial development in this region the nallas or the seasonal drains become effluent channels. During monsoons these nallas carry run off as well as industrial effluents but during the lean period they are just industrial drains carrying waste water from the adjacent industrial estates. Four nallas discharge industrial effluents into the river viz. Mallarwala nalla that joins Sitomajri nalla, Sandholi drain, Housing Board drain and Gullerwala nalla.

River Sirsa receives maximum effluent from the Housing Board and Sandholi drains. The Sandholi nalla carries mainly the industrial effluent to river Sirsa. The status of environment in BBN region is far from satisfactory due to the factors narrated above. The BBN area has in recent times witnessed rapid growth in view of the potential of industrialization in this region and the industrial incentives given from time to time. Accordingly, the level of environmental degradation has increased exponentially in these areas and is bound to go up alarmingly in the times to come, as the state government's priority is to woo the entrepreneurs for putting industries in the state for its economic development. Resultantly, a number of problems have cropped up in the area making it unsustainable for future growth.

Some of the environmental problems that have cropped up in the region are due to reasons viz. haphazard siting of industries; non-implementation of planning regulations; improper water pollution management; improper air pollution management; improper hazardous waste,

municipal solid and bio-medical waste management; lack of integrated approach for natural resources management. The Table-4.2 gives flow and BOD which is the measure of pollution in all the four nallas. The water quality of river Sirsa has deteriorated due to industrialization as the river has been used for the disposal of industrial and domestic wastes into it. The nallas/creeks carrying these effluents have got converted into open sewers, which is evident from the abnormal BOD and DO values. The Point Pollution Load Discharge to river Sirsa through various creeks/nallas increased from 3,800 Kl/day in the year 1990-91 to 20,745 Kl/day in the year 1998-99, a more than 5 times increase in volume (HPSEP & PCB-AusAID Report, 2001). BOD load has increased from 900 Kg/ day to 3,121 Kg/day a more than 3 times increase (Refer: Table-4.2).

Table- 4.2 Water Quality-BOD

NALLA	FLOW (kl/d)	BOD (kg/d)
GULERWALA	1,700	86
HOUSING BOARD	8,850	358
SANDHOLI	5,425	1,021
SITOMAJRI	4,770	1,657
TOTAL	**20,745**	**3,121**

Source: HPSEP& PCB

It is quite evident that the water quality of the study area is critical as these drains simply carry industrial and urban effluents to river Sirsa. This makes the water quality of river Sirsa critically polluted and suitable only for use of fisheries or irrigation and classified as Category- D as per the 'Primary Water Quality Criteria for Inland Surface Water for Designated Best Use (DBU)'. This shows that the river is highly polluted. If we do future predictions of river water quality then even at the pollution loads with 5% flow increase per annum discharge the daily BOD load discharge is likely to be 4,038 Kg/day, 5,083 Kg/day and 8,280 Kg/day BOD in the year 2005, 2010 and 2020 respectively (Kumar, 2005). This puts a question mark on the sustainability of any industrial or developmental activity in the region (Refer Plate- 4.1 at page- 41).

The implications of this scenario are quiet serious, as the area is dependent on ground water for its potable water supply, hence, there are fair chances of this highly polluted effluents reaching the substrata and polluting the ground water as well. A spate of Public Interest Litigations and complaints in state Human Rights Commission against a tannery and other units in the area for causing contamination of wells is a vivid example of the state of affairs. Apart from this, the area is predominantly agrarian with a high percentage of agriculture land and this discharged effluent also causes harm to croplands as is evident from public complaints. It is not that most of the industries do not possess any effluent treatment plants but level of treatment is not satisfactory and cumulative effect is resulting into the environmental degradation of area and affecting the natural carrying capacity of the surface and ground water. Further, there is no common effluent treatment plant or hazardous waste treatment and disposal facility in the area.

Plate- 4.1 River Sirsa carrying Industrial Effluent

4.6.1.2Ground Water: The area depends on its drinking water needs entirely on ground water, whereas, the water of river Sirsa is primarily used for agrarian purposes. The industrialization in the area has obviously affected the water quality of river Sirsa and on account of this there is all likely hood of ground water of area getting polluted. The excessive withdrawal of ground water on account of industrialization and urbanization is also putting a strain on the water resources of the area. Therefore, it is imperative to protect the ground water to ensure its sustainable usage. As per the ground water quality of the study area, it was found that many of the parameters studied to be above the prescribed limits. This fact becomes more alarming as most of the potable water supply in this region is catered by the ground water. Besides, the total groundwater extraction in the area is about 20,320 kl/day and is growing exponentially with industrialization.

The ground water quality of the study area is nearing the prescribed standards and in some areas exceeding the prescribed limit, which is surely, a matter of concern as the infiltration rate in the area is high and due to high water pollution in the area by industries the ground water is getting affected (HPSEP & PCB-AusAID Report, 2001). Also, the possibility of both point pollutants and non-point pollutants such as insecticides, pesticides, etc. entering the water system cannot be ruled out (Plate-4.2, refer page- 42). The aquifers in this region are unconfined and the main source of potable water being ground water, one has to look into the matter seriously and plan effective strategies.

4.7 THE LAND ENVIRONMENT

Soil is a part of lithosphere showing close interaction with atmosphere, hydrosphere and biosphere. It, thus, provides to all the basic needs of terrestrial organisms. The soil pollution is caused by human activities associated with modern life style, industry and agriculture. The crux of waste problems in the land lies in leachates and mounting amount of wastes. Such leachates, which ooze out of the garbage heap, are known to move slowly through the layers of soil beneath

and contaminate the water resources deep down the land. However, the problem of soil pollution differ from air, and water pollution in respect that the pollutants remain in direct contact with the soil for relatively longer periods. The widespread industrialization and increasing consumptions have changed the very complexion of soil. Thus, the soil is getting heavily polluted day by day by toxic materials and dangerous microorganisms, which enter the air, water and food chain. For all this, human beings are the original and basic polluters responsible for pollution hazard and toxic effects. The soil pollution in the area mainly results from the following sources viz. industrial wastes; urban wastes; agricultural practices; chemical and metallic pollutants; biological agents; mining; resistant objects; soil sediments etc.

Plate- 4.2 Stagnant Industrial Effluent-Polluting Ground Water

4.7.1 Soil Erosion/Loss

As the study area is located in the foothills of Shivalik hills, hence is subjected to severe erosion. This scenario is further aggravated by the loss of soils, which takes a thousand years to develop. Soil loss is very critical issue as this area is a prime agricultural land. One inch of soil takes thousand of years to develop and is lost in seconds. *'Choe'* is the local name given to the numerous seasonal streams, which originate in Shivalik hills. These streams are usually dry except in the rainy season when a huge quantity of water gushes down, thereby causing high levels of erosion. The upper catchment of these streams consists of loose rocks that are easily eroded. In the monsoons, the choe streams carry away this material and deposit them in the foothills, thereby engulfing valuable arable land, settlements, forests, roads and canals. The following factors viz. weak rocks in the catchment; intense upstream tectonic activity; heavy biotic pressure and high intensity of rainfall enhance the erosive capacity of these streams.

Apart from the natural sources of pollution in the area, the brick kilns also pose a problem. The area has 32 large scale brick kilns which use up soil from the study area for brick manufacturing most of them are concentrated in sub-watershed No 4. If we estimate the soil loss in the area we see that 485 bricks constitute 1 m^3 hence the loss of soil is approximately 722,474.22 m^3 per year. Hence, there is degradation of the natural environment on a massive scale in the study area.

The results with respect to soil samples at three locations in the study area were taken by the board at the agriculture field Nichli Sandholi, agriculture field near Arihant Industries and agriculture field near Housing Board Colony showed high iron content in the soil.

4.7.2 Hazardous Wastes (HW)

Hazardous substance means *'any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creature, plants, micro-organism, property or the environment'* as per the Environment (Protection) Act, 1986. The hazardous wastes have been defined elaborately under the Hazardous Wastes (Management & Handling) Rules, 1989.

a) The Problem: Total number of industries falling under the purview of Hazardous Wastes (Management & Handling) Rules, 1989 is approx 523 (Baddi-272, Barotiwala-72, Nalagarh-179) and the quantum of hazardous waste generated is approximately ETP sludge- 7,218 tones/annum, used oil- 179,373 lts./annum, used drums- 40,087 drums/annum, process residue- 99,443 kgs./annum, slag- 1,248 tones/annum and others- 6,258 tones/annum (Source: HPSEP & PCB). The present system of waste disposal is either unscientific haphazard disposal on the land, water bodies or within the premises of the units. The hazardous waste being produced in the area is dumped in the study area, as there is no sanitary landfill site with a scientific treatment, storage and disposal facility. The waste is being dumped on land, which finds its way into the substrata contaminating the ground water along with fertile soil. The municipal solid waste is also dumped in an unplanned manner and in the process both surface and ground water are getting severely polluted (HPSEP & PCB-AusAID Report, 2001).

b) The Impacts on Ecology, Environment & Human Health: Improper storage, handling, transportation, treatment and disposal of hazardous waste results in adverse impacts on ecosystems including the human environment. When discharged on land, heavy metals and certain organic compounds are phyto-toxic and at relatively low levels can adversely affect soil productivity for extended period of times. It occurs due to viz. contamination of soil with heavy metals, organic solvents, pesticides, insecticides, oil and grease etc; leacheats from hazardous wastes contaminating the ground water, river systems; bioaccumulation of heavy metals, PCBs, pesticides, insecticides etc. in biota by way of these entering the food chain; contamination of air through releases of toxic substances/fumes and all above leading to deleterious impacts on ecology, environment and human health (Refer, Plate- 4.3 at page- 44).

c) Status of Hazardous and Solid Waste Generation in the Study Area: The generation of industrial solid waste is mainly from the pollution control devices installed to control the air and water pollutants and from the production processes itself. The regulations are relatively recent under the Hazardous Waste (Management & Handling) Rules, 1989, which were amended in 2000. Earlier the hazardous wastes were been grouped into 18 categories of wastes along with threshold values of the constituents present in the waste, except for the categories with off specifications, waste and sludge from the effluent treatment plant (ETP) containing heavy

metals. The new amended Hazardous Waste (Management & Handling) Rules, 2000 lists more than 120 waste streams arising out of 44 processes that contain hazardous chemicals.

Plate- 4.3 Hazardous Waste Dumping in Study Area

In the region hazardous wastes are generated by the manufacturing industrial units, however, some municipal sources, hospitals and other health care facilities too are partial contributors. The hazardous wastes from industries mainly comprise ETP sludge, effluent treatment plant waste, fly ash from boilers/incinerators, slag, residues of various processes, and pharmaceutical manufacturing formulation residual wastes and pesticide formulation wastes. Because of non-availability of common waste treatment and disposal facilities in the region, the sludge, ash, slag etc being generated by the units that cannot be sold for recycling or resource recovery are stored by the industrial units in their own premises in crude pits or the other temporary storage facilities. However, waste oils and spent acids are recycled and used and the other wastes are disposed off as per the nature of waste. No proper log is being maintained which is indicative of fact that there are fair chances of it getting into our eco-systems and food chain.

As stated, approx 523 (Baddi-272, Barotiwala-72, Nalagarh-179) industries fall under the Hazardous Waste (Management & Handling) Rules, 1989. Out of these, 55 units are covered under the Public Liability Insurance Act, 1991 and 147 units are covered under the Hazardous Chemicals (Management & Handling) Rules, 1989; rest all remaining units fall under the Hazardous Waste (Management & Handling) Rules, due to the hazardous waste generated from their processes or waste treatment. Out of the 523 units as enlisted in the above only 357 units have complied with the directions/legal provisions i.e. 68%, obtained authorization under Environment (Protection) Act, 1986 (Annual Report, 2005, HPSEP & PCB). The hazardous waste, therefore, enters the eco-system. The hazardous waste produced in this area is mainly ETP sludge, incinerator ash, waste oils, slag, pickling waste, hazardous chemicals, pharmaceutical

residues, pesticides formulation residues etc. fall under Schedule-I of the Hazardous Waste (Management & Handling) Rules 1989. The details are as under in Tables-4.3.

Table- 4.3 Hazardous Wastes Generated in the BBN Industrial Zone

Type of Hazardous Wastes	Mass (Tonnes/year)	Density (Tonnes/m^3)	Volume (m^3/year)
Sludge	7,218	1.2	6,015
Rice Husk Ash	21,120	0.6	35,200
Slag	1,248	1.7	734
Other Hazardous Wastes	6,258	1.1	5,689
Municipal Solid Waste	2,520	0.75	3,360
Total	**38,364**		**50,998**

Source: HPSEP & PCB

While many industries have installed their own effluent treatment plants, there is a still a high degree of uncontrolled discharge of domestic sewage and industrial wastewaters as well as hazardous and municipal solid wastes. The hospital waste has although not assumed alarming proportions at the moment but with the population growth in the region, it can assume serious proportions in the times to come due to unscientific practices being followed in the area. This uncontrolled waste disposal has resulted degradation of both surface water quality and groundwater quality. It is anticipated that this will increase substantially in coming years unless appropriate waste management measures are implemented. Further, hazardous bio-medical wastes in contact with the inert municipal solid wastes make it hazardous as well; just 15% infectious bio-medical waste due to improper handling contaminates whole of inert waste.

4.7.3 Biomedical Waste (BMW)

Biomedical wastes means any waste, which is generated during the diagnosis, treatment or immunization of human being or animals or in research activities pertaining thereto or in the production or testing of biological, and including categories mentioned in Schedule–1 of the Bio-medical Wastes (Management & Handling) Rules, 1998 notified under the Environment (Protection) Act, 1986. The said Schedule besides classifying the waste into ten categories also indicates the treatment and disposal options. In Himachal Pradesh about 1,033 kg bio-medical wastes is getting generated per day from 230 government and 353 private hospitals (Source: HPSEP & PCB). In the study area in all 12 numbers of health institutions are operating (Government/Civil Dispenceries-7, Private Bhojia Dental College-1 and Private Clinics etc-13).

The nature of hazardous bio-medical waste being generated from these institutions is organic which they are disposing off by way of unscientific methods without any segregation including burning and burial. The practice of disposal of other solid wastes from these institutions such as discarded plastic bottles, syringes etc. along with the municipal solid waste exists. There is also mixing of some highly infectious and hazardous bio-medical wastes with municipal solid wastes,

which results into making the inert wastes as highly infectious posing a serious threat to human lives and environment. The total amount of waste produced from these health institutions is not much at the moment but is likely to go up exponentially in the times to come and can pose a serious threat to the safety, health and environment of the area.

4.7.4 Municipal Solid Waste (MSW)

The municipal solid wastes include commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes defined under the Municipal Solid Wastes (Management & Handling) Rules, 2000 as notified under Environment (Protection) Act, 1986. The municipal solid wastes are required to be disposed off in accordance with the provisions as contained in the Municipal Solid Wastes (Management & Handling) Rules, 2000 especially w.r.t. Schedules-II, III and IV. However, the municipal solid wastes, or domestic wastes, are not presently managed in an environmentally sustainable manner. Common practice is to dispose of such wastes into low-lying areas on the banks of river Balad near toll tax barrier without any proper controls leading to potential adverse impacts on surface water quality and groundwater quality. The population of the area is about 64,000 and on an average waste produced per person per day is 250 grams so the quantum of waste produced is 16,000 kg/day (Source: HPSEP & PCB), which is not being managed properly and is contaminating our ground water, river system and soil.

To judge the impact of municipal solid waste on water quality of river Balad, sampling was got conducted by the state board at existing dumpsite at river Balad which indicated parameters such as Fe to be in the range of 0.59 mg/l to 0.61 mg/l in first instance and 1.42 mg/l to 1.56 mg/l which is above the prescribed limit of 0.3 mg/l. Similarly, the parameters Cu and Pb were found to be 0.19 mg/l against the limit of 0.05 mg/l and 0.06 mg/l against the limit of 0.05 mg/l respectively. Similarly, the pH is also touching the threshold levels of 8.5 in all the sampling so got undertaken. The presence of Ni and Cd is again a matter of concern. There is likelihood that this problem is going to assume gigantic proportions in times to come if proper action in this regard is not timely taken as the population is growing exponentially due to industrialization.

4.7.5 Sewage Waste Water Disposal

Domestic sewage also known as sanitary sewage is the liquid wastes derived from residential and business establishment and institution. It may or may not contain storm water. Accordingly, combined sewage is a combination of sanitary sewage and storm water. Sewage sometime is also regarded as a combination of domestic sewage, industrial wastes and storm water. Sometime sewage also includes sullage. The existing sewerage system in the area is in the form of septic tanks, which are seldom cleaned, and most of them are overflowing creating the environmental mess in the area. The wastewater generated in the area is 80% of the water supplied i.e. approx. 7.2 MLD (Source: HPSEP & PCB). The Housing Board nalla mainly carries sewage in the form of untreated organic matter from the residential colonies, which finally meets river Sirsa and therein, puts a tremendous demand for oxygen. It is also rich in FC/TC resulting in lower class as per designated water quality use.

4.7.6 Squatter and Slum Areas

Baddi-Barotiwala-Nalagarh is an important industrial area in the state. Hence one finds that the lobour migration is high in the area due to available job opportunities. The needs of informal sector are not catered to in the study area. Hence, these unskilled workers settle in slums where the living conditions are horrible with no proper drinking water, sewerage or health facility. Dirt and filth is a part of their life due to this the health condition are grave with water bone diseases cropping up in these slums leading to loss of man days and effecting the industrial sector as well.

To sum up, the industrial area of Baddi-Barotiwala-Nalagarh is critically degraded. Growth pattern in the study area is also unorganized. The development has mainly taken place in a haphazard manner with no proper settlement pattern in the area. There is a lot of haphazard growth leading to problems of urban development in terms of stress on the infrastructure by increased pollution. This is coupled with the basic character of the town i.e. industrial hence the problems are aggravated all the more. Also provisions w.r.t. The Recycled Plastics (Manufacture & Usage) Rules, 1999 are not being complied as required under the law.

The study of surface water quality of river Sirsa upstream of Sitomajri nalla, wherein, no point or non-point pollution exists, the water quality in terms of DO, BOD and COD are well with in the prescribed standards. The DO level varies between 7 mg/l to 10 mg/l against the prescribed limit of 4 mg/l, BOD level varies between 0.2 mg/l to 1.5 mg/l which is well below the prescribed level of 3 mg/l. Similarly, the COD levels varies between 2.4 mg/l to 66 mg/l which is well below the prescribed level of 250 mg/l and TC which signifies human habitation related activity is also well with in the prescribed standards (Source: HPSEP & PCB).

The study of surface water quality of river Sirsa downstream of Sitomajri nalla, wherein both point or non-point pollution in the form of industrial effluents is added to river Sirsa, the water quality in terms of DO, BOD and COD starts deteriorating. The DO level varies between 4.8 mg/l to 8 mg/l against the prescribed limit of 4 mg/l, BOD level varies between 3.0 mg/l to 160 mg/l against the prescribed level of 3 mg/l. Similarly, the COD levels varies between 6.0 mg/l to 496 mg/l against the prescribed level of 250 mg/l and the TC which signifies human habitation related activity also shows the increasing trends. The situation with respect to other nallas is no different with respect to parameters viz. BOD, COD, TC/FC etc. (Source: HPSEP & PCB).

Herein it is worth mentioning that the state board has no analytical or infrastructural capabilities as regards analysis of insecticides, pesticides etc. which are go unhindered both into ground water and surface water systems and finally reach the food chain. Also the position with respect to the heavy metals which cause a vide variety of damage to human body; especially the central nervous system, is not being monitored regularly except at the time of fish mortality when a very high dose of insecticides, pesticides, and heavy metals etc. have been reported in fish viscera (Source: HPSEP & PCB).The study of surface water quality of river Sirsa downstream of Nalagarh bridge with respect to BOD and COD shows the increasing trends, whereas for DO it is more or less static and for TC shows it shows the increasing trend even though the water quality

recuperates down stream Nalagarh Bridge because of the self purification mechanism and cascading effect of water in river Sirsa, but heavy metals, insecticides/pesticides etc. are passed on to the adjoining state Punjab where river Sirsa joins river Satluj. Further, in this stretch of 16 kms. there is a water augmentation/dilution by way of sub-terrarium water supply.

Hence, to sum up wastewater disposal is the main concern in the study area besides, treatment, storage and disposal related aspects of hazardous wastes including bio-medical wastes and municipal solid wastes coupled with the faulty land use planning). Though the air pollution is also a matter of concern but it takes a back seat in this catchment at the moment due to other pressing problems. Therefore, the area needs to be managed in sustainable manner with some basic infrastructural features such as common effluent treatment plant (CETP) for wastewater management and treatment, storage and disposal facility (TSDF) for hazardous wastes including bio-medical wastes and municipal solid wastes. Further, there is also a need to have a look at the existing regulatory setup and its capability of solving the environmental problems of the area. One need to think beyond the system of prevailing regulatory setup in terms of practices being followed in European Union and OECD countries. The possibility of use of economic instruments in Indian context needs to be examined. Last but not the least new tools viz. spatial land use planning, cleaner production, waste minimization etc. need to be adopted in the area for better management.

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Chapter-5
Environmental Management in India

5.1 ENVIRONMENTAL MANAGEMENT & REGULATION

5.1.1 An Introduction

It has been about three decades now that the foundation of the current direction on environment protection was laid and a base initially formed at the national level to protect the environment from the adverse impacts of rapidly expanding industrial society. The legislative and technological base substantially expanded in the subsequent period was primarily necessitated by the agglomeration and magnification of the problems resultant to the development far outpacing the capabilities to resolve them. A beginning made in the mid seventies encompassing and integrating the environmental concerns in a comprehensive national policy proved quite useful in attending the significant concerns of immediate nature. This prompted constant policy and legislation reviews and making suitable amendments wherever necessary to protect the nation from the lurking threats of environmental degradation.

5.1.2 Key Policies Relating to Environment in India

The growth of environmental legislation has been quite study since then and this being a dynamic process had been responding to the complex environmental problems, which the humanity faces on account of its quest for more and more development (CPCB: Pollution Control Law Series, 4th Edition, 2001). The policy framework available to contain pollution is:

- National Environment Policy- May, 2006.
- National Conservation Strategy and Policy Statement on Env. & Development, 1992.
- Policy Statement on Abatement of Pollution, 1992.
- The National Forest Policy, 1988.

5.1.2.1 National Environment Policy- May, 2006: It briefly describes the key environmental challenges currently and prospectively facing the country, the objectives of environment policy, normative principles underlying policy action, strategic themes for intervention, broad indications of legislative and institutional development needed to accomplish the strategic themes, and mechanisms for implementation and review. It has been prepared through a process of extensive consultation with experts, as well as diverse stakeholders. The policy is intended to be a guide to action in regulatory reform, programmes and projects for environmental conservation; and review and enactment of legislation, by agencies of the central, state, and local governments. It also seeks to stimulate partnerships of different stakeholders' i.e. public agencies, local communities, the investment community, and international development partners, in harnessing their respective resources and strengths for environmental management. On the whole, it is expected to do better than fiscal neutrality, and likely raise substantial resources from outside the fiscal regime to realize its objectives which are viz. conservation of critical

environmental resources; intra-generational equity-livelihood security for the poor; inter-generational equity; integration of environmental concerns in economic and social development; efficiency in environmental resource use; environmental governance; and enhancement of resources for environmental conservation (URL: http://envfor.nic.in/).

5.1.2.2 National Conservation Strategy & Policy Statement on Env. & Development, 1992: The strategy and the policy statement are in response to the need for laying down the guidelines that will help to weave environmental considerations into the fabric of our national life and of our development process. It is an expression of our commitment for reorienting policies and action in unison with the environmental perspective (URL: http://envfor.nic.in/). It further states that environmental problems in India can be classified into two broad categories viz. a) Those arising as negative effects of the very process of development; and b) Those arising from conditions of poverty and under-development. The first category has to do with the impact of efforts to achieve rapid economic growth and development and continuing pressures of demand generated by those sections of society who are economically more advanced and impose great strains on supply of natural resources as poorly planned developmental projects are also often environmentally destructive. The second category has to do with the impact on health and integrity of our natural resources (land, soil, water, forests, wildlife etc.) as a result of poverty and inadequate availability, for a large section of our population, of the means to fulfill basic human needs (food, fuel, shelter etc.). Needless to say, the two problems are interrelated.

Population is an important resource for development, yet it is a major source of environmental degradation when it exceeds the threshold limits of the support systems. Unless the relationship between the multiplying population and life support systems can be stabilized, development programmes, howsoever innovative, are not likely to yield the desired results. It is possible to expand the '*carrying capacity*' through technological advances and spatial distribution. But neither of these can support unlimited population growth. Although technological progress will add to the capabilities for sustaining a large number of populations, the need for a vigorous drive for population control can hardly be over emphasized in view of the linkage between poverty, population growth and the environment.

5.1.2.3 Policy Statement on Abatement of Pollution, 1992: Herein the commitment of the government on abatement of pollution for preventing deterioration of environment is stated. The policy elements seek to shift emphasis from defining objectives for each problem area towards actual implementation (URL: http://envfor.nic.in/). The complexities are considerable given the number of industries, organizations and government bodies involved. It emphasizes maximum use of a mix of instruments in the form of legislation and regulation, fiscal incentives, voluntary agreements, educational programmes and information campaigns.

The MoEF is the nodal agency in the administrative structure of the central government, for planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. The principal activities undertaken consist of conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas and protection of environment etc.

5.1.3 Constitutional Provisions

The 42nd amendment to the Constitution was brought about in the year 1974 with insertion of two articles viz. Art.48-A and Art.51-A (g). The state's responsibility with regard to environmental protection has been laid down under Article 48-A of Constitution; it states, *'The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country'.* Further, environmental protection is a fundamental duty of every citizen of this country under Art.51-A (g), which reads as follows: *'It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures'.* Art.48-A comes under Directive Principles of State Policy and Art.51-A (g) comes under Fundamental Duties of the Constitution. Unlike Fundamental Rights, violation of Directive Principles of State Policy or Fundamental Duties cannot be questioned in the Court of Law (Source: Ministry of Law and Justice, GoI).

Article-21 of the Constitution is a fundamental right, which reads as follows: *'No person shall be deprived of his life or personal liberty except according to procedure established by law.'* Though this Article does not explicitly mention the environment, the Apex Court and various High Courts of the country have given a wider interpretation to the word *'life'*, the right to life herein includes the right to a living environment congenial to human existence. Further, as conferred by Article 246(1), while the Union is supreme to make any law over the subjects enumerated in List-I, the States, under Article 246(3), enjoy competence to legislate on the entries contained in List-II, and both the Union and the States under Article 246(2) have concurrent jurisdiction on entries contained in List-III. In the event of a clash, the Union enjoys a primacy over States in that its legislation in the Union and the Concurrent List prevails over State legislations. Also, the Parliament has residuary powers to legislate on any matter not covered in the three Lists (Art. 248). Forests as a subject fall under the Concurrent List of 7th Schedule of the Constitution of India (Source: Ministry of Law and Justice, GoI).

There are about two hundred laws dealing with environmental protection both before and after independence in India. However, the pre-independence laws have not dealt with environmental protection exclusively. For example, the Indian Penal Code (IPC), 1860, had a chapter (chapter XIV) which dealt with offences affecting public health, safety and convenience, which covered aspects like water, air and noise pollution, whereas the post-independence laws mentioned above deal exclusively with environmental protection.

5.1.4 Environmental Legislation

Before discussing the specific environmental provisions, the provisions as prescribed in the Indian Penal Code (IPC) for environmental protection are discussed which are as under:

5.1.4.1 Provisions in the Indian Penal Code (IPC): The IPC has a chapter on offences affecting public health, safety and convenience (chapter XIV). Sec. 268 provides that 'a person is guilty of a public nuisance who does any act or is guilty of an illegal omissions which causes any common injury, danger or annoyance to the public or to people in general who dwell or occupy

property in the vicinity, or which must necessarily cause injury, obstruction, danger, or annoyance to persons who may have occasion to use any public right.' The section further explains that a common nuisance is not excusable on the ground that it causes some convenience or advantage. Other concerned provisions are: a *'negligent act likely to spread infection or disease dangerous to life'* (Sec. 269 I.P.C.), a *'malignant act likely to spread infection or disease dangerous to life'* (Sec. 270 I.P.C.), *'making atmosphere noxious to health'* (Sec. 278 I.P.C.). But the essential requirement of the provision to punish a man is the guilty intention of the accused, i.e. either the act of the accused should be negligent, malignant or voluntary, which vitiates the atmosphere. In case of public nuisance and for making the atmosphere noxious to health, the IPC provides for fines, which are too meagre to meet the objectives. With these penal provisions in IPC, it is not possible to check environmental pollution.

5.1.4.2 Specific Environmental Legislation: Decisions were taken at the UN Conference on the Human Environment held in Stockholm in June 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth, which, among other things, includes the preservation of the quality of water and air and control of water and air pollution (CPCB: Pollution Control Law Series, 4th Edition, 2001). The outcome included initiation of processes in the countries for the protection of environment. Some legislations in Indian context are as under:

i) Water (Prevention & Control of Pollution) Act, 1974: The objectives of the Act are to provide for prevention and control of water pollution and the maintenance or restoration of wholesomeness of water for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith. For the purpose of environmental management and regulation, the regulatory agencies were created one at the apex level and others at state level.

ii) The Air (Prevention & Control of Pollution) Act 1981: The objective of this Act is to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

iii) Environmental (Protection) Act, 1986: In order to provide the existing legislation for control of water and air pollution more effectively and to remove the deficiency of the aforesaid legislation, the union government enacted umbrella legislation with an objective to plug the existing statutory gaps. The following prominent Rules/Acts are worthwhile to mention viz. a) The Environment (Protection) Rules, 1986; b) The Hazardous Wastes (Management and Handling) Rules, 1989; c) The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989; d) The Bio-medical Waste (Management & Handling) Rules, 1998; e) The Recycled Plastics Manufacture and Usage Rules, 1999; e) The Municipal Solid Waste (Management & Handling) Rules, 2000; f) The Noise Pollution (Regulation & Control) Rules, 2000; g) The Ozone Depleting Substances (Regulation) Rules, 2000 and h) The Batteries (Management & Handling) Rules, 2001.

Accordingly, the MoEF, GoI has specified different agencies for the implementation of these laws and the state boards along with other agencies have been assigned a defined role towards maintenance of pristine environment quality (CPCB: PCL Series, 4th Edition, 2001).

5.2 ENVIRONMENTAL MANAGEMENT IN INDIA - 'COMMAND & CONTROL'

Environmental laws in India currently consist largely of regulations and licenses, which prohibit industries from exceeding permissible levels of discharges and require it to install certain abatement equipments. Breaches of these regulations are punished through fines under the purview of civil and criminal law sanctions. These *'Command & Control' (C&C)* approaches to regulation have been enforced for the past three decades with mixed results in tackling the problem of pollution. India has set-up some of the pollution abatement standards based on western parameters, which were rather a tough task in view of the poor infrastructure and techno-economic capabilities. Lately there is a growing recognition that command and control strategies have limitations in terms of their ability to nullify destructive conduct through enforcement alone. The use of economic instruments (EIs) viz. tools that attempt to take advantage of market forces to prevent pollution and influence behaviour are an equally important system to rectify the environmental ills. However, it is felt that an appropriate mix of environmental regulations and economic instruments may accelerate our progress to better environmental protection.

5.2.1 Existing Instruments

Some of the specific instruments for abating and controlling pollution in general in Indian context are viz. Water (Prevention & Control of Pollution) Act, 1974; Water (Prevention and Control of Pollution) Cess Act, 1977; The Air (Prevention & Control of Pollution) Act 1981; The Environmental (Protection) Act, 1986 and rules framed there under; The Public Liability Insurance Act, 1991; The National Environment Tribunal Act, 1995; and The National Environment Appellate Authority Act, 1997 (CPCB: PCL Series, 4th Edition, 2001).

5.2.2 Licences & Penalties

The consent prior to establish/operation of an industry, process or operation is mandatory according to the provisions of section-25 of the Water (Prevention & Control of Pollution) Act, 1974 and/or section-21 of the Air (Prevention & Control of Pollution) Act, 1981 as may be applicable to a particular unit. The main object of the consent mechanism under the aforesaid Acts is to follow the principles of sustainable development and maintain, restore and enhance the environmental quality for a healthy society. A Consent/No Objection Certificate of the state board is required by industrial units, tourism projects, mining units, local bodies, hospitals etc. to establish/operate such industry, operation or process or any treatment and disposal system or an extension or addition thereto, which is likely to emit any air pollutant and/or to discharge sewage or trade effluent into a stream, well, sewer or on land. The schedule of fees exists for all developmental projects (URL: himachal.nic.in).

All legislative provisions listed above contain penal provisions, which are both pecuniary as well as prohibitive. These provisions can be executed only through judiciary. The C&C instruments

are used in the form of fines, penalties and threats of legal action for closure of factories and imprisonment of owners. They can be used either for facilitating the use of specific technologies for the environmental management or for the realization of specific environmental standards, etc.

5.3 POLLUTER PAYS PRINCIPLE

The Polluter Pays Principle (PPP) takes into account that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting trade and investment.

5.3.1 The Water Cess -PPP

The environmental management procedures referred to above in Indian context, are basically C&C mechanisms except for the Water (Prevention & Control of Pollution) Cess Act, 1977 which provides for levy of cess on the water consumed by the industry during the production process for specified purposes with a view to dissuade wasteful and indiscreet use of water. This is the only EI being used for pollution abatement and control in India. The cess proceeds so raised intend to be utilized for programmes related to control of water pollution. All the other legislative provisions are primarily policing mechanisms.

Through the instrument of licenses, the regulatory agencies collect reasonable amount of revenue. The purpose of these instruments was to make regulatory agencies self sufficient as well as to enable to use the proceeds for the purpose of environmental mitigation. Interestingly these proceeds are being primarily used for administrative purposes and allocation of revenue for the purposes of R&D, surveillance and monitoring, environmental mitigation had been just grossly insufficient. Further, lately there is an increasing tendency by the cash starved state governments to use the funds of these cash rich regulatory agencies for meeting their way and means position. Resultantly, the environment is at loss and so is the civil society. Had these funds been utilized for the operations of sewage treatment, BMW, MSW etc., such negative externalities would have been reduced to a great extent. Further, all the legislative provisions listed above contain penal provisions, which are both pecuniary as well as prohibitive. These provisions can be executed only through judiciary, which is a long drawn process, and by the time the decision is out, its pungency is gone.

5.4 EFFICACY OF CURRENT REGULATION

The policing mechanism, which is one of the principal mechanisms for environment management in India, has not proved to be very effective tool in pollution abatement and control the world over. This is also quite evident from the data that environmental problems not only persisted in the area in question but also kept on increasing in its dimension. The governments appear to be in a paradoxical situation. On one hand it wants economic development and one the other hand a clean environment. The incentives being offered by the state has attracted large numbers of industrial groups to set up their industrial ventures in the state and especially in the study area that has certain advantages. This has also consequently resulted in a steep increase in population. As a result, there has been a quantum increase in generation of municipal, bio-

medical and industrial wastes including hazardous wastes. With the new industrial incentives coming into force, there is an exponential rise in number of industries and the pollution load in the area and consequently the stress on the environmental resources is getting worse. The BBN with number of advantages for industrialization also has a potential to transform the area into an industrial slum, if effective measures not taken. Hence, in the developing world where everyone yearns for development, this kind of industrialization can be a curse rather than a boon. The previous discussions indicate the poor environmental status of the area despite a number of C&C mechanisms in place.

5.5 THE GROWTH ISSUES

The issues related to the GDP growth is usually being used in Indian context to self eulogize the development. Some interesting comments in this regard are as under:

- The economy of India is the 4th largest in the world as measured by purchasing power parity (PPP), with a GDP of US $3.36 trillion.
- When measured in USD exchange-rate terms, it is the 10th largest in the world, with a GDP of US $691.87 billion (2004). India was the 2nd fastest growing major economy in the world, with a GDP growth rate of 8.1% at the end of the 1st quarter of 2005–2006.

5.5.1 The Problem

- GDP does not measure the sustainability. A country may achieve a temporarily high GDP by over-exploiting natural resources or by misallocating investment.
- Proper accounting for environmental degradation would reduce the measured growth rate of economy by 3%- an Indonesian Study.

5.5.2 Solution: Innovative EIs & Natural Resource Accounting

As economic policies form the framework for a range of sectoral development, it will be necessary to consider how these policies affect the quality and productivity of environment resources. This requires a system of resource accounting for cost benefit analyses. Therefore, in essence, indicators of growth such as GNP and GDP should include a measure of depletion cost and value judgments in terms of environmental resources. It will require instruments and expertise for evaluation and conscious trade offs, where unavoidable, to meet the legitimate development needs. The government need to prepare, each year, a natural resources budget which will reflect the state and availability of resources like land, forests, water etc. and which will rationally allocate these resources in keeping with the principles of conservation and sustainable development. Besides, there is a need to usher in new and innovative EIs in addition with C&C for effective environmental management of the area.

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Chapter-6
New Initiatives, Efforts & Experience

New efforts are afoot to tackle the menace of environmental degradation. The Ministry of Environment & Forests (MoEF), Government of India (GoI), the apex Central Pollution Control Board (CPCB) and the state boards are continuously striving to find solutions that are just fair and equitable to all stakeholders. Some of the new initiatives taken are listed below:

6.1 FEDERAL INITIATIVES

6.1.1 Charter on Corporate Responsibility for Environmental Protection

Industrial development is an important constituent in our pursuits for economic growth, employment generation and betterment in quality of life. But industrial activities, without proper precautionary measures for environmental protection are known to cause pollution and associated problems. Hence, it is necessary to comply with the regulatory norms for the prevention and control of pollution. Alongside, it is also imperative to go beyond compliance through adoption of clean technologies and improvement in management practices. The commitment and voluntary initiatives of the industry for responsible care of environment helps in building a partnership for pollution abatement and control; this is the very purpose of the Charter on Corporate Responsibility for Environmental Protection (CREP), which is the new initiative for environmental management by the Government of India (Source: MOEF, URL:envfor.nic.in/)

The MoEF and CPCB have come out with a CREP, which is an action plan wherein corporate responsibility for 17 categories of industries has been fixed for environmental protection. Under the action plan, the industries are to take action to reduce pollution created by them in a time bound period. The action points enlisted in the Charter are addressed to corporate bodies as well as regulatory agencies. Thus, it is a commitment for partnership and participatory action of concerned stakeholders. It is also a road map for progressive improvement in environment management systems. It is not necessarily limited to compliance of *'end-of-pipe'* effluent and emission standards as in some cases the targets set are ahead of standards. The compliance under the mechanism has been sought through economic instrument of a bank guarantee. However, this is without any prejudice to the stipulations made in the existing standards and action already taken/initiated for non-compliance and area-specific requirements warranting stringent actions.

The opponents of this school of thought argues that such a Charter would offer a licence to such 17 categories of most polluting industries to pollute by submitting an action plan and a bank guarantee. In Indian context the experience with such type of EIs has not been so healthy especially, as there is neither a standardized format with the state boards nor the required competence, to safeguard the interests of environment and civil society. Further, instances of

frauds have been reported in northeastern India where fake bank guarantees were offered. Also this would also encourage the marginal polluting industries to ask for similar benefits.

6.1.2 Clean Development Mechanism

India is a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. To strengthen the developed country commitments under the Convention, the Parties adopted Kyoto Protocol in 1997, which commits developed country Parties to return their emissions of greenhouse gases to an average of approximately 5.2% below 1990 levels over the period 2008-12. The Kyoto Protocol provides for quantified emission limitations and reduction commitments for the developed countries and mechanisms to facilitate compliance with these targets, reporting and review and it lists six greenhouse gases- Carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

India acceded to the Kyoto Protocol in August 2002 and one of the objectives of acceding was to fulfil prerequisites for implementation of Clean Development Mechanism (CDM) projects, in accordance with national sustainable priorities, where under, a developed country would take up greenhouse gas reduction project activities in developing countries where the costs of greenhouse gas reduction project activities are usually much lower with the purpose to assist developing country parties in achieving sustainable development and in contributing to the ultimate objective of Convention and to assist developed country Parties in achieving compliance with their quantified emission limitation and reduction commitments (URL:envfor.nic.in/). Efforts are on in the state to secure such collaborations especially in hydel power sector.

6.2 THE EFFORTS

Perhaps the Mother Nature gave a warning signal when a large-scale mortality of fish fauna occurred repeatedly in river Sirsa. Thereafter, an effort for search for sustainable solutions started. Besides non-performance by the business community on corporate social responsibility, who many a times behave unethically either by not treating their waste properly or by dumping untreated waste into river Sirsa; different governmental agencies of the state government also contributed to this scenario by pursuing unsustainable practices and contradicting priorities, which put development and environment at loggerheads resulting in overall environmental degradation. This raises a question *'can environment and development go together?'*

With BBN area assuming critical status due to all around environmental degradation, the state board with the help of AusAID through U.R.S. Pty. Australia prepared a Report - Waste Water Collection Treatment & Disposal for Baddi Barotiwala Area H.P., Feb. 2001 with the involvement of all stakeholders. The report attended to two important problems of the area viz. wastewater and solid waste including hazardous wastes pollution. With respect to wastewater management, Common Effluent Treatment Plant (CETP) was proposed and whereas for the

problem of solid waste including hazardous management Treatment Storage Disposal Facility (TSDF) was recommended. The report thereafter became the basis for Public Private Participation (PPP) endeavour by the state Industry Department for securing funding. But are these efforts sufficient given the gravity of situation?

6.2.1 Public Private Participation

Public Private Participation (PPP) is mobilizing resources both by the government as well as private sector to boost infrastructure development. Investment in infrastructure like roads, bridges, ports and other utilities in the form of public goods is the primary responsibility of government. The government uses its revenue (budget and borrowings) to develop essential infrastructure to be used by the general public. In developing countries, government has been facing acute resource crunch in providing these essential services to its people, as a result the concept of PPP has gained momentum and has established an enabling environment in many such countries to provide for participation of private capital in the development of infrastructure. Thus, the partnership between public and private sector has developed over the years to provide such services, which were hitherto provided to by the public sector. Creation and maintenance of infrastructure places an enormous burden on the coffers of the government. In developing countries like India, this can be as high as 7% of GDP. In a huge country like India, there is not enough infrastructure development in backward states. Further, there is also lopsided and skewed developmental approach. The sectors which are in the priority list of the government such as roads, bridges etc. receive more attention whereas sectors like environment protection suffer being low in the list of the governmental priority.

Through PPP, the government is able to mobilize additional resources, besides its own budget, to fund infrastructure development. It helps to implement developmental projects without waiting for finances to improve and support such development. According to UN Commission on International Trade Law (UNCITRAL), PPP is not only being used for large-scale projects but also being utilized for medium and small-scale projects. The main reasons for taking the PPP route for development of infrastructure are viz. availability of additional sources of funds to take up infrastructure works on priority; faster implementation of infrastructure projects; improvement in the quality of construction through improved equipments and technology; reduced cost of implementation through competition and economies of scale and poor condition of environment requiring immediate attention.

One of the advantages of PPP in its different forms is that a considerable workload, including responsibility for financing, designing, construction and operation of the projects, is transferred from the government agencies and ministries traditionally responsible for the infrastructure to private sector. Generally speaking, it does not, however, imply that the role of the government is limited to supervision and monitoring of projects. Built Operate and Transfer (BOT) infrastructure projects require that the government play an active role, in particular in the pre-construction phases of a project. It has been rightly stated in the Training Module of UNIDO

BOT Programme-The Government Role, 1997 that infrastructure projects cannot be realized without substantial commitment and cooperation on the part of the host government.

6.2.2 The Experience

The experience with posing environmental protection project to PPP has not been encouraging as there were not many takers for such projects related to wastewater management viz. CETP and TSDF. The experiences in India and especially in my state with respect to such typical environmental projects have not been encouraging. The World Bank study of 'Private Participation in the Water and Sewerage Sector' further corroborates this. According to this study, in developing countries private sector participation in water and sewerage is a relatively recent phenomenon. Before 1990, almost all developing countries relied on government provision of water supply and sewerage services; private participation in the sector was rare. The potential for gains from private sector involvement, through greater efficiency and improved access to finance for new investments, was as great in water and sewerage as in other infrastructure sectors. But governments' willingness to take the steps to secure private participation was relatively limited. In many countries, water continued to be treated as a social rather than an economic commodity. There was considerable political resistance to raising tariffs to cost recovery levels, increasing the risk of long-term investment in water and sewerage assets. In addition, many national governments in recent years decentralized responsibility for water and sewerage services to municipal or provincial governments, which often had little experience with private sector contracting and regulation and were thus relatively unlikely to initiate private transactions. According to the same study, breakdown of private involvement by sub-sector (water treatment, water distribution, sewage collection, sewage treatment) highlights the greater prevalence of private sector involvement in water relative to sewerage. Government priorities have generally given greater emphasis to supplying water than to removing wastewater after use. Consumers are more willing to pay for water delivery service that yields immediate and direct benefits than for services such as sewage treatment, the benefits of which are more dispersed. The same probably applies to the CETP and TSDF.

But Why a Common Facility for Environment Management

- One of the advantages of common facility for wastewater and hazardous waste management is that monitoring and surveillance becomes easy which results in effective environmental management. With 200 units discharging wastewater into four open drains and then finally to river Sirsa, the regulator is required to draw 200 samples of wastewater and analyze them with each taking 3 to 5 days for analysis. So 200x3 to 200x5 man-days are required for analysis and resultantly there is no control on quality of environment. The regulator with existing equipments and manpower can hardly cope up with this situation so environmental monitoring and surveillance suffers and resultantly the environment and civil society suffers as well.
- Under the proposed new regime, environmental monitoring and surveillance become easy for regulator as the wastewater from the units do not flow into the open drains but through closed pipes to a common treatment facility. The regulator is required to check at the final point at which the service provider discharges water into river Sirsa. This makes environmental

monitoring and surveillance easy and the regulator can concentrate on other hitherto neglected aspects of environmental management. Herein the net gainer is the environment.

Two Scenarios

Common Effluent Treatment Plant (CETP)

If one examines the funding scenarios, interestingly both funding scenarios as referred viz. i) Full Cost Recovery- Secondary Treatment by Industry and ii) Donor Capital Grant- Secondary Treatment by Industry were tried by the Industries Department in securing funding through PPP mode. The first scenario, wherein all capital and operating costs were proposed to be covered by income from user charges, the industries complained that such user charges would make them economically unviable and uncompetitive. Besides, no entrepreneur was interested in investing in an environmental protection project as they considered it economically less attractive.

Further, the second scenario wherein the Donor Capital Funding the capital cost of the CETP plant is covered by a grant and operating costs are covered by income from charges, the donor funding could not be secured as all the donors insisted on participation by the industry and grants for civil works is not easy to come. Even the government funding could not be secured, as environment protection probably could not compete with more pressing resource requirements. Under both the scenarios, the entrepreneurs wanted special relaxation w.r.t. compliance to environmental standards, which was not possible as the law does not differentiate between the entrepreneur and environmental entrepreneur (Source: HPSEP & PCB & URS Pty. Study, 2001).

Treatment Storage Disposal Facility (TSDF)

The situation for securing funding for PPP management of MSW including hazardous TSDF was no different w.r.t. both the funding scenarios viz. i) Full cost recovery of capital costs and annual operating costs with a commercial operation and ii) Donor funding of capital costs combined with cost recovery of fixed and variable operating costs with a commercial operation. No entrepreneur came forward for such venture as it was found to economically unattractive. May be economies of scale at the later stage would make a difference.

6.2.3 Open Questions

This dilemma raises some open questions viz.

- Is PPP an only way out in this dilemma?
- Being public good nature of benefits of safe disposal of combined wastes, can government only mitigate the situation?

In my view being the public good nature of the benefits of safe disposal of combined wastes and in view of free riding tendencies, there is a sufficient reason for the government to fully back such endeavours. The suggestions in this regard have been attended to in later in the thesis.

6.3 THE POLLUTER PAYS

In environmental scenario, the impacts of acts of production and consumption of one party may be visited on third parties who do not have a direct economic nexus with the original act. In case the causal agent of negative externality is not getting revisited on the party responsible for the

original act, the resulting level of the entire sequence of production or consumption, and externality, is inefficient then economic efficiency may be restored by making the perpetrator of the externality bear the cost of the same. This policy, accordingly, promotes the internalization of environmental costs, including through the use of incentives based policy instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting trade and investment.

6.3.1 Existing Mechanism for PPP

i) The Water Cess: As already been discussed the procedures for environmental protection in Indian context are basically C&C. The mechanism except for the Water (Prevention & Control of Pollution) Cess Act, 1977 which provides for levy of cess on the water consumed by the industry during the production process for specified purposes with a view to dissuade wasteful and indiscreet use of water, is the only economic instrument (EI) being used for pollution abatement and control in India. The cess proceeds so raised are utilized for programmes related to control of water pollution.

During the subsequent discussions, the assessment on the adequacy of such policing mechanisms for prevention, abatement and control of pollution would be made. Before 2003, the prevalent rate structure of water cess was too low to dissuade the industry to reduce the use of water and the consequent wastewater discharge. In order to set the things right, the federal government modified the cess rates in 2003, which are given in the Table-6.1. Still the rates are not at the level to offer meaningful deterrent to the industry for wasteful consumption of water. Moreover, the cess is only with respect to water pollution and till today no instrument has been designed for combating the menace of air and other forms pollution which are much more deadly than water pollution and also spread faster.

Table-6.1 Water Cess Rates (w.e.f. May 2003)

Purpose for which water is consumed	Rates-Compliance to the provisions of Water Act & Env. (Protection) Act	Rates-Non-compliance to the provisions of Water Act & Env. (Protection) Act
Industrial cooling, spraying in mine pits or boiler feeds.	5 paise per kiloliter.	10 paise per kiloliter.
Domestic purpose.	2 paise per kiloliter.	3 paise per kiloliter.
Processing whereby water gets polluted and the pollutants are easily biodegradable.	10 paise per kiloliter.	20 paise per kiloliter.
Processing whereby water gets polluted and the pollutants are not easily bio-degradable and toxic.	15 paise per kiloliter.	30 paise per kiloliter.

Source: Ministry of Environment & Forests, Govt. of India.

6.3.2 To Use or to Misuse

Water use in industry is a double-edged sword. On one hand it puts immense pressure on local water resources and on the other, wastewater discharged from the industry pollutes the local environment. Water is required, often in large volumes, by industries as process inputs in most industries. In other cases, like food and beverage and chlor-alkali industry, water is used as a raw material: turned into a manufactured product and exported out of the local water system. According to CPCB, the annual water consumption in Indian industry is 40 billion cubic meters and the annual wastewater discharge is about 30.7 billion cubic meters. The overall ratio of wastewater discharged to freshwater consumption in Indian industry works out to be about 0.77. That is, for every cubic meter of water consumed by Indian industry, 0.77 cubic meters of wastewater is discharged.

In most industries, water is essentially used as input and mass and heat transfer media wherein a very small fraction of water is actually consumed and lost. Most of the water is actually meant for non-consumptive process uses and is ultimately discharged as effluent. The amount of water available matters but so also does its quality. Industry requires water of good quality for its use, and for this it uses cleaner upstream water. However, the water it discharges is always of lower quality than the feed water and this wastewater is discharged downstream. Further, ratio of water consumption and economic value creation in Indian industry is poor. For every cubic metre of water that Indian industry uses, it generates merely US $7.5 economic productivity (Source: World Bank, 2001) which is very low as compared to UK, Sewden etc.

6.4 Environment- A Public Good

Public goods are defined in terms of their economic rather than their administrative, physical, normative or financing characteristics. The market fails to exist for public goods because they are non-excludable and non-rival in consumption. With its non-excludable character it is not possible to prevent use of (or benefit from) the service by those who do not pay for it (producers therefore being unable to recover the costs); and its non-rival in consumption attribute refers that one person’s consumption of the commodity does not affect any other person’s consumption of it. This brings in economic roles of the government viz. allocative role, distributive role, regulatory role and stabilization role into focus. Considering that public health benefits of safe disposal of industrial, domestic and commercial wastes is a public good there is a high tendency of free riding, resultantly the environmental pollution and degradation takes place. Herein, potentially an infinite number of users can benefit simultaneously and it is not possible to prevent people from benefiting from service. Market failure is profound and absolute in the pure public goods where both non-excludability and non-rivalness exists simultaneously (Bailey S.J., 2002).

Water resources have natural regenerative capacity and they can accept certain amounts of pollution loads without affecting themselves. That means this natural regenerative capacity of water imposes a constraint on the supply of waste disposal services. Industry and households demand waste disposal services and if this demand exceeds the supply constrained by the natural

regenerative capacity, the degradation of water resources starts. Given the public good nature of waste disposal service, market is absent for this service and the polluter takes it as a free service (Murty M.N., 2002). Therefore, the demand for the waste disposal service may exceed the natural supply. The need then is to look for instruments and institutions to reduce water demand for waste disposal services to their natural levels of supply.

6.5 C&C v/s EIs- SOME DISCUSSION

So now what is the way out? Here I would undertake some discussion on economic instruments (EIs) and their mechanism. Over the past two decades, EIs have become accepted as effective policy tools with which to address environmental concerns. The OECD (1997) has defined EI as *'those policy instruments, which may influence environmental outcomes by changing the costs and benefits of alternative actions open to economic agents….* They aim to do so by making the environmentally preferred action financially more attractive. Put more simply, EI create incentives that encourage people acting more-or-less in their own best interests, simultaneously, to treat the environment in a way that is in the best interests of society. In general, EI reward people monetarily for producing environmental benefits and penalize people for imposing environmental costs. They are closely related to the *'Polluter Pays Principle'* whereby people are made to pay for using the environment (Clinch, 2000).

The set of economic instruments available for implementing an economic incentives approach to natural resource management and environmental protection spans a wide range of options and possibilities, and the potential permutations and combinations are virtually limitless. Any instrument that aims to induce a change in behavior of economic agents by internalizing environmental or depletion cost through a change in the incentive structure that these agents face (rather than mandating a standard or a technology) qualifies as an economic instrument. Different instruments have advantages over other instruments in different applications and circumstances, and severe limitations in others (Panayotou T., 1994). Economic instruments may be classified into seven broad types: a) Property rights; b) Market creation; c) Fiscal instruments; d) Charge systems; e) Financial instruments; f) Liability instruments; g) Performance bonds and deposit refund systems.

Alternative institutions for the control of environmental pollution are (a) market, (b) government, and (c) community or associations of people (Greening Industry, World Bank, 2000). A practical policy may involve all these institutions. Normally one does not come across a market with producers of waste and processors of waste acting with same price/cost arrangements to abate such pollutants. Therefore, it is generally stated that market forces fail to control environmental pollution. Government has been viewed as an alternative institution to deal or manage the environment. According to Murty (2002), community action or people's participation is now gaining prominence as an alternative to governmental agencies for the management of environmental resources because of high monitoring and enforcing costs to the state boards.

6.5.1 Market, Government & Instruments for Pollution Control

Non-market policy instruments include C&C. Market based instruments consist of pollution taxes (Pigou, 1932) and marketable pollution permits (Dales, 1968) often referred to as economic instruments. The choice between these instruments depends both on their efficacy in achieving the target level of emissions as well as on the relative size of welfare losses they produce (Baumol and Oates, 1988). Government can use non-market policy instruments, market based or economic instruments or a combination of two.

The C&C instruments are in the form of fines, penalties and threats of legal action for closure of factories and imprisonment of the owners. They can be used either for facilitating the use of specific technologies for environment management or for realization of specific environmental standards. The cost of imposing and implementing compliance are generally higher when C&C instruments are used than with EIs. Furthermore, under C&C instruments, there can be no incentives for firms to innovate or invest in more efficient pollution control technologies or in cleaner process technologies. EIs also called as market based instruments can be divided in to three categories: price based instruments, quantity based instruments and hybrid instruments. Together with supply-demand forces of the market they achieve efficiency even with the presence of environmental externalities like air and water pollution. This can be explained as under:

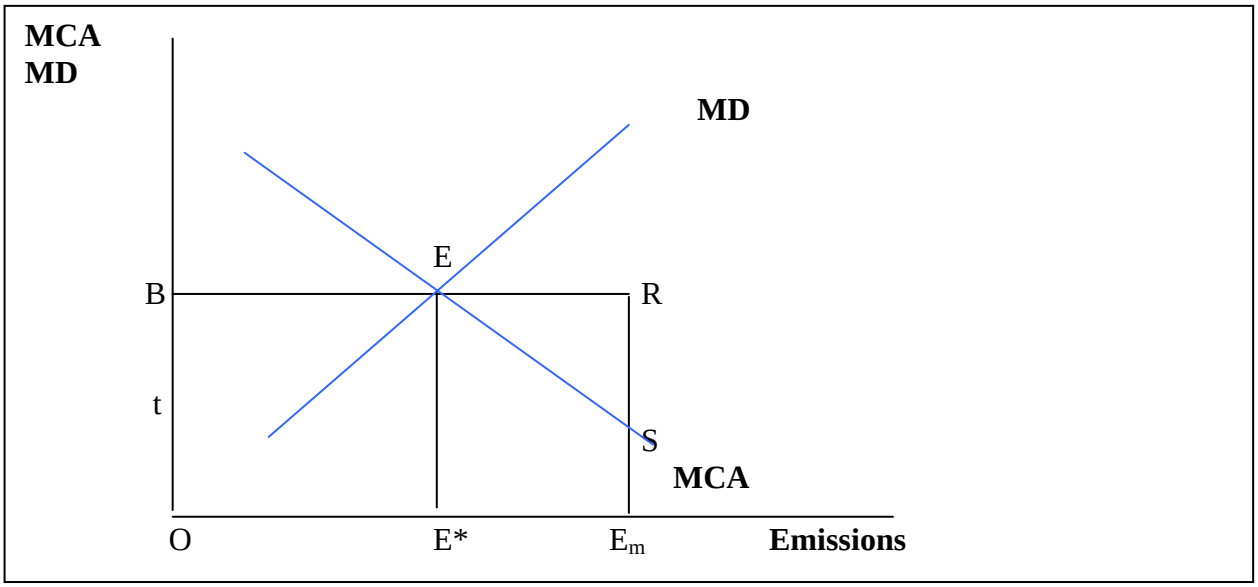
Fig-6.1 at page-66 depicts the demand curve for the waste disposal service as the falling MCA or demand price with respect to the pollution load generated. In Fig-6.1, E_m, E* stand respectively for pollution loads with and without tax instrument and 't' stands for the pollution tax. With the polluters using the pollution abatement technologies, the optimality or maximization of welfare requires that the pollution to be reduced up to the level at which the MCA equals the MD as shown in figure. If a tax equivalent to `t' on per unit of pollution is levied on the polluter based on the 'polluter pay principle', the polluter has an incentive to reduce pollution up to the optimal level, E* in the free market. The polluter has two choices: pay tax equivalent to E^*ERE_m or reduce pollution load from E_m to E* incurring the cost equal to E^*ESE_m. If he reduces the pollution, he will save cost equal to ERS. Therefore, given the tax rate equivalent to 't', he chooses to reduce pollution rather than paying the tax.

The damages from pollution are felt by a large number of people. Therefore, the damage from a unit of pollution at margin is the sum of marginal damages to all the affected people. Therefore, to design a pollution tax, we require the information about abatement cost functions of polluting firms and damage functions for all the affected people. The cost of collecting the information to estimate these functions can be prohibitively high. For example millions of people are affected from the pollution of a major river like Ganges and an urban air-shed like Delhi and therefore it may not be economically feasible to design such a tax (Murty M.N., 2002).

Once the environmental standards are given apriori, the difficult problem of estimating the damages to all the affected people from pollution can be avoided for designing the EIs. However,

we need an estimate of pollution abatement cost. It is economically feasible to obtain an estimate of pollution abatement costs because (a) the polluters may normally be much less in number than the affected people, and (b) tangible information can be obtained about technologies used by the polluters, pollution loads and levels of production. Using the firm level data on pollution loads, the costs of abatement and production levels, the pollution abatement cost functions can be estimated using econometric techniques (Murty M.N., 2002). Given the environmental standards and the estimated marginal abatement cost function, a rate of tax can be fixed such that the firms will automatically have an incentive to reduce pollution for meeting the standards.

Fig-6.1 Pollution Tax/Subsidy Framework

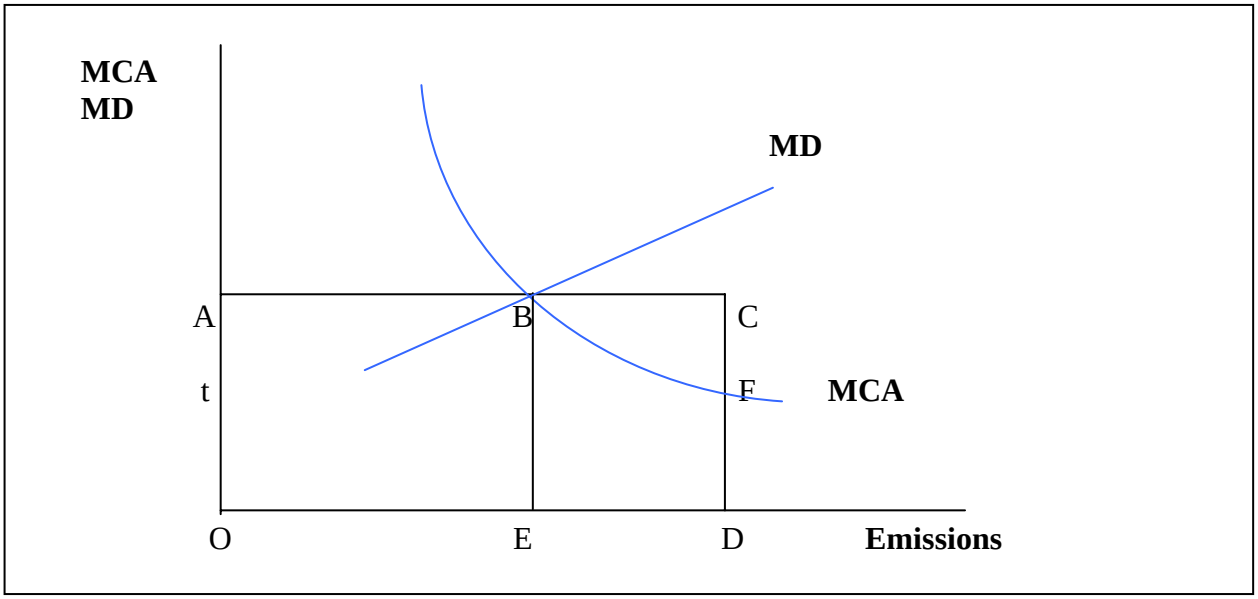


In practice, we should have a mixture of both C&C and EIs (Murty M.N., 2002). EIs alone may not be feasible because of high their imposition requires a lot of information, which are not easy to come by. C&C measures alone are inefficient measures. Similarly, the estimation of damages to affected people in the case of pollution tax, and knowing aprioi the optimal level of pollution in the case of tradable permits pose practical problems for the design of EIs. Fixation of pollution standards MINAS (Minimum National Standard) apriori by the state boards and using either pollution tax or marketable permits instrument to induce the polluter industry to meet those standards can be a hybrid method using regulatory and EIs. However, in this case the criteria for fixation of environmental standards are a subject of debate about whether they have to be decided on scientific basis or on the basis of referendum or political process (Murty M.N., 2002).

Here (Fig-6.2) OE represents emission standard. Suppose the current rate of firm's emission is OD. If the firm has to reduce pollution load from D to E as per the environmental standard, the rate of tax equivalent to OA will make the firm to do so. The rate of tax-'t' in this case is marginal abatement cost corresponding to the level pollution permitted by the given standard. The firm has an incentive to do pollution abatement rather than paying tax because the cost of abatement given by the area BFDE in the figure is lower than the tax liability given by the area

BCDE. Similarly marketable pollution permits can be used to obtain the reduction in pollution loads by the firms as required by the environmental standards. These measures cause adoption of least cost technologies by the firms (Baumol and Oates, 1988).

Fig-6.2 Pollution Tax/Incentive Framework



There can be many situations in which C&C instruments are unavoidable for example environmental crisis requiring emergency measures in the form of command and controls. Pollution tax rates cannot be changed on short notice to deal with emergencies and even if the changes are effected, polluters' response follows with a longer time lag. Marketable permits also result in long run adjustments in environmental quality and are not suitable for emergencies. C&C measures on the other hand can be quickly operated to deal with more than normal amount of emissions arising out of emergencies, since they do not require extra monitoring. Therefore, in practice neither EIs nor C&C alone constitute an optimal environmental strategy. The cost minimizing strategy to realize given environmental standards is a mixed strategy consisting of EIs and C&C.

The fast developing economy like India cannot slow the pace of its development. However, it is also a stark reality that the natural resources are not unlimited and their contamination is a matter of serious concern. The quality and quantity of both renewable and non-renewable resources has to be maintained and improved for providing better quality life to the society of present and future. To achieve this, application of EIs in pollution causing industries is of vital importance and the need of hour. The incentive approach as discussed above, will not only be appeal to the industry for reducing pollution, but it will also marginalize the control and policing mechanism which many a time become a source of acrimony among stakeholders. By such instruments, the industry is bound to respond more favorably and responsibly towards pollution abatement. These EIs are certainly going to help companies in thinking that pollution abatement matter is not a necessary evil but an opportunity to improve their efficiency on account of clean technology and

also assuring them to have their sustained profits along with fulfilling the social responsibilities. In view of discussions, for adopting a scientific socially acceptable approach for pollution abatement, the network of EIs is required to be expanded in Indian perspective. For regulating the environmental policy, five sets of criteria can be used for finalizing instruments i) environmental effectiveness ii) economic efficiency iii) equity iv) administrative feasibility and cost v) acceptability (Environmental Policy OECD, Paris 1991).

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Chapter-7
International Perspective

7.1 INTERNATIONAL SCENARIO

As stated, the EIs can complement or substitute traditional regulatory C&C measures to reduce pollution. The difference between EI and traditional/regulatory C&C measures is that EI use market forces to induce behavioral change, while C&C measures dictate how polluters must control specific activities. Studies and real-world experience show that EIs are more flexible stimulate innovation, and lower costs for consumers and companies that want to green the way they do the business.

Around the world, the use of EIs is a recent phenomenon. The U.S. took the lead in the late 1980's with several tradable permit programs. Permit trading is an economic instrument used to create pollution market in which companies facing high marginal abatement costs buy permits (emission rights) from companies operating at low marginal abatement costs, thereby minimizing the total costs of pollution abatement. Companies trade these permits amongst themselves or through brokers or financial exchanges. In early 1990s, northern European countries such as Finland, Sweden, Norway, Denmark, and the Netherlands began levying a variety of green taxes. A second wave started in the late 1990s in France, Germany, Italy and the UK. Green taxes could be levied on emissions of pollutants or economic activities that are sources of environmental problems, to modify the behavior of polluters and at the same time generate revenue to finance environmental protection and conservation or other government programs. Ideally, the tax rate is set equal to the marginal damage to society of a pollutant at the socially optimal emission level.

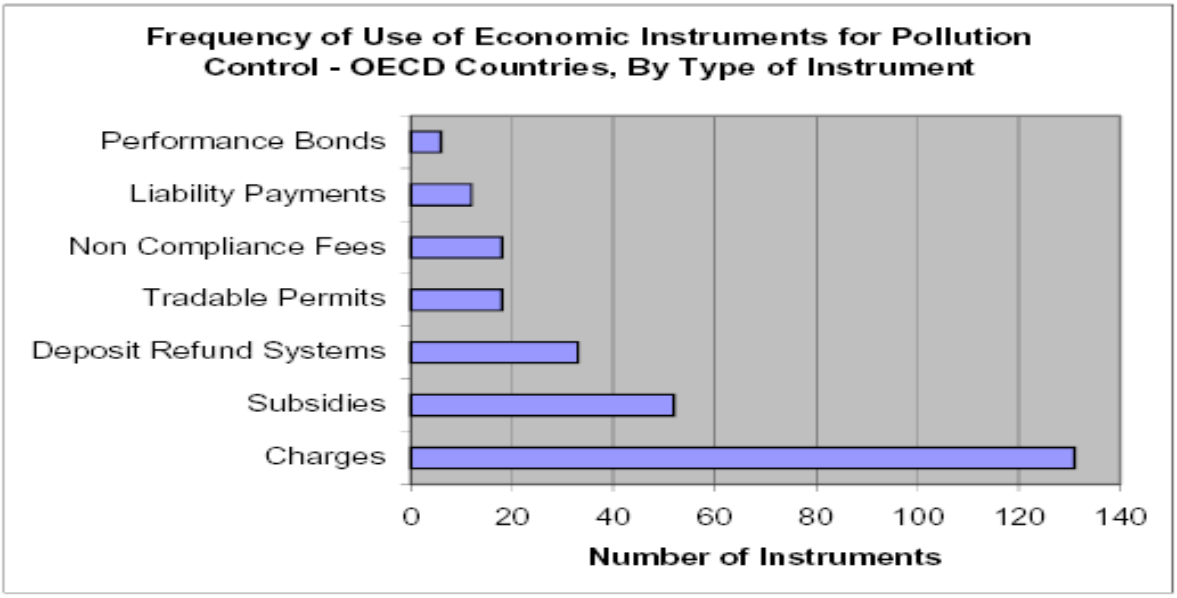
By comparison, the EI of choice in the US has been a tradable permit, largely because of the early success of a program to control acid rain that was implemented in 1993, and continues to operate today. In Canada, EI are being considered more and more. The federal, provincial and territorial governments are involved in a range of instruments such as economic incentives, green taxes and tradable permits. Overall, the international experience to date has shown that an appropriate combination of traditional regulatory C&C measures and EIs can achieve significant reductions in air pollution. In Sweden, for example, the combination of strict regulations removal of subsidies and implementation of environmental taxes has been very effective. The Frequency of use of EIs in OECD countries by type of instrument is given in Fig-7.1 at page- 75.

7.2 EIs AS EFFECTIVE POLICY TOOLS:

Unlike the traditional C&C approach to environmental policy, in general, EI allow the polluter to choose the level of pollution but a cost is imposed for the pollution produced. The strongest argument in favour of EIs over regulation is that, in theory, they minimize the cost to society of reducing environmental damage. If a charge on pollution is used to reach an ambient standard, the abatement will be undertaken where it is cheapest to do so. This is because a firm with a

relatively high cost of abatement will pollute relatively more as, up to a certain point; it will be cheaper to pay the charge than to abate. However, a firm facing relatively low abatement costs will find it relatively cheaper to abate rather than pay the charge. Under uniform regulation, there is no incentive for the firm with lower abatement costs to undertake more of abatement. Thus, the costs of achieving the ambient standard will be higher (Tietenberg, 1990).

Fig-7.1 Frequency of Use of EIs in OECD Countries



Source: OECD

EIs also work on the basis that firms, rather than the regulator, know best as to how to reduce pollution. They leave the pollution reduction strategy up to the polluter (change of product, change of inputs, change of process, and change of treatment) and, therefore, are likely to yield the least cost mix of control strategies (Convery, 1998). In addition, EIs provide incentives for improvement in environmental performance over time. Unlike with EIs where there is a financial gain from polluting less and less, there is little incentive for firms to improve upon the maximum pollution limits set by C&C. There is also an argument that the replacement of C&C mechanisms with EIs reduces bureaucracy. Markets are more-or-less automatic in their effects, thereby minimizing bureaucratic interference. However, there may be set up costs involved.

There is evidence that environmental performance gets improved (Convery, 1998), particularly if reduced bureaucracy makes their implementation easier. In addition, certain EIs are revenue raising. The application of charges for emissions to water in France, the Netherlands and Germany has been used for decades to help finance watershed management and provision and operation of collective treatment facilities. Where governments or public agencies are short of cash, this is perceived to be a potentially significant advantage when compared with C&C and subsidy approaches, which are typically a drain on public funds. It is important to note that EIs generally require a regulatory framework in order to operate effectively. Further, they work most effectively when the pollutant is readily identifiable (point-source pollution) and where the environment can absorb some level of pollutants in question without significant damage.

The first step in examining trends in use of EI is to define what one considers being an EI. A classification of EI types is as under:

i) *'Environmental taxes and charges'* impose an obligation on users to pay for the use of the environmental resources. These bring the costs of pollution and of using environmental resources into the prices of goods and services produced by economic activities.

ii) *'Emissions and effluent charges and taxes'* are levied upon the quantity and/or quality of discharge into the air, water and soil, and are based either on direct measurement or estimations of discharge.

iii) *'Product charges and taxes'* are levied on products that cause environmental damage through their extraction, production, use and disposal. They may take the form of a charge or tax relating to the composition of product, for example the phosphorous content of fertilizers or they can be levied upon the product itself, for example a fuel tax (OECD, 1994, p19).

iv) *'Resource use charges'* are payments made in return for direct use of an environmental good. Payments may be implemented on the basis of quantity (for e.g., mining tax), time scales (for e.g., hunting and fishing permits) or access (for e.g., national park entrance charge).

v) *'User charges'* are payments made in return for the provision of a service, such as collection and treatment of emissions and waste, for example, sewage charges and municipal waste charges.

vi) *'Emissions trading'* system- permits to emit a specified volume of pollution are traded in the market place. The total amount issued is set such that the environmental objective will be achieved. Trades can take place within a plant, within firms (bubbling) or among different firms (offsetting) or amongst countries. Earned credits can sometimes be saved for later use.

vii) *'Deposit-refund schemes'* add a surcharge to the price of a product. The surcharge is refunded when the product, it's residual, or packaging is returned to a collection system instead of conventional disposal. Enforcement incentives are at the border between administrative regulations and EIs. Enforcement incentives usually take the form of non-compliance fees.

viii) *'Performance bond'* type instruments include the case where funds, which are independently held, are set aside by resource extraction companies to make good any damages imposed as a result of, for e.g., ore extraction. They can also include provision of refunds for users of bottles and cans, or for cars to be scrapped, on their return to supplier or other intermediary.

ix) *'Subsidies'* (grants, soft loans and tax exemptions) can be provided to firms who reduce pollution. These are not consistent with the *'Polluter Pays Principle'* - rather it is the *'Victim Pays Principle'* (VPA).

Improved information is also considered to be an EI. Approaches such as education, information and training change the perception and priorities within an agent's decision framework. This internalizes environmental awareness/responsibility into individual decisions by applying pressure indirectly or otherwise (Tietenberg, 1997). Voluntary approaches are agreements whereby an individual firm or group of firms makes a commitment to operate in a certain way, and/or achieve certain qualitative or quantitative objectives such that environmental performance is improved. The use of the term *'voluntary'* is a bit misleading as, to be effective; the regulator

usually threatens that a regulation or some other instrument will be introduced if firms do not stick to the agreement. Voluntary agreements are sometimes categorized as EIs.

J.P. Clinch and M. Gooch in their paper 'Inquiry into the Use of Economic Instruments in Environmental Policy', 2001 summarized the following:

a) Certain EIs are applied more so than others: Charges and taxes experience the greatest application, accounting for over 85% of all instruments implemented. The enforcement incentives are second most frequently implemented instruments, representing a mere 5.9%, and similarly, the remaining instruments viz. subsidies, deposit refunds, tradable permits, information access etc. play a relatively minor role as compared to charges and taxes.

b) Certain sub-classifications of EIs are applied more so than others: Since charges and taxes dominate instrument use, the sub-classification of this category is applied more so than the remaining sub-classifications of instruments. Product charges and taxes represent 59% of all charges and taxes, and just over 50% of all instruments implemented. The second most frequently implemented instruments are user charges, representing 20% of all instruments, whilst the remaining sub-classifications represent a relatively minor proportion.

c) EIs are applied to a greater extent in EU than OECD & CEECs: Countries within CEE, on average, employ approximately two more instruments than EU member states, and one more than the OECD (including EU countries) members contrary to general belief that EIs are, on an average, applied to a greater extent in the EU than the OECD and CEECs.

d) EIs are applied to a greater extent in Northern than Southern Europe and Western than Eastern Europe: North European countries, on average, employ 25% more instruments than those countries located within Southern Europe. Further, East European countries, on average, employing 8% more instruments than those located in Western Europe.

f) EU Member States utilize certain types of EIs more than other countries: Throughout EU, OECD and CEE countries, many instruments are implemented to a similar extent. The exceptions are product charges and taxes, which are implemented to a greater extent in the EU and OECD than CEE. Resource use charges and non-compliance fees are implemented to a greater extent in CEECs as opposed to EU and OECD Member States.

g) EIs are applied to a greater extent in countries with higher GDP: Those countries experiencing the greatest increases in GDP per capita have implemented a greater number of instruments over the past decade.

h) EIs are applied to a greater extent in some environmental areas: 33% more instruments are applied in relation to air pollution than water, and 26% more than in relation to pollution on land.

i) EIs are applied to a greater extent in some sectors: 15% more instruments are applied in the industrial sector than in the domestic sector and 14% more than in the transport sector. EIs are applied relatively rarely in the agriculture and tourism sectors.

7.2.1 Developed Country Experience and its Relevance to Developing Countries

The experience of one country does not readily transfer to another (Panayotou T., 1994). Particularly problematic is the transfer of developed country experience to developing countries because of differences in the stages of development, culture, traditions, and political and administrative infrastructure. Nevertheless, there are lessons to be learned from other country' experience that either transcend these differences or at least could be sifted through for relevant elements. With regard to EIs, developed countries have relatively longer experience with such instruments which may help developing countries follow more promising routes of experimentation. The main categories of instruments covered in this regard are the following: (a) fiscal instruments, (b) charge systems, (c) market creation, and (d) deposit-refund systems.

7.2.1.1 Fiscal Instruments in Europe: Developed countries, especially in Europe, have a long experience with the application of EIs in environmental management. This experience has been mixed, but a general lesson is that fiscal instruments, while effective in generating fiscal revenues, are generally ineffective as incentives for changing behavior unless they are set high enough to alter the relative profitability of inputs, products, technologies and practices (Panayotou T., 1994). Countries are often reluctant to set taxes and charges high enough to act as economic incentives because of the political reasons, resistance by industry or concerns about competitiveness. Among developed countries, only the Netherlands has come close to charging the marginal damage cost of pollution. France lies at the other extreme: charges have been set at less than a quarter of the level necessary to induce a significant change in behavior, and 90% of the charge revenue is returned to the industry as subsidies for investment in pollution abatement technology. Developed countries experience (mainly European) with fiscal instruments focusing on (a) effluent charges, (b) product charges, (c) tax differentiation, and (d) subsidies is as under.

a) Effluent Charges: '*Effluent charges'* have been applied in developed countries to air, water waste and noise pollution. *'Air emission charges'* are rare, having been used only in France with rather modest results. The charge was set low, with 90% of the charge revenues returned to the charge payers as a subsidy for pollution control equipment, and the rest is used to develop new technologies. The performance of this system is limited by the unfeasibility of collective treatment of air pollutants and complexity of monitoring when applied to more than one or two pollutants. This system is clearly unsuitable for developing countries with monitoring difficulties (Panayotou T., 1994).

Several countries- notably France, the Netherlands, and Germany- have used effluent charges to control water pollution. France has had such a system since 1969. The *'effluent charge'* is levied on all fresh and seawater polluters- both households and industries- and applies to several pollutants such as BOD, COD, soluble salts, organic ammonia, N and P. Industries are charged on a flat rate set by actual measurement. The system is designed to raise revenues rather than to act as incentive for waste minimization, as the charge rate is set too low to induce a change in production process. France's success with effluent charges lies in the acceptance of these charges as a way of doing business. The key has been their gradual introduction of these charges at low

levels and on a few pollutants and their progressive escalation to higher levels and wider scope (Hahn, 1989).

In Germany, a *'water pollution charge'* was implemented in 1981 with an explicit incentive purpose and a close link to direct regulations. The nominal charge per unit of discharge was set at ECU 5.75 in 1981 and raised to 19.20 ECU in 1986; the effective charge varied according to the degree of compliance with standards. For example, a 50% discount is applied when minimum effluent standards are met. Although it is difficult to assess the effectiveness of the system separately from that of direct regulation, there is evidence of substantial incentive effects. 10% of the firms complied with the standards in order to benefit from the charge discount; several large firms treated more than the minimum requirements for economic reasons; 1/3rd of the municipalities claimed that the charge system induced them to intensity their water treatment facilities; and the clean technology market grew rapidly (OECD, 1989). OECD, 1989 reports that the system was adjusted in 1989 to increase the discount on the charge to 100% for a discharge of less than half the minimum standard, and to 80% for the application of *'state-of-the-art'* techniques for the control of toxic waste.

The Netherlands have a combined effluent user charge system: the Water Boards and firms pay an effluent charge (based on BOD and COD) to the State Water Authority for discharges into state waters; firms and households pay a user charge to Water Boards for discharges in other waters that are treated by the Water Boards. The overall charge is calculated by the Water Boards in order to balance their budgets for water treatment. The individual polluter's charge is based both on volume and concentration. Large polluters are monitored and charged accordingly; medium-sized firms are charged according to a table of coefficients that vary by type of industry; small firms and households are charged a standard fee. Panayotou (1994), states that the charge system in Netherlands has been effective not only in raising substantial revenues to finance water quality improvement, but also in its significant incentive impacts, and in inducing behavioral and technological changes in certain industries such as chemicals, food, beverages, and tobacco. According to OECD (1989), waste pollution was reduced by 70% during 1969-80 and another 10% reduction in the 1980s. The success of the Dutch system is attributed to the fact that the charge rates have increased considerably over time, generating expectations for further increases. In per capita terms the Dutch charges are 8 times those of France and 16 times those of Germany with low administrative costs.

In conclusion, effluent charges for water pollution in combination with regulatory standards have been reasonably effective and acceptable in Europe. Where the charge rates were set at relatively high rates and escalated over time, there has been a continuing incentive for firms to minimize waste and to abate it. The charges have also been a major source of revenue for collective water treatment. It is also important to note the need for variability in charges according to source and type of pollutant (i.e., small vs. large, toxic vs. non-toxic). Effluent charges for water pollution are quite relevant to developing countries that experience heavy pollution loads in rivers flowing through urban and industrial centers (Panayotou, 1994). Of the country experiences reviewed,

the Dutch system is the most relevant, not only because it has been very effective and administratively inexpensive but also because it takes monitoring and enforcement difficulties into account, differentiating between large, medium, and small firms and households.

Effluent charges for solid waste are rarer than water pollution charges. Belgium imposes a charge of ECU 0.02 - 2.15 per ton of industrial and municipal waste, depending on the type of waste and its treatment before dumping, while exempting recycled wastes. To encourage recycling, Denmark charges ECU 5.20 per ton of *'harmful'* waste dumped. Netherlands imposes a progressive charge on surplus manure, which is a major source of acid depositions, eutrophication, and soil pollution. The US levies ECU 1.85 per dry ton of hazardous waste on waste site operations to finance the restoration of the site after closure. The problem with these simple charge systems for waste is that *'low charges would not be effective and high charges would encourage evasive behavior and illegal dumping'* (OECD, 1989). According to Panayotou (1994), the effluent charges for solid waste are not recommended for developing countries unless they are combined with delivery bonds and auditing. User charges on waste disposal are preferable, more common, and their use is recommended for developing countries.

b) Product Charges: One product charge used by many European community countries, such as France, Germany, and Italy, is a charge on lubricant oils. Its effectiveness in terms of waste oil recovered is high in Germany, where it is set at ECU 96 per ton, and low in France, where it is set at ECU 6 per ton. The most remarkable *'product charge'* is the Dutch general fuel charge; its purpose is to raise revenues to finance the environmental programs. The incentive value of the general fuel charge is low, but it is enhanced with rebates for installation of SO_2 abatement technologies. Sweden- and to a lesser extent Norway- has a preference for product charges. Some common charges include charges on batteries, fertilizers and pesticides, non-returnable containers, and oil products. The U.S. has a general feed stock charge on industries using chemical and other hazardous materials in their production process in order to finance the *'superfund'* for the cleaning up of abandoned hazardous waste sites. The incentive effect of this charge is limited and so is its efficiency, but it is well accepted by the industry.

Panayotou (1994), states that the *'product charges'* lack a strong incentive impact. Whatever reduction of waste is accomplished it's because consumption of the product has been discouraged, not because the producers have an incentive to minimize or treat waste. Thus, only prevention through sufficiently high product charges to discourage consumption and/or encourage reuse and recycling of reusable and recyclable material would result in environmental improvement. In contrast, the revenue-raising impacts of these charges are considerable, especially when the demand for the product is price inelastic. The administrative efficiency is also high because product charges are self-enforced. Product charges, despite their drawbacks, have particular relevance to developing countries because they are virtually self-enforced as the low monitoring and enforcement capabilities of developing countries present difficulties for many other economic and regulatory instruments.

c) Tax Differentiation: Tax differentiation has been used mainly in Europe to reduce transport-related emissions by: (a) speeding up the shift from leaded to unleaded gasoline and (b) encouraging clean car sales. As with other charge forms, tax differentials have an incentive effect only to the extent that they are sufficiently large to alter behavior. Further, European countries have used tax differentiation as a transitional policy to speed up implementation of direct regulations of air pollution from vehicles. In terms of transport-related emissions, the general level of gasoline taxes is as important, if not more, as gas tax differentials. U.S. has traditionally maintained low gas taxes and domestic oil prices below world price levels while Europe and Japan have practiced the reverse. This resulted in significant differences in energy efficiency.
Several European countries introduced tax differentiation during 1985 and 1986 as an instrument for the promotion of cleaner cars to meet existing or forthcoming regulations. Buyers of *'cleaner'* cars were given a tax advantage paid by buyers of *'dirtier'* cars. Tax differentiation was based on pollution characteristics, size of vehicle, and/or year of purchase. Evidence from several countries indicates considerable effectiveness of tax differentials as instruments for speeding up the implementation of regulations.

Two other variants of tax differentiation in the Netherlands according to Panayotou (1994), warrant mentioning here because of the potential applicability to developing countries: (i) a differential VAT between environmentally *'friendly'* and 'unfriendly' products; and (ii) a reduction in the annual road tax on cars and an increase in the indirect tax on car fuels to create a tax differential between light and heavy car users in order to discourage driving. The latter is thought to have three related benefits: reduction of energy use, pollution, and congestion. The great advantage of a tax differentiation system is high administrative efficiency because it is integrated into the existing tax system and requires little additional collection and enforcement effort, as such; it is especially relevant to developing countries with low monitoring and enforcement capabilities.

d) Subsidies: Most OECD countries, with exception of UK and Australia, have provided some financial assistance for environmental investments by private sector in the form of grants, soft loans, or tax allowances with objectives to speed up the enforcement of direct regulations; to assist especially small firms, that face cash flow problems or financial difficulties caused by capital investments required by compliance to new regulations; and to support the research, development, and introduction of pollution control equipment and Cleaner technologies. Subsidies are financed from charges, revolving funds, and the general budget. It has been estimated that environmental subsidies in Europe range between 5% and 20% of total environmental investments. In France, most environmental subsidies are closely linked to charge systems: polluters pay for their emissions, but as much as 90% of the revenues is returned to them as refunds for environmental investment/improvements that they make. About 10% goes to finance R&D of new technologies. Subsidies financed from the general budget are found mainly in industrial and household waste-collection and treatment. In Germany, subsidies are financed mainly from the general budget with the aim of assisting small firms during the transition period and speeding up implementation of new environmental regulations (OECD, 1989).

Revolving funds provide an additional source of financing. Subsidies are given in the form of soft loans to polluters facing strict environmental standards. There is conflicting evidence as to the environmental effectiveness and economic efficiency of these subsidies. While some claims 100% success in emission reduction, others argue that *"subsidies have no incentive impact…, but may only give rise to 'windfall profits'* (OECD, 1989). The function of subsidies in speeding up the enforcement of regulations is also disputed. The economic efficiency of subsidies- that is, their contribution to optimal pollution reduction- is also reported to be low, not only because of the windfall profits they give rise to but also because subsidies are not tied to specific environmental outcomes; non-environmental criteria play a role as well. Finally, according to Panayotou (1994), subsidies are a violation of PPP to the extent that part of environmental costs are not borne by the polluters, although OECD accepted that subsidies to target groups facing difficulties, especially during well-defined transitional periods, are not in conflict with PPP.

The US has limited experience with environmental subsidies, which are applied mainly in waste treatment and noise abatement. The government subsidy to investment in wastewater treatment facilities was initiated in 1956 and has varied over time between 30% and 75%. The U.S. experience indicates that with the exception of a few financially strapped communities, subsidies were not indispensable to the wastewater treatment programs; the variation in the level of subsidies over time induced a postponement of investment and of compliance with regulations in expectation of higher subsidies; and the high subsidy share of investment costs has induced capital-intensive treatment plants with excess capacity (OECD, 1989).

According to Panayotou (1994), the developed country experience with environmental subsidies suggests the following lessons for the developing countries: i) Its use should be minimized, targeted, and of limited duration during the transitional phase; ii) It should not be escalated, but rather, phased down over time to create incentives for accelerated rather than delayed compliance; iii). It should not be tied to a particular technology or investment but to a specific environmental outcomes (improvements); iv). For subsidies to be compatible with the PPP, they should be financed from charges on polluters and given in connection with specific environmental improvements; partial refunding of charges may help secure industry's cooperation and willingness to pay the charges; and v). Subsidies from general budget may be justified for cleaning accumulated hazardous waste prior to the introduction of control policies, for abatement of non-point pollution/waste generated by large numbers of small and dispersed units, and for support of R&D of new pollution abatement and cleaner production technologies. Further, environmental subsidies are not relevant to developing countries because their industry is dominated by a large number of small, unregistered, dispersed, and fugitive firms that cannot be easily regulated and monitored; nor can effluent charges be collected at reasonable administrative costs. Indirect instruments such as product charges, differential taxes, refundable deposits, and subsidized collection and treatment of residual waste appear to be superior instruments under these circumstances.

Similarly, user charges may not fully cover the costs of sanitation and solid waste collection services making subsidies unavoidable. Every effort, however, should be made to finance such subsidies from surcharges on related public utilities and property taxes approximating as much as possible the *'polluter pays and beneficiary pays principles'*. Finally, in developing countries with little experience in pollution charges, subsidies in the form of refunded charges for environmental improvements might be indispensable for obtaining the agreement of the industry to the introduction of such charges. The great danger with subsidies in developing (as in developed) countries is that they become institutionalized in public policy and capitalized in the value of economic assets, resulting in windfall profits or capital gains with little influence on behavior towards more environmentally benign activities and practices.

7.2.1.2 Charge Systems in Europe & the US User Charges*:* ***'****User charges'* are applied to collection and treatment of MSW and wastewater in the public sewage systems. All developed countries apply a form of user charge for wastewater. Belgium and Denmark, levy user charges only on households. Others, such as U.K., apply the charge only to firms. Most countries, however, target both firms and households. The most common form of user charge is a flat rate. A few countries such as Canada, Sweden, and U.S., supplement the flat rate with a water use charge, while others, such as France and U.K., charge according to water use only. In few countries, such as Finland, U.K., and U.S., user charges for firms are based partially on a flat rate and partially according to pollution load. Only Denmark and Germany levy a user charge according to the volume of wastewater discharged. In some countries, such as Sweden, there is cross-subsidization of households (which pay a low charge) by firms (which pay a high charge). Because in most countries the charge is not on water pollution strength, industries that reduce their water use and hence their wastewater may simply be raising the pollution load. To avert this problem, U.S. has introduced a water-pollution-strength charge, but because of high monitoring costs it is applied only to large dischargers.

User charges for solid waste collection services also exist in virtually every developed country, but only a few provide incentives for waste minimization and recycling. A flat rate charge is usually used for households and a waste-volume-based charge for firms. In Finland, a joint private-public sector chemical waste treatment firm offers its services at a user charge based on the volume, type of waste and transport distance. In the past, France has had the only system that provided incentives for waste minimization: a household waste-collection charge that is based on the actual volume of waste that households and firms offer for collection and the unit service costs. Because of problems with invoicing and with the charge base, this system is being increasingly replaced by a household waste collection tax based on property value. Thus, in the case of user charges there is a clear trade-off between incentive impact and administrative efficiency. User charge systems are generally acceptable and effective, but provide little incentive for waste minimization and recycling. User charges, however, can be made to provide such incentives, if they are based on the quantity and quality of waste for large polluters and if they rely on a simpler system (e.g. waste collection taxes) for small firms and households.

Despite the unimaginative use of user charges in developed countries, the scope of user charges for solid waste collection is considerable on solid waste management in developing countries.

Access Charges (Road Pricing) **-** The traditional response to traffic congestion has been the building of more roads. An ever-increasing demand for road infrastructure combined with budgeting pressures has stimulated the interest in demand management in general and in road pricing in particular. The costs of building new highways is increasingly recovered from revenues collected from road tolls, a form of user charge that serves both as a cost recovery instrument and as a traffic regulator. A major problem with toll highways, however, has been the need for drivers to stop and pay the toll, thus slowing down traffic and negating some of the congestion reduction benefits of the system. In response to this problem, automatic toll and entry fee systems have been developed. This toll system has the capacity to alter the charge based on the level of congestion (i.e., to charge higher tolls during rush hours) and thus to regulate and smooth out the flow of traffic (e.g. toll highway E-470, the first high-tech toll highway in U.S.) The benefits from such a system are many. First, congestion costs in terms of loss of time and fuel are reduced, thus motorists benefit. Second, pollution is reduced because of higher speeds, less time on the road, and fewer cars running (as a result of car pooling). Third, the government raises revenue for maintenance and expansion of road infrastructure. Road pricing in general, and the electronic toll system in particular, can be applicable in any country regardless of level of development. Because in developing like India, the car owners belong to upper middle class, a road pricing system would not only be efficient but also distributionally progressive; especially if the revenue from tolls is used to subsidize an efficient mass transit system which is less polluting and more affordable by low income groups.

7.2.1.3 Market Creation: Tradeable Emission Permits in US: The major applications of tradeable emission permits have been in the U.S.: (a) trading of emission rights of pollutants regulated under the Clean Air Act; (b) inter-refinery trading of lead credits; and (c) trading of permits for water pollution control. Interestingly, the U.S. trading of emission rights arose from an attempt to implement strict emission regulations, which in many areas could not be met within the set timetable or could be met only at substantial opportunity cost in terms of foregone economic growth (Panayotou, 1994). When it was realized that many states could not meet the planned emission reduction, the EPA formulated an offset policy by which new and modified emission sources were allowed as long as any additional emissions were offset by reductions in existing sources. This led to the 1986 Emissions Trading Policy Statement, which covered several pollutants such as CO**,** SO_2, particulates, VOCs, and nitrogen oxides. The U.S. Emissions Trading Program has several elements. The *'netting'* or *'bubble'* element allows *'trade'* of emission reductions among different sources within a firm, as long as the combined emissions under the *'bubble'* are within the allowable limit. The *'offset'* element allows firms to trade emission credits between existing and new sources within a firm and among firms; new sources of emissions can be constructed as long as the new emissions are (more than) offset by a reduction of emissions from existing sources. Finally, the *'banking'* element allows firms to accumulate and store emission reduction credits for future use or sale.

The Emissions Trading Program fared well in both environmental effectiveness and economic efficiency. According to Rehbinder and Stewart (1985), trading has produced at least as high an ambient air quality as direct regulations and at a much lower cost. In contrast to '*technology forcing'* implied by the strict technology requirements of the Clean Air Act, emissions trading allows plant operators the flexibility to choose the technologies most suitable to their own circumstances, to come up with their own inventive technological solutions, and to go beyond the minimum requirements of the imposed standards to control pollution for profit.

An outcome of emissions trading of particular relevance to developing countries is that it allowed the construction of a large number of new plants in highly polluted areas without increasing pollution levels; an outcome that would not have been possible with direct regulations. Developing countries cannot afford to retard their industrialization and economic development through inflexible and costly regulations or mandated technology standards. Emissions trading offer industrial firms the option to avoid meeting stringent emission standards for new plants by reducing emissions in existing plants or purchasing emission credits from other firms that can reduce their emissions at lower costs. The replacement of the requirement for approval of abatement technologies by the requirement for approval of emissions trading transactions did not reduce the involvement of the regulators and the administrative costs. It did, however, shift decisions about the choice of abatement technology and its location from regulators to plant operators (Panayotou, 1994).

In India, an emissions trading system would be further limited by the high monitoring of, and transaction costs between, a large numbers of small firms, many of which are unregistered. Yet there is no reason why an emission trading system could not be applied to public utilities, multinationals, large local firms, and industrial estates, while small sources may be controlled by a system that targets fuel use rather than emissions. The main limitation is that emissions trading do not apply to more than one pollutant simultaneously, unless some equivalence index is developed (OECD, 1991).

Tradeable permit programs have also been used in controlling water pollution in the U.S. There are two notable cases: (a) the Wisconsin Fox River water permits for point pollution sources and (b) the Colorado Dillon Reservoir water permits for non-point pollution sources. In the early 1980s, the state of Wisconsin issued discharge permits to 14 paper mills and 4 wastewater treatment plants discharging effluents into the Fox River. The permits were issued only for reductions of BOD discharges exceeding the levels required by treatment standards. Trading of permits was allowed in order to give firms more flexibility in controlling and treating their effluents. Somewhat more promising is the permit-trading program between point and non-point pollution sources at the Dillon Reservoir in Colorado. Under this system point sources are allowed to treat their effluents by less than required (drinking water) standards in exchange for reduction or treatment of non-point pollution sources. In the Dillon Reservoir case, the point sources are publicly owned sewage treatment plants, and the non-point sources are agricultural, recreational, and urban activities. The scope for trading arises from the lower marginal costs of

treating discharges from non-point sources to some level (say from zero to 60% or 70%) compared to treating point discharges from 95%-98%, which requires new purification facilities. The fact that trading in this system is between the waste treatment facilities and the water authorities implies low transaction costs and hence easier implementation.

At a somewhat superficial level, Tradeable Emission Permits (TEP) appears to have little applicability to developing countries. First, TEPs involve trading pollution rights in countries where even commodities are not freely traded in undistorted, competitive markets. Second, the system of TEPs seems to require a level of market sophistication and abstraction that does not exist in many developing countries. More damagingly, TEPs seem to require large data requirements and monitoring capabilities that are very scarce in developing countries. All of these criticisms are valid if developing countries attempt to copy the U.S. system of TEPs, which is clearly over regulated and cumbersome. India can begin by introducing TEPs for large domestic and foreign firms as well as public utilities. At a second stage, trades can also be established between point and non-point sources of pollution. By working with local industry associations, governments can reduce monitoring and enforcement costs.

7.2.1.4 Deposit Refund Systems in the U.S. and Europe: '*Deposit-refund systems'* on beverage containers combined with product charges on non-reusable containers have been operating successfully in Finland, Norway, and Sweden. The percentage of containers returned is 90% for beer and soft drinks and 70%-80% for wine and liquor. Similarly, successful deposit-refund systems for beverage containers also operate in many states in U.S. There is evidence to suggest that consumers are responsive to the level of the deposit. For example, in 1983 Sweden introduced a deposit of ECU 0.04 on aluminum beverage cans, which resulted in the return of 60% to 70% of the cans. In 1987, the government doubled the deposit, and in response 80% of the cans were returned. The success with deposit-refund systems has encouraged several European countries to extend the system to other products such as batteries, car hulks, and pesticide residues. Denmark and Netherlands introduced refundable deposits for batteries with a high content of Cd and Hg to control soil contamination. A deposit-refund system for car batteries has been introduced in several European countries and the U.S.

Norway and Sweden have introduced deposit refund systems for car hulks since the mid-to-late 1970s to reduce solid waste and visual pollution and to promote the reuse of materials. The system worked well in Norway and poorly in Sweden for a good reason. In Norway the deposit in 1988 was ECU 130 per vehicle, while in Sweden it was only ECU 42. While in both countries a larger amount was refunded when the hulk was delivered, in Sweden the deposit and the refund were lower than the cost of scrapping. Thus, a much smaller percentage of disused cars were returned in Sweden than in Norway (90% to 99%). Lastly, there is an interesting Dutch proposal for extending the deposit-refund concept to various polluting chemicals such as Cd, Hg, Pb etc. The deposit would be paid by the producer of the substance; it would then be passed on to the user of the products that contain the substance and be refunded to the final user when the product is disposed. Producers of products containing the substance could also be eligible for a refund of

any waste of the substance they return or dispose of safely. Thus, the deposit-refund system is gradually expanding from an instrument of limited scope (mainly beverage containers) into a more generic instrument that can be used at the micro level by industry to limit environmental liability risks (e.g. hazardous chemicals) and at the macro level by policy-makers to transform the current linear production process into a more ecologically sound circular flow.

The experience of developed countries indicates that deposit-refund systems are cost-effective instruments for reducing littering and waste disposal costs and for conserving material inputs. Deposit-refund systems are compatible with the *'Polluter Pays Principle'* and have high administrative efficiency because they require no monitoring or collection costs, especially when they are operated by private companies that produce and distribute the products in the first place. Further, high administrative efficiency (self-enforcement) of deposit-refund is a great advantage for countries with administrative constraints and limited enforcement capability; besides, the low opportunity cost of labor in developing countries implies that even small deposits would generate an active collection activity that would have both economic and environmental benefits.

Developed countries, even those that think of themselves as free market economies, have relied on C&C regulations for the protection of environment. Now there has been a trend towards increased use of market-based incentives to achieve environmental objectives. This shift, has been prompted by four factors: (a) the lackluster performance of regulations in achieving the objectives of environmental management; (b) the high costs of administration, monitoring and enforcement of regulations as well as the high cost of compliance to regulations; (c) the need to raise revenues to pay for these costs as well as the costs of residual clean up, which have been substantial; and (d) growing evidence that market-based incentives accomplish the same benefits at the lower costs. It must be noted, however, that there are hardly any cases of economic incentives actually replacing regulations; i.e., they have been introduced in parallel, supplementary to regulation with the primary aim of collecting revenues (many a times) rather than altering behavior in favour of environmentally less destructive activities and practices. The trend, however, is towards increased reliance on economic incentives as instruments of behavior modification. There has also been a trend towards the increased use of instruments such as charges, market creation, deposit-refund systems, and a declining use of subsidies. The developed country experience with economic incentives is encouraging, and is replete with lessons for developing countries. One should not look for EIs that have succeeded in developed countries to transfer wholesale to developing countries, but rather for lessons that would help avoid the pitfalls that lie ahead. Ultimately, it is a combination of lessons from developed (and developing) country experience and an accommodation of local conditions and realities that will indicate which EI in what form might be applicable.

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Chapter-8
Recommendations

8.1 SUMMARY

Twentieth Century was characterized by unprecedented industrial growth, which generated huge wealth resulting in vastly improved standards of living of people in the developed countries. To a lesser degree there has been considerable industrial growth even in the developing countries, which has helped the majority of population to rise above the poverty line and enabled them in meeting their basic needs of food, clothing and shelter. The adverse effects of reckless pursuit of industrialization on earth's resources and environment were first noticed in 1960s.

Organized environment protection activities at international level started after UN Conference on Human Environment, 1972 when World Commission on Environments and Development was created. This Commission took up the task of assessing the impact of development on environment and published report titled *'Our Common Future'* in 1987. The report introduced the concept of sustainable development and urged industry to take effective steps to manage the environment while pursuing industrial activities. Nevertheless in our pursuit for development we committed the same blunders as were done in the developed world. It was at the Stockholm Conference in 1972 wherein it was stated that *'poverty is a major pollutant'*. At that time, environment pollution was thought to be rich nations' problem due to economic development. Twenty years later, prior to the Rio Summit, the World Bank (1992) stated that *'poor people are both agents and victims of environmental degradation'*. The poor become agents of environmental degradation when they are victims of it. In either case, they suffer the loss due to environmental degradation caused by their own as well as by the actions of the rich. Their dependence on environmental resources is threatened with nothing else to substantiate with.

Problems in India can be classified into two broad categories which are interrelated: 1). those arising as negative effects of the very process of development; and 2). those arising from conditions of poverty and under-development. The first category has to do with the impact of efforts to achieve rapid economic growth and development and continuing pressures of demand generated by those sections of society who are economically more advanced and impose great strains on supply of natural resources. The second category has to do with the impact on the health and integrity of our natural resources (land, soil, water, forests, wildlife etc.) as a result of poverty and inadequate availability, for a large section of our population, of the means to fulfill basic human needs (food, fuel, shelter, employment, etc.).

As has been stated earlier that industrial activity although embodies the diversity and energy of human pursuits and the industrial areas are remarkable engines of economic and social progress

yet they also play a central role in degrading the physical environment and also in shaping the social environment if adequate preventive care is not taken. Further, the dysfunctional environment has a high cost that makes more difficult the economic growth needed to improve the living standards and thus help perpetuate inequalities.

The story in Himachal Pradesh had been no different than other states/regions of the country. Various incentives offered by the state government have attracted a large numbers of entrepreneurs to set up their industrial ventures especially in the BBN industrial area that offers plenty of logistic advantages and economic incentives. This has also consequently resulted in a steep increase in population. This together with rapid haphazard industrialization in the area has caused environmental degradation. The main source of water pollution in this area is industry, and its resultant derivatives. Further, domestic sewage is also a source of pollution. As has been stated, all the industries located in the BBN areas discharge their effluents in the seasonal nallas (creeks), which carry only the effluents during the lean season, and during monsoons these channels carry both effluent and the surface runoff. The pollution load on the recipient body i.e. river Sirsa has also assumed interstate dimensions besides adversely affecting the surface and ground water quality. As the infiltration in this area is good, therefore, the pollutants find their way into the ground water and finally to the biomass posing a much bigger a problem than expected. The whole ecological web appears to be laced with pesticides, insecticides, heavy metals, etc. These impacts are being reflected in repeated fish mortality in the area and by presence of pesticides, insecticides, heavy metals, etc. in its viscera. Apart from this, the toxic elements in the water discharged by the industries get into the food chain and through bio-magnification lead to dangerous and chronic diseases. Further, as the study area has a large part of its area under agricultural use; hence this polluted water is bound to affect the crop output both qualitatively and quantitatively.

The exponential growth in population, industrial pollution, haphazard industrialization, inadequate planning and lack of proper technology has converted the BBN industrial area into a *'model'* of environmentally degraded area. The problems of pollution has acquired a colossal shape with effects that are not confined to short term but threatening to extend to long term and bound to adversely aftermath the environment and ecology in the times to come. There had been a quantum increase in generation of municipal, bio-medical and the industrial wastes including hazardous waste, thereby making the whole area unsustainable wherein development and environment are at loggerheads. This poses before the government the problems both to provide better shelter, sanitation, pure drinking water, medical services etc. for its populace and keep the wheels of economic development moving.

The industrial development in the area is unsustainable with practices that are irreversibly damaging the environment with the result that efforts both in physical and financial terms would be far more for mitigation than the profits yield by the industrialization. The regulatory policing mechanism, which is the one of the principal mechanism for environment management did not, prove to be very effective tool in pollution abatement and control and this is quite evident from

the state of environment of the area as the environmental problems not only persisted in the area but also grew leap and bound. With an exponential rise in industries and pollution load in the area, the stress on environmental and natural resources is getting even worse.

With development and environment at loggerheads in the area and understandably a false dichotomy between development and environment, the need is being felt to usher in sustainable practices. Although the watershed approach has been adopted for the development and management of natural resources, hitherto, the efforts had been *'department centric'* with functioning in watertight compartments rather than with *'catchment centric'* approach. The environmental status of the catchment should govern the activities to be taken in the area. Although some facets of the problem have been attended to in past, but the situation would have been entirely different, positive and healthy had all the stakeholders worked in unison with big picture in focus and strategies framed accordingly for effective environmental management and sustainability. Different environmental management tools are needed for attending to ecological and environmental problems of the study area.

8.2 RECOMMENDATIONS

There is no denying that Baddi-Barotiwala-Nalagarh industrial region has emerged as a flagship industrial area of the state which offers entrepreneurs a number of advantages. This coupled with the industrial incentives offered by the government to woo the entrepreneurs has resulted in the exponential growth of this area in terms of industrial development, population growth and environmental degradation. Now what should be the strategies to counter these? In the background of narrations made, now let's discuss strategies for sustainable management of area.

The present scenario of environmental management is governed under the C&C mechanism, surveillance and monitoring and compliance to concentration based environmental standards. Command-and-controls regime requires the generous use of resources such as capital, government revenue, management skills, administrative and enforcement capabilities, the very factors that are in scarce supply in developing economies like ours.

Environmental policy and management, as originated in developed countries, is divorced from economic policy and sustainable development. Having achieved high levels of economic development with unrestricted access to resources and unhindered by the environmental concerns, developed countries then sought to protect their environment and ultimately their quality of life from the side effects of economic activity. Environmental management was seen as a necessary restriction or regulation of economic activity to contain environmental damage within acceptable bounds. Therefore, it appeared reasonable to set environmental policy independent of economic policy - as a set of quantity constraints such as emission standards on the level of pollutants and maximum allowable harvests to stem the depletion of natural resources.

The experience with standards-driven environmental policy in developed countries over the past decades suggests that the mandated environmental standards and technologies acted as a drag on

economic growth and costs have been far greater than expected, though still quite affordable given their high incomes (Jorgenson and Wilcoxen, 1990). This realization has induced developed countries to seek more efficient or at least less costly means of achieving the same level of environmental protection through the use of economic or market-based instruments.

For developing countries, the divorce of environmental policy from economic policy and from efforts to achieve sustainable development is meaningless and potentially disastrous both economically and environmentally (Panayotou, 1994). Where standards of living are unacceptably low, where poverty is a major source and victim of environmental degradation, where exploitation of natural resource is the engine of growth, where economies struggle to restructure and recover, imposing constraints on economic activity to protect the environment for its own sake rather than as an input in sustainable development has very limited appeal and this we have seen in the study area. Under these conditions, environmental policy cannot be divorced from economic policy and development strategy. Moreover, under conditions of (desired) rapid economic growth and massive structural change, mandated standards and technologies that allow no room for differential response and adjustment to rapidly changing circumstances are both very costly and difficult to enforce.

The challenge for developing countries like India is to identify and adopt instruments that integrate environmental and economic policy and that are parsimonious in their use of scarce development and management resources; instruments that allow differential response by economic units and adjust flexibly to the changing circumstances. The search for instruments of environmental management in developing countries is a search for instruments of sustainable development. EIs meet most of these conditions and are uniquely suited for the integration of environmental and economic policy and can be designed to advance sustainable development.

There is an allegation that the standards in India are simply copied from the developed world as India is signatory to various international treaties and conventions. Also the weak regulation has not yielded the desired results. But as now we are becoming both technologically and economically viable, and with a fairly developed civil society and stock markets, it is now time to have a re-look at concentration based environmental standards and other issues in the realm of environmental management. It is especially true w.r.t. the industries generating large volumes of waste water. For them, there is a need to apply load-based environment standards. Further, now the time has arrived to apply EIs and other incentives and tools along with C&C. Given below is the brief explanation of environmental management tools and strategies that can be made operational in the area or other areas with similar problems for ushering in sustainability.

- **Participatory Approaches & Self Regulation**

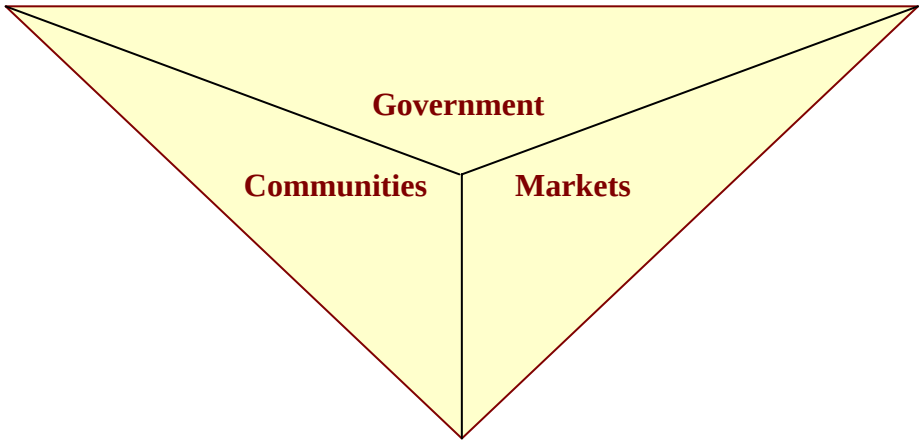
This involves the participation of regulatory authority, the industry and all other stakeholders of the area for environmental planning and management not only to bring about improvement in the quality of environment but also to put the area back on sustainability trail. The environmental planning, management and mitigation plans needs not only be shared with all stakeholders but

rather prepared with their active involvement and consultation. Now the time has come when the regulator has to act as a facilitator and mediator rather than as an authoritarian of environmental standards Also, there is a need for the principal stakeholders' viz. industry to undertake self-regulation as well. This can be undertaken by active participation of the respective industrial association whereby it scrutinizes the report card of polluters and puts a peer group pressure on them for compliance.

- **Communities, Markets, and Public Information**

The success story of PT Indah Kiat Pulp and Paper (IKPP), Indonesia offers some insights into new roles of communities, markets, and public information. The largest pulp producer in Indonesia, IKPP is now also the cleanest. But it wasn't always an environmental paragon. Mill's cleanup began in the early 1990s, with a backlash from local villagers. Allying themselves with local and national NGOs, the villagers claimed severe health damage from the mill's emissions and demanded more pollution control and compensation for their losses. In 1992 Indonesia's national pollution control agency, BAPEDAL, mediated an agreement in which IKPP acceded to the villagers' demands. The IKPP saga illustrates a *'new model'* (Fig.-8.1) for pollution control in developing countries. As formal regulation contributed little in pollution reduction, defending their own interests, local communities applied pressure for cleanup and compensation. Abandoning the traditional agency role, BAPEDAL acted as a mediator rather than as a dictator of environmental standards. The forces that influenced IKPP-links among local communities, market agents, and regulators- have sparked several of the world's most innovative experiments in environmental policy in countries where traditional regulation has failed (World Bank, 2000). These creative programs harness the power of public information, enabling communities and markets to exert maximum influence on polluters. Such pioneering efforts too can have a significant impact on industrial pollution in developing countries especially India.

Fig- 8.1 The New Model



- Communities as Informal Regulators: It is undertaken through community participation in the neighbourhood of the firms for environmental management and protection. This channel for *'informal'* regulation has proven to be potent, even in cases where formal regulation is weak or absent.

- The Power of the Market: The environmental concerns of market agents create additional incentives for pollution control. Capital markets everywhere are taking information about environmental performance into account, and firms are responding by cleaning up.

Once the roles of communities and markets are introduced, and even where formal regulation is weak or absent, pressure applied through these new channels can significantly increase a plant's expected penalties for polluting. Polluters will react by reducing emissions, just as if government inspectors were enforcing regulatory standards. Regulators still play an important part in controlling pollution, but their role is no longer confined to establishing and enforcing standards or charges. Instead, regulators gain leverage through programmes designed to provide concrete information to communities and markets. This *'new model'* is captured by the regulatory triangle wherein Communities, Markets and the Regulators each occupy 1/3 space (Fig- 8.1).

- Power of Public Information: There is a need to put all the environmental related information in public domain and reach to a situation wherein the society proactively reacts to any environmental contingency. Besides, now the society has a right to information on status of environment of area. Jong Ho Hong, (2005) states that this has been tried in many countries especially in Korea as a Public Disclosure Programme which is a structured information release programme by regulatory authority relying on non-regulatory measures to create incentives for firms to improve environmental performance. In developed countries it exists as Toxics Release Inventory (U.S., Canada, Great Britain) and in developing countries as PROPER (Indonesia), EcoWatch (Philippines). In the Indian perspective, the Right to information Act, 2005 can play central role in times to come.

- **Environmental Evaluation and Ratings**

The story of a pioneering Indonesian program illustrates the *'new model'* (Fig- 8.1) in action. In 1980s, the Indonesian Government charged BAPEDAL, with enforcing standards on discharges from industrial plants when enforcement was weak and the courts were plagued by corruption but industrial output was growing at over 10% annually. By mid-1990s, with the risk of severe damage from pollution looming large, BAPEDAL decided to initiate a program for rating and publicly disclosing the environmental performance of Indonesian factories. It was hoped that the resulting pressure would provide a low-cost way to promote compliance with regulations, as well as create new incentives for managers to adopt cleaner technologies.

The program that ensued is called PROPER-for Program for Pollution Control, Evaluation and Rating. Hereunder, each polluter is rated on its environmental performance**.** *'Black'* denotes factories that have made no attempt to control pollution and are causing serious damage, while *'red'* denotes those that have instituted some pollution control but fall short of compliance. Factories that adhere to national standards receive a *'blue'* rating, and those whose emissions controls and production and waste-management procedures significantly exceed national standards receive a *'green'* label. World-class performers attain *'gold'* ranking.

Initial ratings showed that 2/3rd of the plants failed to comply with the regulations. Although this showing was dismal by Western standards, fully 1/3rd of the rated factories were in compliance

despite BAPEDAL's evident inability to enforce regulations. The IKPP story suggests why: 2/3rd of the regulatory triangle-local communities and markets-were already in place, albeit operating with poor information. These actors had already brought considerable pressure to bear. With public disclosure being a political act and a media event, the results were declared in a high-profile public ceremony to congratulate the *'good guys'*- the green-ranked plants whose performance exceeded formal requirements. After publicly rewarding these best actors, other plants i.e the non-compliant one were privately notified of their ratings, and given six month's time to clean up before full public disclosure. Thereafter, a scramble ensued, compliant plants, originally 1/3rd of the sample, now constituted over half. While the *'green'* group was unchanged, the *'blue'* group grew by 54%. *'Red'*-rated plants dropped by 24%, and the flight from 'black' continued. Only one plant remained in *'black'* category-a decline of 83% from the original size of group (Greening Industry, World Bank, 2000).

Given Indonesia's previous regulatory history, this remarkable result suggests that performance ratings and public disclosure can be powerful tools for improving environmental conditions in developing countries like India and especially BBN region where industrial growth is exponential and so is the waste generation and environmental degradation.

- Public Disclosure and Pollution Control: Armed with such performance ratings, the citizens are in a much stronger position to negotiate on pollution control. This is especially true because lack of information can distort communities' perceptions. For example, residents can often see or smell organic water pollution and H_2S air pollution, but emissions of the metals and toxins that accumulate in organisms' tissues are likely to escape notice. And even where pollutants are clearly detectable, local communities may be unable to gauge the severity of their long-term impact or identify individual polluters. The PROPER system adds critical information to this picture and certifies the claims of local communities, which can use such ratings to engage the most serious polluters.

Better information can also influence market side of the triangle (Fig- 8.1). Indonesia with a relatively new stock market and rapidly expanding industrial economy has had extensive credit needs. With such ratings, the stock market can more accurately value companies' environmental performance, and banks can factor pollution-related liability into their lending decisions. For consumers, nothing less than a *'green'* or *'gold'* ranking may suffice, and the availability of information, may greatly influence their decisions. All these factors should encourage the polluters to clean up. Agency itself benefits from public disclosure as widespread adherence to environmental standards boosts its credibility with industry, NGOs, and the public.

Such ratings appealed to BAPEDAL because it had neither the resources nor the legal support to implement traditional standards based system. The agency's managers also lacked the capacity to enforce pollution charges. Viewing charge-based regulation as an inside transaction between the agency and a plant, corruption of their inspectors can distort emissions information and undermine the market-based approach. However, public disclosure, by contrast, allows communities to check an agency's claims against their own daily experience. Public disclosure does not have to necessarily rely on benchmarks at all- regulators could simply report each

plant's emissions. The OECD's Pollutant Release and Transfer Register and the U.S. Toxics Release Inventory (TRI) are examples of such disclosure programs (Source: US-EPA).

In the developing world PROPER-type systems seem to be taking hold more rapidly. Their strength probably lies in two characteristics: They are compatible with standards-based regulations that are still on the books almost everywhere, and they rate environmental performance in a clear, straightforward format that is easy for the media to report and citizens to understand.

In Philippines, the Department of Environment and Natural Resources (DENR) has created a similar program, called '*EcoWatch'*. As in Indonesian case, the program dramatically increased plants' compliance with national regulations. Other countries are following closely in the wake of Indonesia and Philippines (URL: www.worldbank.org/). What began as a ripple in Indonesia is clearly building into an international wave.

The environmental reformers these days are increasingly using rating systems to publicly recognize factories that adhere to local and national pollution standards- and to train the community's eye on those that do not. So, by classifying factories based on their reported emissions, and widely broadcasting the results, regulators are enabling communities to identify serious polluters and pressure them to clean up. Such public disclosure programmes also enlist the efforts of investors, lenders, and consumers, whose concern over liability from poor environmental practices and desire to reward green manufacturers brings pressure to bear on polluters. Indonesia and Philippines, in particular, have shown that such programmes can curb pollution at a modest cost (World Bank, 1999).

The C&C exists in the forms of emission standard, technology standard, production ban, permission etc. whereas EIs exists as charges & taxes, subsidies, deposit-refund system, marketable permits, voluntary agreement but the importance of public disclosure lies as it serves as an alternative or a complement to traditional C&C or economic incentives regulatory policies because the implementation of traditional environmental policies suffer from lack of resources to undertake appropriate monitoring activities and reluctance to use strict enforcement actions. In several of the countries (Japan, Korea, Taiwan, Thailand, Indonesia), the monitoring problem is compounded by weak enforcement. In short, when violations of standards are detected, and if penalized at all they often face only weak sanctions. … polluters are exempted from fines either on grounds of financial hardship or because the violators wield undue political influence. Perhaps the most pervasive problem is that, even when fines are levied, they are frequently so low in real terms that they have little if any deterrent value- O'Conner (1994), *Managing the Environment with rapid industrialization: Lessons from the East Asian Experience*, OECD.

Herein I would like to quote the latest Indian experience of public disclosure by an NGO-Centre for Science & Environment on presence of pesticides and insecticides in multinational cola companies (Coke & Pepsi) have resulted in many state governments restricting and/or banning the sale of such products and the Apex Court of the country issuing notice to such companies.

This has not only tarnished their corporate image but also resulted in sizable drop in their sales. Interestingly, till filing of this thesis, the war of nerves and wits is on and now these companies have resorted to counter campaign in news papers as well as taking help of FICCI/CII (industries associations) that with this episode the investments in India would suffer.

- Regulating Pollution and Promoting Equity in the Information Age: Widespread acceptance of PROPER reflects a broader trend in public policy. Now there is a need to pay attention to the role of social capital- the informal relationships and institutions that strengthen developing communities to focus on the strong complementarities between social norms, which communities draw on to enforce public disclosure programs, and formal laws. The evidence shows that formal and informal regulatory mechanisms almost always coexist, but that the latter given a chance often dominate in developing countries where regulatory institutions are weak.

In environmental policy, a new thinking about the role of local influence reflects the insights of economist Ronald Coase, who called traditional regulation into question by noting that pollution victims, as well as regulators, can take action if they perceive that the benefits outweigh the costs (Greening Industry, World Bank, 1999). As Coase noted, these costs stem from the need to acquire and analyze information, confront polluters, and negotiate settlements. Without good information such settlements may be far from optimal. Polluters and regulators usually have the most concrete knowledge of emissions; but polluters are unlikely to share this information in the absence of outside pressure, and bureaucratic inertia and/or legal constraints often prevent regulators from sharing information as well. Moreover, even if the public has information on emissions, it may not fully understand the risks it faces.

In short, effective local negotiations require good environmental information, and regulators are often in best position to supply it. They can play a valuable new role by focusing more resources on information collection and dissemination, including public disclosure of polluters. But a new role for regulators does not mean that they should abandon the traditional one. Efficient enforcement of regulations will remain very important because of potential penalties provide an incentive for capital markets to react to public disclosure of non-compliance. In addition, the regulators can encourage local settlements by promoting negotiations; supplying the negotiators with objective information, and, as a last resort; posing the threat of official sanctions against non-compliant factories that refuse to negotiate with pollution victims.

Employment concerns may lead poor communities as in India to welcome industrial activity, but such communities may lack enough political influence and environmental information to negotiate effective pollution control agreements. Economic development may be the best antidote to such problems in the long run, but in the meantime poor communities may suffer from excessive pollution. Here environmental agencies can help, by educating communities on the pollution risks they face and ensuring that polluters conform to basic norms. Local residents pressure polluters more successfully if they are richer, more educated, and better able to bargain. In developed countries, the so-called *'NIMBY' (not in my back yard)* phenomenon stems largely from wealthy communities' ability to exclude polluting activities completely.

- **Environmental Planning**

There is an urgent need for the protection of environment by proper planning and management of various spatial entities viz. water resources, land, settlements, forests etc. It would be expected from the developmental agencies to strictly adhere to the tenets of environmental planning based on the carrying capacity of the area and operate within the framework of the plan and undertake developmental activities keeping in view the recommendations contained therein. Any attempt to bypass the recommendations would result in addition of increased pollution load in the area far beyond its carrying capacity. The aerial sensitivity and water sensitivity of the area need to be kept in mind before embarking on any activity, which adds to the existing air and water pollution levels of the area. It is imperative that the environmental plans should be integrated with the overall developmental plan of the area.

- **Environmental Audits**

The environmental audit is a key to ensure the good health and safety of the personnel besides, minimizing wastes, enhancing the effectiveness and efficiency of any enterprise. It, therefore, forms an integral part of any Environmental Impact Assessment (EIA) and even though it is legally binding on every industry to undertake environment audit under the provisions of environmental legislation, it is not been complied in letter and spirit. Therefore, it is imperative that the industry, civil society, markets etc. recognize the need of such instruments for environment protection and also proactively obtain compliance under environmental management system such as ISO-14000 so as to ensure health, safety and better environment to all.

- **Waste Minimization & Cleaner Production**

Waste minimization is all about being efficient. By preventing waste and emissions at source, all organizations can maximize output and increase profits. Waste being the by-product of an enterprise is also reflection of resources, which gets wasted due to ignorance. It is prudent to produce less waste and consequently spend less on its treatment rather than first produce huge quantities of waste and then spend even more in cleaning it up. Waste is also a manifestation of traditional *'end-of-pipe'* approach and it can be reduced through pollution prevention. The sector-wise waste minimization efforts along with its awareness would not only generate additional revenue for the industry but also make the area environmentally sustainable. Efforts are also needed to upgrade the existing skills through R&D and its propagation amongst entrepreneurs. There is a need to expand the existing mechanisms wherein the wastes are *'reduced', 'reused', and 'recycled'* (3Rs) for better environmental management. The waste recycling or reuse should be encouraged among the industries by creating the Waste Exchange Bank at the local and regional levels.

Cleaner production is continuous application of an integrated preventive environmental strategy to process, products and services to increase overall efficiency and reduce risks for humans and environment. Although initiatives were taken with regard to cleaner aspects of production, it is imperative that all the components of production cycle be got studied carefully through experts

and road map be prepared not only to bring more and more sectors of development including industrial production under its umbrella but also to follow *'cradle to grave'* approach by way of practicing Life Cycle Assessment (LCA) for better and effective environmental management. The need is not to produce *'less'* but to produce *'differently'*.

- **Corporate Social Responsibility**

There is also a need for all the developmental agencies to have social responsibility for the area more especially for the industrial/corporate sector towards society wherein all the stakeholders practice the tenets of such responsibility. It would be appropriate if all five dimensions of corporate strategy viz. centrality, specificity, proactivity, voluntarism and visibility are integrated in business operations. The firms by correct perception and analysis of task and societal environment can convert threats in opportunities and weakness into strength by linking strategy to CSR and jointly serve societal and economic interests.

- **Surveillance & Monitoring**

The traditional surveillance and monitoring mechanisms as proposed need to be strictly followed besides its continuous updating, as industrial development is a dynamic process and not a static one. In present times, the need is to actively use information technology for pollution abatement, control and prevention. Besides, online monitoring and display of both ambient air and water environment is a necessity in present times as highly polluting industries have mushroomed in the area. This would not only ensure effective protection but also thwart any untoward accidental emergency. The policing functions need to go hand in hand with pollution prevention functions for effective compliance and better environment; therefore, it is imperative that inspection and monitoring schedule as prescribed under the statute is followed in right earnest.

- **HRM & Capacity Building**

The need for capacity building cannot be over emphasized in view of the dynamic, complex emerging environmental challenges. There is a need for not only for the capacity building of the personnel of the state board and of different agencies involved in environmental management of the area but also for the introduction of state of the art surveillance and monitoring equipments for undertaking online monitoring of air, soil and water environs, its networking with the state board and interventions as and when necessary. In the advent of EIs being introduced in the area, the skills of the state board's personnel need to be developed in areas pertaining to economics and sociology. Besides, continuous up gradation of the skills of the Effluent Treatment Plant (ETP) operators are required as new and new technological advancements are putting new challenges before the personnel engaged in operating the ETPs. New tools viz. Cleaner Production, Waste Minimization and Life Cycle Assessment etc. also require continuous skills up gradation and R&D.

- **Environmental Pubic Private Partnership**

The question here is how to ensure effective environmental governance when there is a dilemma w.r.t. Public Private Partnership in environment sector (CETP & TSDF) as discussed in Chapter-

6. The waste disposal service of environment resources is a public good with a tendency for free riding., 'Public Private partnership' (PPP) can not succeed till there is an active government patronage, cooperation, commitment, support and participation. Further, the government needs to lay ground rules whereby it is mandatory for the factories to not only use common waste disposal services but also abide by the user charges regime as fixed and agreed through participation, scientific logic and rationale based on pollution load rather than concentration of the effluent. The amendment in the legislation is required whereby the onus of the failure of CETP and TSDF is both on operator of the facilities along with the units who contribute to such an incident. It would make regulation more encompassing and effective. Further, the environmental projects are need to be viewed as similar to any other infrastructure project with government according equal priority and urgency, as it would accord to roads or bridge construction activity.

Last but not the least the state must have a realistic and consistent BOT strategy based on its particular situation and needs. The government's commitment to private sector participation in development of environment infrastructural services should be clear and unequivocal and it should develop political consensus in favour of such policy. Then there is also a need to have incentives and various forms of government support to encourage the private sector to participate in such BOT projects and a pragmatic approach to risk reward issues. The government should also disseminate information on private sector involvement in infrastructure service and gain public acceptance for this involvement, which may be particularly sensitive to public opinion as the services were previously provided to the public at below cost or at no cost at all. Besides strategy, the requirement is also for enactment of special and comprehensive BOT laws and regulations covering authorizations, required governmental approvals, preferential tax treatment, procurement issues and the framework for BOT agreements. The government must also establish credible and efficient administrative framework to successfully implement a BOT strategy and a *'single window'* approach to the administration of BOT projects along with incentives by way of tax incentives and concessions; land and other logistic facilities; guarantees and standby financing; loans and equity contribution; completion and performance incentives and penalties.

- **Economic Instruments**

Decades of attempts to control pollution through traditional regulations, which make discharges above designated limits illegal, have often yielded disappointing results. Under traditional regulation, pollution above the legal limit is punishable by fines, plant shutdowns, or, in extreme cases, imprisonment of offending managers. But such an approach requires strong enforcement mechanisms: Regulators have to monitor and analyze pollution from each plant, determine whether it has violated the rules, and institute legal proceedings in cases where violation is clear. These steps are not cheap, and many developing countries including India have not been able to effectively implement them. What's more, such a system requires every commercial enterprise to toe the same regulatory line regardless of cost.

In an effort to break out of this *'one-size-fits-all'* approach, many countries are opting for more flexible and efficient regulation that nevertheless provides strong incentives for polluters to change their ways. Some countries have chosen strategies for traditional regulation that take

benefits and costs into account. Some are using pollution charges like those in Colombia-often combined with other strategies-to achieve impressive results. Still others are using public disclosure programs that pressure polluters to clean up their act. Plant managers respond mainly to economic incentives. Although public spirit moves a notable minority to control pollution, most managers are bound by pressures from markets and shareholders. They will reduce discharges only if they expect the additional cost to be less than the penalties that continued pollution will impose on them. Such penalties can include not only fines and plant closures but also pollution charges, credit refusals from bankers worried about liability, reduced sales to consumers who care about the environment, and even social ostracism within communities outraged about pollution. Thus, although the *'golden rule' i.e. MAC = MSD* provides a good framework for determining environmental goals and pollution charges, in the real world the actual levels are determined through the political process. Concrete information about lives lost, fisheries destroyed, and other damage can play some role, but it will never be the sole determining factor. Policymakers have to seek consensus on environmental goals and then use the available regulatory instruments to pursue them.

In the 1970s, economists William Baumol and Wallace Oates explained as to how pollution charges could be adapted to these realities. They recommended a four-step approach: 1. Determine environmental quality goals; 2. Estimate the pollution reduction required by these goals; 3. Estimate the marginal cost of abatement at the desired level of pollution; 4. Set the pollution charge equal to the estimated marginal cost. It had a straight forward approach- If the estimate is right, pollution should fall to the desired level. If it is wrong, the charge can be raised if there is too little abatement and reduced if there is too much. Baumol and Oates further argue that all revenues from such a system should be rebated to the central treasury, where they can be allocated to the highest priority spending categories which might be environmental.

Therefore, the situation warrants whereby the EIs are practiced in the area by way of pollution charges, public disclosure, tradable permits, bank guaranties/performance bonds and public procurement policies. This requires a policy shift both at the federal and state level. The EIs should serve as a complement to the existing regulatory standards regime and not as a substitute, besides these should be used as an incentive mechanism to encourage industry to adopt environment friendly technologies viz. waste minimization, cleaner production and cleaner technologies etc. It must be ensured that all stakeholders are involved in design and enforcements of EIs, which is so essential in ensuring the success of EIs in improving environmental quality of the area. There can be many situations where C&C instruments are unavoidable. In emergency situations these are the only ones, which can obviate the crisis, as the EIs suffer from a time lag meaning thereby they take a longer time to respond to such emergency situations. Therefore, for an effective optimal environmental strategy, the judicious mix of these two categories of instruments may be taken recourse to (Murty M.N., 2002).

- **Environmental Education & Sensitizing Masses**

There is a need that the regulatory agency also concentrates on softer options for environmental protection such as environmental education and sensitizing masses towards protection and

conservation of environment and ecology besides focusing on regulatory aspects viz. policing. The introduction of environment as a subject in school curricula, regular radio/TV talks and programmes, airing of environmental films etc. can create an army of environmentally sensitive and responsible citizens. For sustainable future we have to focus more on children in sensitizing them.

- **National Economic Policies-The Impact**

National economic policies affect industrial emissions so strongly that they constitute *'pollution's hidden half'* (World Bank, 2000). Recent research shows that cleaner production generally results from economic reforms reducing barriers to international trade, privatizing state industries, developing new stock markets, eliminating subsidies for energy and raw materials, and deregulating domestic industries. However, such reform is not a panacea. Few countries reform their economies for environmental reasons, so it would be a strange stroke of luck if all such actions had clean impacts. In some cases economic reform can actually increase industry's pollution intensity, and the faster growth sparked by more-open markets magnifies the potential for pollution. Fortunately, numerous studies have suggested ways to anticipate and offset such side effects while economic reform attacks pollution's *'hidden half'* on a broad front. Incomes should also rise with economic reform, increasing public support for formal and informal regulation of pollution. However, ensuring lower pollution requires close cooperation between economic reformers and environmentalists, as well as added resources to help regulators monitor pollution in the wake of reform (Greening Industry: World Bank, 2000).

Overall, economic reform reduces pollution intensity by cutting subsidies for raw materials and encouraging international trade, privatization of state enterprises, more publicly traded firms, and larger firms and plants. However, economic reforms do not always reduce pollution: Accelerated output growth may overwhelm cuts in pollution intensity. And devaluing a country's currency, removing energy subsidies, and eliminating monopolies on production of raw materials may actually increase pollution intensity in some cases. Furthermore, consolidation may bring more large plants to urban areas, increasing the impact of pollution on human health. *The bottom line is that environmentalists can welcome most reforms as pollution fighters, but economic reformers should also recognize that their efforts can produce perverse environmental impacts.*

Careful analysis of such effects by- economists and environmentalists- as well as collaboration between them- is essential. Fortunately, sophisticated use of information technology can help regulators focus on the worst polluters and enlist communities in keeping them in line. To sustain such efforts and ensure their success, policymakers will have to devote some of the dividends from economic reform to improving environmental information and regulation.

- **Natural Resource Accounting**

Conventionally, according to Mr. Pavan Suchdev, Founder Director, GAISP, the state accounts are used to calculate the Net State Domestic Product (NDSP). This gives indication of how well the state is performing economically but it only considers the depreciation of man-made assets. If the extraction and consumption of natural resources are also included, then a new figure,

Environmental Adjusted State Domestic Product (ESDP) can be calculated. A comparison of NDSP and ESDP would show whether or not the state is growing economically at the expense of the environment. As economic policies form the framework for a range of sectoral development, it will be necessary to consider how these policies affect the quality and productivity of environment resources. This will require a system of resource accounting along with the other exercises of cost benefit analyses. Further, in essence, indicators of growth such as GNP and GDP should include a measure of depletion cost and value judgments in terms of environmental resources. It will require instruments and expertise for evaluation and conscious trade offs, where unavoidable, to meet the legitimate development needs It would be appropriate if the government prepares, each year, a natural resources budget based on State of Environment Report, which will reflect the state and availability of resources, like land, forests, water etc. and rationally allocate these resources in keeping with the principles of conservation and sustainable development.

Finally, I would like to conclude my thesis with the following remark: *'all the stakeholders must work in a unison manner and strategize their actions accordingly for effective and sound environmental management and manage the area holistically through sustainable practices, stakeholder's participation and by use of both C&C and economic instruments'*.

*****

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