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**EMERGING ISSUES OF
ENVIRONMENTAL MANAGEMENT
IN INDIA**

A THESIS

Submitted to

Saurashtra University

For the award of the degree of

Doctor of Philosophy in Geography

(Faculty of Arts)

Submitted by :

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Under the Guidance of

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CERTIFICATE

It is certified that the thesis entitled "**Emerging Issues of Environmental Management in India**" is a research work done by **Mr Rajiv Chaudhary** during the period of study under my supervision and that the thesis has not been formed the basis for the award of any degree, diploma, associateship, fellowship or similar title to the candidate and that the thesis represents independent work on the part of the candidate.

(Dr Pratap Sinh Chauhan)

Research Supervisor

DECLARATION

I declare that the conceptual framework of this thesis has been developed based on the detailed literature review as shown in the bibliographical references. I have quoted several notes, opinions and other information directly from various books, journals, periodicals and other reference material with clear mention of the source of information in the references. Apart from these, all other opinions, hypothesis, remarks, inferences, analysis and interpretations in this thesis are my own and original creations.

I also declare that the work done in the thesis entitled **“Emerging Issues of Environmental Management in India “**is a record of independent research work carried out by me under the supervision and guidance of **Dr. Pratap Sinh Chauhan**, Professor, Head & Dean, Department of Business Management (MBA Programme), Saurashtra University, Rajkot.

This work has not been previously submitted for the award of any diploma, degree, associateship or any similar title.

Rajiv Chaudhary

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Rajiv Chaudhary

Conceptual frame work of Environmental Management

- Introduction
- Environmental Management System
- Initial Environmental Examination
- Environmental Impact Assessment
- Environmental Auditing
- National Environmental Quality Standards
- Forces that have led to changes in
Environmental Management

1. Conceptual frame work of Environmental Management

Introduction :

Environmental disasters such as Bhopal Gas Tragedy and Chernobyl, and problems like global warming and ozone depletion that arise due to the industrial mode of development have opened our minds to the fact that there is something grossly wrong with it. These are major accidents or problems. There are several minor happenings around us, which reveal the crying need for good environmental management. For instance, think about the distance you have to travel for reaching your work place. You may have suffered irritation from noise and health problems due to the exhaust of vehicles. Thus, developments that signify economic and industrial progress also lead to environmental degradation. Does it then mean that the interests of business and the integrity of the natural environment are naturally opposing forces? In the past, it often seemed so. Exploitation of natural resources was directed more by financial balance sheets than by environmental concerns. More recently, however, industries have become more responsible for the environmental side effects of their operations. What has led to this change of heart?

Setting the Context

Let us ask: How can societies meet human needs and nurture economic growth while preserving natural resources and environmental integrity? Why is it important for businesses and industries to care for the environment? You could list a number of reasons such as the following:

- National economies depend upon the wise use of natural resources. Agriculture and the industries of energy, forestry, pharmaceuticals, chemicals, fishing, real estate, recreation and tourism could all be jeopardised by poor management of the environment.
- The management of resources in developing countries has a direct impact on the economic well-being of developed countries. The failure of a country to observe the policy of sustainable development could lead to economic restrictions, social turmoil, and even political instability. Any of these factors could affect access to both materials and markets, and result in long term repercussions to the local and world economy.
- Global economic interdependence is affected by factors such as explosive population growth, which affects the consumption of natural resources.
- It is in the best interest of businesses and industries to resolve their environmental problems before the governments become involved and impose their restrictions on industry.

Do you agree with these reasons? Would you like to add some of your own, or change this list? You may try doing so. **SAG 1** Why should environmental concerns figure in all measures taken for economic growth and progress? Explain. Besides the reasons given so far, good environmental management can be of economic advantage to any organisation. The benefits of environmental management include both economic benefits and strategic benefits.

Economic Benefits

Cost saving due to

- reduced consumption of energy and other resources.
- recycling, selling of by-products and wastes,

resulting in decreased waste disposal costs. • Reduced environmental charges, pollution penalties, and compensation following legal damage suits. **B. Revenue increases due to** • Increased marginal contribution of “Green Products” which sell at higher prices. • Increased market share due to product innovation and decreased number of competitors. • Completely new products that open up new markets. • Increased demand for a traditional product, which contributes to pollution abatement.

Strategic Benefits

Improved public image. • Renovation of product portfolio. • Productivity improvement. • Higher staff commitment and better labour relations. • Creativity and openness to new challenges. • Better relations with public authorities, community and Green activist groups. • Assured access to foreign markets. • Easier compliance with environmental standards.

Perhaps, due to the reasons cited above, we have been witnessing important changes in the approaches to environmental management. These changes could be described briefly in terms of three generations of organisational environmental management

Evolving approach to organisational environment management

First Generation : • No long-term strategic approach.
• Environmental management seen as an overhead cost.
• Pollution control oriented.

Second Generation : • Limited strategic approach
• Environmental management seen as a necessary survival cost, especially to avoid future liabilities.
• Regulation oriented.

- Third Generation** : • Essential element of a company's strategic approach.
- Environmental management seen as a fully legitimate business expense.
 - Competitive advantage, quality, community and customer oriented.

Environmental Management System

The definition of environmental management system (EMS) as given in ISO 14001 is as follows: An EMS is that part of the overall management system which includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the *environmental policy*. It could also be defined as follows: An EMS is that facet of an organisation's overall management structure that addresses the immediate and long term impacts of its products, services and processes on the environment. The EMS approach brings together three concepts: • Everything we do in business has some impact on the environment. • Management systems control everything we do in business. • Standards can be set for the environmental management system. An EMS makes the following possible: • controlling environmental impacts, • setting initiatives to improve environmental performance, • achieving environmental objectives, and • demonstrating that they have been achieved on an ongoing, continual basis. An effective EMS makes good sense, whether the implementing organisation is in the public or the private sector. By helping to identify the causes of environmental problems and then eliminating them, an EMS can help save money and improve productivity in any organisation. An EMS is characterised by the following elements: • A policy statement that indicates the organisation's overall commitment to the improvement of

environmental performance, including conservation and protection of natural resources, waste minimisation, pollution control and continual improvement. • A set of plans and programmes to implement the policy throughout the organisation including the advancement of the programme through suppliers and customers. • The integration of the environmental **plans into the day-to-day operation** of the organisation, developing innovative techniques and technologies to minimise the impact of the organisation on the environment. • The **measurement of the environment management performance** of the organisation against the plans and programmes – auditing and reviewing progress towards achieving the policy.

The **communication of information, education and training** to improve understanding of environmental issues and to publicise various aspects of the environmental performance of the organisation. Conceptually, an Environmental Management System is no different from other management systems that have typical “Plan, Do, Check, Act” loop. This loop ensures that environmental matters are systematically **identified, controlled, and monitored.**

Management Tools for EMS A number of management tools are needed to implement an EMS. These include • An initial environment examination (IEE). • An environmental impact assessment (EIA) before any new operation starts. • An environmental audit (EA) by which the environmental performance of the organisation and its units can be assessed, weak points can be identified and subsequently the required mitigating measures may be determined. • An appropriate organisation of environmental functions in the enterprise ensuring that initiatives are taken, expertise is available and responsibilities are clear. • Communication and participation inside and outside the enterprise, which play a decisive role in the creation of a positive image of the organisation to avoid

resistance and commit staff to contribute to a common cause. **Environment-related training**, which raises awareness, introduces behaviour changes and helps to acquire the necessary managerial and technical skills.

INITIAL ENVIRONMENTAL EXAMINATION

Environmental concerns at the project level. IEE should be carried out as early as the project planning stage as part of the feasibility study to ensure that the project will be environmentally feasible. The general objectives of any IEE study should be:

- To provide information about the general environmental settings of the project area as baseline data;
- To provide information on potential impacts of the project and the characteristics of the impacts, magnitude, distribution, the affected groups;
- To provide information on potential mitigation measures to minimise the impacts including mitigation costs;
- To assess the best alternative project at maximum benefits and least financial, social and environment costs. It is not always necessary to change the location of the project but the project design or project management can be changed; and
- To provide basic information on formulating the management and monitoring plan.

The Process of Preparing IEE An early step in this process is to determine the scope of the IEE study. This activity is known as “scoping”. It is a procedure designed to establish the terms of reference for the IEE. The scoping procedure should at least produce the following outputs:

- Identify the likely environmental impacts or other environmental concerns and considerations that need to be further investigated in IEE study.
- Identify environmental components, which need detailed or further study.
- Determine a general approach and methodology required to carry out the IEE study.
- Identify in general all affected parties to be consulted in carrying out IEE study.
- Identify the need to

fit the outputs of IEE into the project context especially on environmental management and monitoring plan.

Environmental Management System :Outputs of the scoping study

The next step is undertaking the IEE study. The following are the key activities in the study:

- **Describing environmental conditions of the project area:** Collection of baseline information on biophysical, social and economic aspects of the project area is the most important reference for conducting IEE study. Normally information is obtained from secondary sources when there is a facility of maintaining database or other existing documentation, and through field sampling. Collection of baseline data should be designed to satisfy information requirements and should focus on relevant aspects that are likely to be affected by the proposed project. Therefore, the level of details in this description of study area should be sufficient to convey to its users, the condition and nature of environmental and social resources of the affected areas.
- **Assessing Potential Impact:** The “technical heart” of the environmental assessment process involves the prediction of changes over time in various environmental aspects as a result of a proposed project. The prediction of the nature, extent and magnitude of environmental changes likely to result from the proposed project is aided by various tools and techniques, the choice of which depends upon the impacts of concern, data availability or lack thereof, and the appropriate specificity of quantitative models.
- **Formulating Mitigation Measures:** Once the impacts have been analysed, their significance has to be determined, i.e., whether they are acceptable, require mitigation or are unacceptable. Subsequently, measures have to be devised

to mitigate anticipated environmental changes and consequential impacts during project implementation and operation or to further reduce the residual environmental changes inherent in the selected project design. They normally include technical, social and institutional measures to be implemented as an integral element of the project.

- **Preparing the Institutional Requirements and Environmental Monitoring Plan:** Environmental management involves the implementation of environmental protection and mitigation measures and monitoring for significant environmental impacts. Environmental protection measures are taken to: - Mitigate environmental impacts; - Provide in kind compensation for lost environmental resources; and - Enhance environmental resources. These measures are usually set out in a plan, which covers all phases of the project from pre-construction to decommissioning. It outlines mitigation and other measures that would be undertaken to ensure compliance with environmental regulations and reduce or eliminate adverse impacts. **Environmental monitoring** involves: - planning a survey and sampling collection of data/information relevant to environmental assessment and project environmental management; - conduct of the survey and sampling programme; - analysis of samples and data/information collected and its interpretation; and preparation of reports to support environmental management. The IEE yields a lot of information and data which has to be documented properly in the form of a report.

Documenting IEE Studies IEE reports and their summaries are presented in a specific format (see Fig.4.4), which is described below. Outline of an IEE Report • Introduction: This section includes the purpose of the report, brief description about the project and its importance, any other background

information, scope of the study, magnitude of efforts, who is performing IEE and acknowledgement. • Description of the project: This provides sufficient details to give a clear picture of the project. • Description of the environment: This section furnishes sufficient information to give a brief but clear picture of the existing environmental resources including physical, ecological, economic, social and cultural resources in the area affected by the project. • Screening of potential environmental parameters for different sector projects:

The impacts that are not significant screened out and the parameters with potential significant adverse impact are retained. In this screening process each relevant parameter is reviewed according to the stages of operation. Mitigation measures, where appropriate, are also recommended. • Institutional requirements and environmental monitoring plan: This section includes impacts that are to be mitigated and activities to implement the mitigation measures including, how, when and where they will be implemented. • Public consultation and information disclosure: This section describes the process undertaken to involve the public in project design and recommended measures for continuing public participation; it summarises major comments received from beneficiaries, local officials, community leaders, NGOs, and others and describes how these comments were addressed. • Findings and recommendations: This section includes an evaluation of the screening process and recommendations as to whether significant environmental impacts exist, needing further detailed study or EIA. If there is no need of further study, the IEE itself, becomes the complete environmental assessment for the project and no follow-up EIA is then needed. At times it may need to be supplemented by a special study in view of limited but significant impacts. • Conclusions: This section discusses the result of the IEE and justification, if any, of the need for additional study or EIA.

The possible outcomes of IEE

- ❖ Activity has significant adverse environmental impacts.
- ❖ Activity has no significant environmental impacts.
- ❖ With adequate mitigation and monitoring activity, it will have no significant adverse impacts.
- ❖ Not enough information to evaluate the project.
- ❖ Do full EIA or redesign project.
- ❖ Project passes IEE.
- ❖ Project passes IEE, by adding mitigation.
- ❖ IEE must be finalised before funds could be spent.

ENVIRONMENTAL IMPACT ASSESSMENT

Environmental impact assessment (EIA) procedures were developed in the 1970s in order to predict environmental impacts of any development activity and to provide an opportunity to mitigate negative impacts and enhance positive impacts.

An EIA may be defined as A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and augment positive effects.

The EIA is a management tool to • forecast the impact that a project will have on the environment, and • find ways to reduce unacceptable impacts. EIA should apply to all actions likely to have a significant environmental effect. So the potential scope of an EIA could include the appraisal of policies, plans, programmes and projects.

Why is EIA Needed?

There are a number of reasons to carry out Environmental Impact Assessment: • Assurance of adequate procedures for managing environmental risks, and compliance with procedures. • Improved statutory compliance. • Identification of environmental risks and problem areas, early warning and prevention of

potential adverse environmental effects (risk identification, assessment and management). • Improved financial planning through the identification of future and potential capital, operation and maintenance costs associated with environmental activities. • Improved preparation for emergency and crisis situation management. • Improved corporate image and positive public relations. • Enhancement of environmental awareness and responsibility throughout the corporate hierarchy. • Improved relations with regulatory authorities. • Facilitation of obtaining insurance coverage for environmental impairment liability.

Principles of EIA

An EIA is not a one time process ending with the preparation of a report. It provides an essential input to project management through a continuing evaluation and re-evaluation of the various environmental issues as project plans are developed and defined. This process should continue throughout the life of the development from conception to final abandonment or closure. It is important, therefore, that careful consideration be given to the scope, management and planning aspects of an EIA. In the management and planning of EIA there are a number of factors that require consideration. There are five basic principles of managing an EIA. **Principle 1: Focus on the main issues.** • It is important that an environmental impact assessment does not try to cover too many topics in too much detail. • At an early stage, the scope of the EIA should be limited to only the most likely and most serious of the possible environmental impacts, which could be identified by screening or a preliminary assessment. • Where mitigation measures are being suggested, it is again important to focus the study only on workable, acceptable solutions to the problems.

Involve the appropriate persons and groups.

The persons that need to be involved are • Those appointed to manage and undertake the EIA process. • Those who can contribute facts, ideas or concerns to the study, including scientists, economists, engineers, policy-makers and representatives of interested or affected groups. • Those who have direct authority to permit, control or alter the project – that is, the decision makers including, for example, the developer, aid agency or investors, competent authorities, regulators and politicians.

Link information to decisions about the project

An EIA should be organised so that it directly supports the many decisions that need to be taken about the proposed project. It should start early enough to provide information to improve basic designs, and should progress through the several stages of project planning and implementation.

Present clear options for the mitigation of impact and for sound environmental management

To help decision makers, the EIA must be designed so as to present clear choices on the planning and implementation of the project, and it should make clear the likely results of each option. For instance, to mitigate adverse impacts, the EIA could propose: - Pollution control technology or design features; - The reduction, treatment or disposal of wastes; - Compensations or concessions to affected groups.

To enhance environmental compatibility, the EIA could suggest: - Several alternative sites; - Changes to the project's design and operation; - Limitations to its initial size or growth; - Separate programmes, which contribute in a positive way to local resources or to the quality of the environment. • To ensure that the implementation of an approved project is environmentally

sound, the EIA may prescribe: - Monitoring programmes or periodic impact reviews; - Contingency plans for regulatory action; - The involvement of the local community in later decisions.

Provide information in a form useful to the decision-makers

The objective of an EIA is to ensure that environmental problems are foreseen and addressed by decision-makers. They must fully understand the EIA's conclusions, which should be presented in terms and formats immediately meaningful.

The Process of EIA

The way in which an EIA is carried out is not rigid: it is a process comprising a series of steps. These steps are outlined below and the techniques more commonly used in EIA are described in some detail later on. The **main steps** in the EIA process are:

Scoping, • Prediction and mitigation, • Management and monitoring, and • Auditing.

Screening: This is the process of deciding on whether an EIA is required. This may be determined by size or it may be based on site-specific information. The output from the screening process is often a document called an Initial Environmental Examination or Evaluation (IEE) about which you have studied in the previous section. The main conclusion of this step is a classification of the project according to its likely environmental sensitivity.

Scoping: It is used to identify the key issues of concern at an early stage in the planning process. It aids site selection and identifies any possible alternatives. The scoping process should involve all interested parties such as the proponent, planning or environmental agencies and members of the public. The results of scoping will determine the scope, depth and terms of reference to be addressed within the Environmental Statement.

Prediction and mitigation: Several major options are likely to have been proposed either at the scoping stage or before, and each option may require separate prediction studies. An important outcome of this stage is recommendations for mitigation measures. The aim is to introduce measures, which minimise any identified adverse impacts and enhance positive impacts.

Management and Monitoring: The part of the EIA covering monitoring and management is often referred to as the **Environmental Action Plan** or **Environmental Management Plan**.

The purpose of monitoring is to compare predicted and actual impacts. The results of monitoring can be used to manage the environment, particularly to highlight problems early so that action can be taken. The Environmental Management Plan needs to not only include clear recommendations for action and the procedures for their implementation but must also define a programme of action and costs. It must be quite clear exactly how management and mitigation methods are phased with project implementation and at what stage the various costs will be incurred.

Auditing

This is usually done by a separate team of specialists from the one working on the bulk of the EIA. The audit should include an analysis of the technical, procedural and decision-making aspects of the EIA. The audit will determine whether recommendations and requirements made by the earlier EIA steps were incorporated successfully into project implementation.

EIA Tools and Techniques

We now describe certain tools and techniques used in EIA. **Baseline studies** Baseline studies using available data and local knowledge are required for scoping. Once key issues have

been identified, the need for further in-depth studies can be clearly identified and any additional data collection initiated. Specialists, preferably with local knowledge, will be needed in each key area identified. They will need to define further data collection, to ensure that it is efficient and targeted to answer specific questions, and to quantify impacts. A full year of baseline data is desirable to capture seasonal effects of many environmental phenomena.

Check-lists

Check-lists are prepared by experts for non-specialists and enable much time-consuming work to be carried out in advance of expert input. It includes extensive data collection sheets. The collected data can then be used to answer a series of questions to identify major impacts and to identify shortages of data. A matrix indicates which data are linked to which questions.

Overlay

Overlays provide a technique for illustrating the geographical extent of different environmental impacts. Each overlay is a map of a single impact. The original technique used transparencies, which is somewhat cumbersome. However, the development of Geographic Information Systems (GIS) has made this technique particularly suitable for comparing options, pinpointing sensitive zones and proposing different areas or methods of land management

Mathematical modelling

Mathematical modelling is one of the most useful tools for prediction work. It is the natural tool to assess both flow quantities and qualities (e.g. salt/water balances, pollution transport, changing flood patterns). However, it is essential to

use methods with an accuracy, which reflects the quality of the input data, which may be quite coarse. **Expert advice** Expert advice should be sought for predictions, which are inherently non-numeric and is particularly suitable for estimating social and cultural impacts. It should preferably take the form of a consensus of expert opinion. Local experience will provide invaluable insights. Expert opinions are also likely to be needed to assess the implications of any modelling predictions.

Economic techniques

Economic techniques have been developed to try to value the environment and research work is continuing in environmental economics. The most commonly used methods of project appraisal are cost-benefit and cost-effectiveness analysis. It has not been found easy to incorporate environmental impacts into traditional cost-benefit analysis, principally because of the difficulty in quantifying and valuing environmental effects.

Environmental health impact assessment

There are various stages in an Environmental Health Impact Assessment: • Hazard Identification, • Exposure Assessment, • Exposure-Response relationship, • Estimation of risks to health, and communication of these risks to all concerned, • Determination of health costs (potential or actual), • Option appraisal, and so on.

Environmental Impact Statement

The **Environmental Impact Statement is the final report of an EIA**. EIS is defined as a document prepared to describe the effects of the proposed activities on the environment. The report consists of a summary of the impact of alternatives and a section on follow up action required to enable implementation of proposals and to monitor long-term impacts.

Recommendations are a crucial part of EIS. The format of the report should preferably follow a standard as recommended by the appropriate institution or required by legislations. The main text should include:

- A description of the programme, plan or project,
- A summary of the EIA methodology,
- The policy, legal and administrative framework,
- A summary of the base line data,
- A description of the government and non-government participation,
- Environmental impacts,
- Environmental action plan,
- Recommendations and guidance to the decision maker, and
- A statement of provision for auditing, who should carry it out and when.

The appendixes should include:

- A glossary of technical terms used and the units,
- A list of the team who prepared the EIA,
- Records of public meeting and consultations,
- A catalogue of information, both data and written material and their sources, and
- Technical information too detailed for the main text.

ENVIRONMENTAL AUDITING (EA)

It is a management tool comprising a systematic, documented, periodic and objective evaluation of how well management and equipment are performing in environmental terms. Its aim is to help safeguard the environment by:

- Facilitating management control of environmental practices; and
- Assessing compliance with company policies, which would include meeting regulatory requirements.

The benefits of EA

- ❖ Better control of process & pollution control system
- ❖ Less exposure to litigation / Regulatory Risk
- ❖ Timely warning on potential future problems
- ❖ Evaluation of possible impact on surroundings
- ❖ Waste Minimization
- ❖ Cost Saving through Cycle Recovery

ISO 14000

ISO is the International Organization for Standardization. It is a network of National Standard Institutes from 140 countries working in partnership with International Organisations, Government, Industry, Business and Consumer Representatives. ISO is a non-governmental organisation and its members are the Standards Institutes in their respective countries instead of their Governments. India is also Member of ISO and is represented by the Bureau of Indian Standards. ISO provides business management with the structure for managing environmental impacts. ISO 14000 is a series of voluntary generic standards developed / being developed by ISO. The standards include a broad range of environmental management disciplines, including the basic management system, auditing, performance evaluation, labelling and life cycle assessment.

ISO 14001 refers to the first of the ISO 14000 series standards, which is the only standard available so far in this series against which an organisation can go for certification/ registration.

World trade is playing an increasingly important role in the economic health of nations. It is dependent on various bilateral or multilateral agreements amongst industrial countries, most of which are under the umbrella of WTO. These trade agreements, however, require an underpinning by technical agreements, which provide for compatible standards of products of the trading partners. Trade between countries thus becomes easier and fairer by using standards which are widely acceptable. The ISO 14000 provides such internationally acceptable standards.

ISO 14000 Certification, Registration and Accreditation

In common usage and even in publications, the term certification and registration are used interchangeably. Scholars

may make the distinction between “registering” a management system and “certifying” a product standard but this distinction is rarely noted in the world of ISO 14001. Even the Standard speaks of certification/registration. Each country has its own accreditation body established either nationally or by their government. They are expected to perform the following accreditation services: • Quality Management Systems, • Product Conformity.

Environmental Management Systems and/or EMAS, • Certification of Personnel, and • Information Security Management Systems. Each accreditation organisation has developed their criteria for accreditation, ISO 14001 registration or Certification. Accreditation is not a legal requirement. However, accreditation provides organisations with the assurance that their registrar has met the accreditation requirements for things such as impartiality, confidentiality, a documented registration system, quality assurance, and policies to handle complaints and appeals. A common myth about EMS and ISO 14001 certification is that the organisation will completely eliminate all sorts of pollution before deciding to get it certified for ISO 14001 standards. However, this is not entirely true. ISO 14000 is a management standard, and does not mandate any specific requirements for improved environmental performance. Instead, the requirement is more obliquely stated, requiring an organisation to identify their environmental impacts; prioritise those impacts; set targets and objectives for reducing those impacts; select activities to achieve the identified targets and then to use a continuous improvement cycle to evaluate and re-approach the system. There is nothing in the standard that tells organisations what goals to set, which means that improved environmental performance is not guaranteed.

The central concept of ISO 14001 is **continual improvement**. During certification audits, what an auditor would

like to see is the continual improvement or a “delta improvement” from time to time.

The ISO 14001 Certification Process The ISO 14001 Certification process is generally divided into the following four steps. However, there could be exceptions where some organisation may opt to skip or merge some of the steps. The four steps are:

Gap Analysis All organisations would have some environmental practices and procedures in place. Therefore, it is a usual practice that organisations seeking ISO 14001

Environmental Management System certification conduct a Gap Analysis exercise to see how the existing practices and procedures are complying with the Standard, and what more needs to be done.

Initial Planning Implementation of an ISO 14001 EMS will require an organisation to: a) Develop an implementation strategy (including selecting a certification agency); b) Develop or redesign documentation (policies, programmes, procedures, forms).

3. Registration and Certification The selected certification company usually performs three EMS audits to test for the conformance of the organisation’s EMS to the requirements specified in ISO 14001. These audits are usually titled as:

❖ **Pre stage assessment:** Baseline conditions for EMS are developed.

❖ **First stage assessment:** First formal audit followed by a report of system non conformities is done.

❖ **Second stage assessment:**

This is the assessment for certification. There are four possible scenarios as a result of this certification assessment: Scenario 1: recommendation for certification without any non-conformance. Scenario 2: recommendation for certification with some minor non-conformance. Scenario 3: not recommended for certification because of some major non-conformances. Scenario 4: not recommended for certification and the entire EMS or major part of it is declared in non-compliance with the standards.

Surveillance and Maintenance Once certification is conferred upon the organisation, it undergoes a series of surveillance audits. The frequency of surveillance visits will be a function of the rate of change within the organisation and/or the scale of the environmental impacts.

NATIONAL ENVIRONMENTAL QUALITY STANDARDS

To approach the environmental pollution control, various countries of the world have adopted different approaches so as to suit their local and socio-economic conditions. Nevertheless all the approaches start from the desire to achieve and maintain an acceptable quality of the environment. In this respect, many countries have technically specified quality standards even though many difficulties are inherent in establishing such specifications. By general definition, A standard is a document, established by consensus and approved by recognised body that provides, for the common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree or order in a given context.

Standards are varied in character, subject and medium. They cover several disciplines dealing with all technical, economic and social aspects of human activity. Standards are developed by technical committees, which are coordinated by a specialised body. Environmental quality standards are the *measuring stick* for substances in soil, surface water and groundwater at sites. They tell us “*how clean is clean*”. The environmental quality standards can be defined in terms of Primary, Secondary and Emission Standards.

Primary Environmental Quality Standards:

These are defined as those standards that establish the maximum and minimum concentration and period values for elements, compounds, substances, chemical or bio-chemical

derivatives, energy, radiation, vibration, noise or a combination of them, whose presence or lack thereof in the environment can constitute a risk to life or the health of the population, defining the levels that give rise to emergency situations.

Secondary Environmental Standards: These standards establish the maximum or minimum concentration and the period values for substances, elements, energy or a combination of them, whose presence or lack thereof in the environment can constitute a risk for the protection or conservation of the greater environment, or the preservation of nature.

Emission Standards: These establish the maximum permissible quantity of a pollutant measured in the effluent of the emission source. A holistic approach to environment should be incorporated into business operations. EMS is an approach that ensures operationalisation and self-regulation of company as compared to government imposed regulations. An EMS is that part of the overall management system which includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

The **tools** to implement an EMS include **IEE, EIA, EA, ISO 14000, NEQS**. • **Initial Environmental Examination (IEE)** helps in deciding whether an EIA is required or not. • **Environmental Impact Assessment (EIA)** describes details of impacts, its mitigation measures and monitoring. • **Environmental Auditing (EA)** comprises a systematic, documented periodic and objective evaluation of how management and equipments are performing in environmental terms. • **ISO 14000** provides guidelines for business management with the structure for managing environment. • **National Environmental Quality Standards (NEQS)** are designed to control pollution and tell us how environment friendly the products and services are.

Forces That Have Led To Changes In Environmental Management, Both In Urban And Rural India

The phrase built environment refers to the man-made surroundings that provide the setting for human activity, ranging from the large-scale civic surroundings to the personal places.

The term is also now widely used to describe the interdisciplinary field of study which addresses the design, management and use of these man-made surroundings and their relationship to the human activities which take place within them. The field is generally not regarded as an academic discipline in its own right, but as a “field of application” (or “interdiscipline”) which draws upon the individual disciplines of economics, law, management, design and technology in sustainable sense.¹

In architecture and environmental psychology, the phrase is a useful acknowledgement that a small fraction of buildings constructed annually, even in the industrialized world, are designed by architects, and that users of the built environment encounter issues that cross the traditional professional boundaries between urban planners, traffic engineers, zoning authorities, architects, interior designers, industrial designers, etc. Historically, much of the built environment has taken the form of vernacular architecture, and this is still the case in large parts of the world. In the industrialized world, many buildings are produced by large scale development remote from its eventual users.

In landscape architecture, the built environment is identified as opposed to the natural environment, with the recognition that places like Central Park may have the look, feel, and nourishing quality of natural surroundings while being completely artificial and “built,” thus blurring the line between the two.

In urban planning, the phrase connotes the idea that a large percentage of the human environment is manmade, and these artificial surroundings are so extensive and cohesive that they function as organisms in the consumption of resources, disposal of wastes, and facilitation of productive enterprise within its bounds. Recently there has also been considerable dialogue and research into the impact of the built environment's impact on population health

Anthropogenic Effects

Anthropogenic effects, processes or materials are those that are derived from human activities, as opposed to those occurring in natural environments without human influence. The term is often used in the context of environmental externalities in the form of chemical or biological wastes that are produced as by-products of otherwise purposeful human activities.²

The term *anthropogenic* designates an effect or object resulting from human activity. The term was first introduced as "anthropocene" in the mid-1970s by the atmospheric scientist Paul Crutzen. Shortly after, Sherwood Rowling and Mario Molina published a series of articles putting forward the idea of the impact of chlorofluorocarbons (CFCs) on the stratospheric ozone. The term is used in the context of pollution emissions that are produced as a result of human industry.

The **natural environment**, commonly referred to simply as the **environment**, is a term that encompasses all living and non-living things occurring naturally on Earth or some region thereof.

The concept of the *natural environment* can be broken down into a few key components:

- Complete ecological units that function as natural systems without massive human intervention, including

all vegetation, animals, microorganisms, soil, rocks, atmosphere and natural phenomena that occur within their boundaries.

- Universal natural resources and physical phenomena that lack clear-cut boundaries, such as air, water, and climate, as well as energy, radiation, electric charge, and magnetism, not originating from human activity.

The natural environment is contrasted with the built environment, which comprises the areas and components that are strongly influenced by humans. A geographical area is regarded as a natural environment (with an indefinite article), if the human impact on it is kept under a certain limited level

Composition

Earth science (also known as geoscience, the geosciences or the Earth Sciences), is an all-embracing term for the sciences related to the planet Earth. There are four major disciplines in earth sciences, namely geography, geology, geophysics and geodesy. These major disciplines use physics, chemistry, biology, chronology and mathematics to build a qualitative and quantitative understanding of the principal areas or *spheres* of the Earth system. Earth science generally recognizes spheres, the lithosphere, the hydrosphere, the atmosphere, and the biosphere, these correspond to rocks, water, air, and life. Some practitioners include, as part of the spheres of the Earth, the cryosphere (corresponding to ice) as a distinct portion of the hydrosphere, as well as the pedosphere (corresponding to soil) as an active and intermixed sphere.

Geological Activity

A volcanic fissure and lava channel.

The Earth's crust, or Continental crust, is the outermost solid land surface of the planet, is chemically and mechanically

different from underlying mantles, and has been generated largely by igneous processes in which magma (molten rock) cools and solidifies to form solid land. Plate tectonics, mountain ranges, volcanoes, and earthquakes are geological phenomena that can be explained in terms of energy transformations in the Earth's crust and might be thought of as the process by which the earth resurfaces itself. Beneath the Earth's crust lies the mantle which is heated by the radioactive decay of heavy elements. The mantle is not quite solid and consists of magma which is in a state of semi-perpetual convection. This convection process causes the lithospheric plates to move, albeit slowly. The resulting process is known as plate tectonics. Volcanoes result primarily from the melting of subducted crust material. Crust material that is forced into the Asthenosphere melts, and some portion of the melted material becomes light enough to rise to the surface, giving birth to volcanoes.

Oceanic activity

An ocean is a major body of saline water, and a principal component of the hydrosphere. Approximately 71% of the Earth's surface (an area of some 361 million square kilometers) is covered by ocean, a continuous body of water that is customarily divided into several principal oceans and smaller seas. More than half of this area is over 3,000 meters (9,800 ft) deep. Average oceanic salinity is around 35 parts per thousand (ppt) (3.5%), and nearly all seawater has a salinity in the range of 30 to 38 ppt. Though generally recognized as several 'separate' oceans, these waters comprise one global, interconnected body of salt water often referred to as the World Ocean or global ocean. This concept of a global ocean as a continuous body of water with relatively free interchange among its parts is of fundamental importance to oceanography.³

The major oceanic divisions are defined in part by the continents, various archipelagos, and other criteria: these divisions are (in descending order of size) the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, the Southern Ocean (which is sometimes subsumed as the southern portions of the Pacific, Atlantic, and Indian Oceans), and the Arctic Ocean (which is sometimes considered a sea of the Atlantic). The Pacific and Atlantic may be further subdivided by the equator into northerly and southerly portions. Smaller regions of the oceans are called seas, gulfs, bays and other names. There are also salt lakes, which are smaller bodies of landlocked saltwater that are not interconnected with the World Ocean. Two notable examples of salt lakes are the Aral Sea and the Great Salt Lake.

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Atmosphere, climate and weather

Atmospheric gases scatter blue light more than other wavelengths, creating a blue halo when seen from space.

The atmosphere of the Earth serves as a key factor in sustaining the planetary ecosystem. The thin layer of gases that envelops the Earth is held in place by the planet's gravity. Dry air consists of 78% nitrogen, 21% oxygen, 1% argon and other inert gases, carbon dioxide, etc.; but air also contains a variable amount of water vapor. The atmospheric pressure declines steadily with altitude, and has a scale height of about 8 kilometres at the Earth's surface: the height at which the atmospheric pressure has declined by a factor of (a mathematical constant equal to 2.71...). The ozone layer of the Earth's atmosphere plays an important role in depleting the amount of ultraviolet (UV) radiation that reaches the surface. As DNA is readily damaged by UV light, this serves to protect life at the surface. The atmosphere also retains heat during the night, thereby reducing the daily temperature extremes.

Effect of global warming

The retreat of Aletsch Glacier in the Swiss Alps (situation in 1979, 1991 and 2002), due to global warming.

Another view of the Aletsch Glacier in the Swiss Alps, which due to global warming, has been decreasing.

The potential dangers of global warming are being increasingly studied by a wide global consortium of scientists, who are increasingly concerned about the potential long-term effects of global warming on our natural environment and on the planet. Of particular concern is how climate change and global warming caused by anthropogenic, or human-made releases of greenhouse gases, most notably carbon dioxide, can act interactively, and have adverse effects upon the planet, its natural environment and humans' existence. Efforts have been increasingly focused on the mitigation of greenhouse gases that are causing climatic changes, on developing adaptive strategies to global warming, to assist humans, animal and plant species, ecosystems, regions and nations in adjusting to the effects of global warming. Some examples of recent collaboration to address climate change and global warming include:

- The United Nations Framework Convention Treaty and convention on Climate Change, to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- The Kyoto Protocol, which is the protocol to the international Framework Convention on Climate Change treaty, again with the objective of reducing greenhouse gases in an effort to prevent anthropogenic climate change.
- The Western Climate Initiative, to identify, evaluate, and implement collective and cooperative ways to reduce greenhouse gases in the region, focusing on a market-based cap-and-trade system.

A significantly profound challenge is to identify the natural environmental dynamics in contrast to environmental changes not within natural variances. A common solution is to adapt a static view neglecting natural variances to exist. Methodologically,

this view could be defended when looking at processes which change slowly and short time series, while the problem arrives when fast processes turns essential in the object of the study.

Life

Female mallard and ducklings - reproduction is essential for continuing life

Main articles: Life and Biosphere

Although there is no universal agreement on the definition of life, scientists generally accept that the biological manifestation of life is characterized by organization, metabolism, growth, adaptation, response to stimuli and reproduction. Life may also be said to be simply the characteristic state of organisms.

Properties common to terrestrial organisms (plants, animals, fungi, protists, archaea and bacteria) are that they are cellular, carbon-and-water-based with complex organization, having a metabolism, a capacity to grow, respond to stimuli, and reproduce. An entity with these properties is generally considered life. However, not every definition of life considers all of these properties to be essential. Human-made analogs of life may also be considered to be life.

The biosphere is the part of Earth's outer shell — including air, land, surface rocks and water — within which life occurs, and which biotic processes in turn alter or transform. From the broadest geophysiological point of view, the biosphere is the global ecological system integrating all living beings and their relationships, including their interaction with the elements of the lithosphere (rocks), hydrosphere (water), and atmosphere (air). Currently the entire Earth contains over 75 billion tons (150 *trillion* pounds or about 6.8×10^{13} kilograms) of biomass (life), which lives within various environments within the biosphere.¹

Ecosystems

A coral reef near the Hawaiian islands is an example of a complex marine ecosystem.

An ecosystem is a natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area functioning together with all of the non-living physical (abiotic) factors of the environment.

Central to the ecosystem concept is the idea that living organisms are continually engaged in a highly interrelated set of relationships with every other element constituting the environment in which they exist. Eugene Odum, one of the founders of the science of ecology, stated: "Any unit that includes all of the organisms (ie: the "community") in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (ie: exchange of materials between living and nonliving parts) within the system is an ecosystem." The human ecosystem concept is then grounded in the deconstruction of the human/nature dichotomy, and the emergent premise that all species are ecologically integrated with each other, as well as with the abiotic constituents of their biotope.

Ecosystems can be bounded and discussed with tremendous variety of scope, and describe any situation where there is relationship between organisms and their environment. If humans are part of the organisms, one can speak of a 'human ecosystem'. As virtually no surface of the earth today is free of human contact, all ecosystems can be more accurately considered as human ecosystems, or more neutrally as human-influenced ecosystems.

Biomes

Map of Terrestrial biomes classified by vegetation.

Biomes are terminologically similar to the concept of ecosystems, and are climatically and geographically defined areas

of ecologically similar climatic conditions such as communities of plants, animals, and soil organisms, often referred to as ecosystems. Biomes are defined based on factors such as plant structures (such as trees, shrubs, and grasses), leaf types (such as broadleaf and needleleaf), plant spacing (forest, woodland, savanna), and climate. Unlike ecozones, biomes are not defined by genetic, taxonomic, or historical similarities. Biomes are often identified with particular patterns of ecological succession and climax vegetation.

The High Peaks Wilderness Area in the 6,000,000-acre (2,400,000 ha) Adirondack Park

Wilderness

Wilderness is generally defined as a **natural environment** on Earth that has not been significantly modified by human activity. The WILD Foundation goes into more detail, defining wilderness as: “The most intact, undisturbed wild natural areas left on our planet - those last truly wild places that humans do not control and have not developed with roads, pipelines or other industrial infrastructure.” Wilderness areas and protected parks are considered important for the survival of certain species, ecological studies, conservation, solitude, and recreation. Wilderness is deeply valued for cultural, spiritual, moral, and aesthetic reasons. Some nature writers believe wilderness areas are vital for the human spirit and creativity.

The word, “wilderness”, derives from the notion of wildness; in other words that which is not controllable by humans. The word’s etymology is from the Old English *wildeornes*, which in turn derives from *wildeor* meaning *wild beast* (wild + deor = beast, deer). From this point of view, it is the wildness of a place that makes it a wilderness. The mere presence or activity of people does not disqualify an area from being “wilderness.” Many ecosystems that are, or have been, inhabited or influenced

by activities of people may still be considered “wild.” This way of looking at wilderness includes areas within which natural processes operate without very noticeable human interference.

Challenges

Before flue gas desulfurization was installed, the air-polluting emissions from this power plant in New Mexico contained excessive amounts of sulfur dioxide. Summer field in Belgium (Hamois). The blue flower is *Centaurea cyanus* and the red one a *Papaver rhoeas*.

It is the common understanding of *natural environment* that underlies environmentalism — a broad political, social, and philosophical movement that advocates various actions and policies in the interest of protecting what nature remains in the natural environment, or restoring or expanding the role of nature in this environment. While true wilderness is increasingly rare, *wild* nature (e.g., unmanaged forests, uncultivated grasslands, wildlife, wildflowers) can be found in many locations previously inhabited by humans.

Goals commonly expressed by environmental scientists include:

- Reduction and clean up of pollution, with future goals of zero pollution;
- Cleanly converting nonrecyclable materials into energy through direct combustion or after conversion into secondary fuels;
- Reducing societal consumption of non-renewable fuels;
- Development of alternative, green, low-carbon or renewable energy sources;
- Conservation and sustainable use of scarce resources such as water, land, and air;
- Protection of representative or unique or pristine ecosystems;

- Preservation of threatened and endangered species extinction;
- The establishment of nature and biosphere reserves under various types of protection; and, most generally, the protection of biodiversity and ecosystems upon which all human and other life on earth depends.

Very large development projects - megaprojects - pose special challenges and risks to the natural environment. Major dams and power plants are cases in point. The challenge to the environment from such projects is growing because more and bigger megaprojects are being built, in developed and developing nations alike

Built Environment and Health in Rural Areas

Low population density, land use mix, and connectivity define urban sprawl, and urban sprawl is a major outcome of development strategies in the United States. Since the early 20th century, the population of the United States has shifted from living predominantly in rural areas to living predominantly in urban regions. The first year in U.S. history in which more people lived in cities than in rural areas was 1920 (U.S. Census Bureau, 2000a). Suburban growth was fueled by many factors, including the desire to avoid polluted cities. People considered suburban living to be healthier. Urban encroachment in rural areas creates health problems and issues involving health care access, air pollution, water pollution and water availability, and other concerns, said Bernard Goldstein of the University of Pittsburgh.

Health Impact Of Urban Encroachment On Rural Areas

Specific health issues in rural areas need to be considered, said Goldstein. Access to health care, which can be difficult in rural areas, is such issue. For example, it is common for there to be only one main road going from a rural area into

the nearest city with a hospital. Traffic congestion on that key road may impede ambulances from getting to the tertiary-care hospital. Also, the more rural the area, the more likely it is that people will die if they are in an automobile accident because people drive at higher speeds in rural areas. The state and development trends of technical infrastructure elements on rural areas, which affect the ecological protection based on the countryside, was studied. The situation was analysed on the basis of available statistical data for all provinces of Poland. It was found that the intensification of the extension of water supply and sewerage system on rural terrains, by using the EU structural funds, is a necessity.

Government Offices promote sustainable development, protect the environment and help rural areas. We make sure the policies of the Department for Environment, Food and Rural Affairs (Defra) are implemented and properly integrated with the work of other Government departments.

Good environment is central to the quality of life and success of both urban and rural areas. This means that the Government must work to protect and improve the environment. A key part of delivering this strategy is 'sustainable development' – that is, making sure what we do today to produce what we need doesn't compromise the ability of future generations to do the same.

Rural areas face some specific challenges. It is important to ensure their economies thrive and that their public services are delivered effectively. This must be done in a way that respects the needs of communities, yet ensures that the landscapes and environment are protected for us all.

The specific tasks carried out by Government Offices to support these objectives include:

- promoting effective policies for rural areas, as outlined in the Government's 'Rural Strategy 2004'

- implementing the Government's 'Strategy for Sustainable Farming and Food' in each region
- ensuring that rural communities and their key stakeholders have an effective voice in regional rural policy-making and can influence national policy, through supporting regional Rural Affairs Forums – the Government Offices are the secretariat for the forums, which bring together representatives from rural communities, businesses, service providers and local authorities.
- promoting sustainable development with local partners
- supporting local authorities and others to improve recycling and waste reduction
- promoting the Energy White Paper, including energy efficiency and the development of renewable energy generation
- representing the region's views on a wide range of environmental and rural policy issues to Defra and other government departments

This research proposal discusses the various issues of the emerging concept, "Environmental Management", its thrust, scope, objectives and applicability in a developing country like India. This proposal also aims at improving industrial and urban environmental management and promoting the management of all natural resources to their best use. The study also provide state of the art solutions to the complex problems of environmental management in India, to look ahead and understand how concerns in environmental management can be anticipated and procedures for addressing them by integrating the environmental aspect⁴ into the economical and social context to achieve this objective.



Notes and References

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Research Methodology

- Need for Environmental Management
- Problems of the Study
- Scope of the Study
- Hypothesis
- Objectives of the Study
- Exploration of the Study
- Assumptions of the Study
- Methodology used
- Plan of the Study

2. Research Methodology

Need for Environmental Management:

Man's desire for ultimate joy and comfort has led him to exploit nature's "free" goods to the extent of reducing its natural capacity for self stabilization. As a consequence of this outright disregard of the impact of these activities on the environment, numerous environmental problems have arisen.

Man's capability to transform his environment can bring the benefits of economic development and an opportunity to enhance the quality of life. But this same power, incorrectly applied, can also cause incalculable harm to the natural environment and consequently to human life. There should be no delay in tackling the task of solving these environmental problems, as these problems have cumulative impact. Delayed remedial action will cost considerably more and the damage will become irreversible. There is only one world to pollute, if this is ruined, there is no other. Man will survive only as long as the earth survives.

Hence, environmental management must regulate the demands and activities of man in such a way that the ability of environment to sustain future development remains unimpaired. Efficient environmental management is a pre-requisite for

sustained economic development. Environmental Management aims at the development of the environment for human benefit; It the process of balancing socio-economic, technological and ecological forces in the development and allocation of resources in order to fulfill the needs and aspirations of present and future generations. In doing so, Environmental Management should work to preserve the maximum evolutionary potential of the biosphere.

No matter how the concept of Environmental Management is define, the attainment of its objectives will necessarily require significant changes in the values, attitudes and behavior of those concerned with the maintenance of the society.

Problems of the Study

India's environmental problems are gaining global significance because of the rapid and aggressive speed of urbanization and lack of infrastructure. Increasing urbanization, industrialization, deforestation and transportation, the second cousins of economic development put tremendous pressure on natural resources and therefore there is a pressing need to strike a balance between developmental planning and urgency to safeguard the environment. As a means of self-preservation, people in India, as in other parts of the world, have been denuding the forests, digging up the land, mining the mountains and farming the seas and so forth. While they were inflicting serious damages to the ecosystem, the regenerative power of the nature, were generally able to heal the environmental damage **(Farnandes, 1996)**. Today, people are destroying faster than nature can replenish, because of our numerical strength of ten million people, and our insatiable desire of producing more and more effective tools for conquering nature. We in India have been polluting the water and air and degrading land faster than nature can purify them.

In India, the environmental problems are caused because of under development. Millions of our people still continue to live for below the minimum levels required for a decent human existence; deprived of adequate food, clothing, shelter, education, health and sanitation. Poverty and lack of alternatives are the forces which drive rural people in India to the burning of forests, tilling of marginal lands, the over dependence of on finding grazing land for cattle, the over cutting of trees for fuel. We can see the other part of the coin also. Over technological and economic development leads people to live in poor environmental condition. Increasing number of vehicles, construction of industries and dams are the causes of environmental degradation in country like India. Both urban and rural areas in India are overwhelmed by large numbers of people, who no doubt are looking for opportunity to join the process of development. Green revolution has already forced large numbers of rural people to migrate to cities. In India, we are faced with the size of the population and its uneven distribution; poor housing conditions, slums, squatter settlements, inadequate water and sanitation (**Farnandes, 1996**). The man-made environment of our cities is undergoing violent changes to the extent that authorities seem powerless in grappling with the situation.¹

Present Situation In Environmental Degradation:

India is facing an alarming situation in environmental condition in present day. India ranks the sixth largest and second fastest growing producer of Green House Gases (GHGs) in the world. Three of India's largest cities are considered among world's 10 most polluted cities. Nearly 12 years since the disastrous Union Carbide Chemical leak in Bhopal and after 5 years of economic resurgence, environmental awareness is high, titled GREEN – India (Growth with Resource Enhancement of Environment and Nature). A report by TERI (Tata Energy Research

Institute) focusing on the state of the Indian natural resources and environmental pollution was released recently. According to the study, India is losing at least 10 % of its natural income due to environmental degradation. The study of the report reveals that, the availability of fresh water declined by two-thirds. The water requirement of major water consuming industries such as agro based, refineries, petrochemicals, fertilizers has grown 40 times but these are not yet treating the huge waste water generated. Indoors and out door air pollution result in the nation almost 2.5 million premature deaths. The total sewage generation from the urban centers has grown six times in the last 60 years **(TERI, 2003)**.

Concern Of Degradation In India's Planning:

More than two decades ago the United Nations' conference on the "Human Environment" in Stockholm (1972) drew attention to the government and people of world to the increasing evidence that our activities were producing deleterious effects on the natural and man made environment, and creating serious risks for the survival and well-being of people themselves and also to provide the basis for international cooperation, to meet this new challenge of the 20th century.

India is the first country, which has provided for the protection and improvement for the environment in its constitution and has taken several steps in planning and policies to overcome the environmental problems. If we go to back we can have the idea that there is an evolutionary process in India's planning from the beginning.

After the formal independence the Planning Commission of India prepared the first documented plan in 1952 under the chairmanship of the then Prime Minister of India. The main objective of this plan was to raise the living standard of people and to increase the National Income and Per capita Income by

20% and 17% respectively and open revenues for all people. But in the first and second plan there were no concrete steps for environmental degradation. Only few scattered forest and soil conservation policies were undertaken. The Forest Policy Revolution act of May 12, 1952, suggested maintaining one thirds of its total land area under forests. In the third 5-year planning it was proposed not only to intensify some of the programs initiated under the first and second plans, but also to put special emphasize on more intensive forest and soil conservation programs. Steps were taken both for utilization of forest resources as well as to protect the forests. Different afforestation programs and river valley projects were in focus.

The fourth 5-year plan showed no new dimension in environmental concern. Only some few forests policies and programs were merged with Animal Husbandry and Fisheries section. Fifth plan also goes to same direction. There were no such new areas. Only some few forestry programs had taken place. But in this plan emphasize was given to improve urban environmental condition basically in the slum areas.²

Concern of environmental problem made its first footsteps in the 6th five-year planning. For the first time, in India's planning there was separate provision for environmental degradation. Steps were taken for water pollution, air, noise and land pollution separately. Though plans and programs in the field of soil conservation and public health forests and wild life protection, industrial hygiene etc. had been in existence in India for many decades, but the first formal recognition of the need for integrated environmental planning was made when the Govt. of India constituted the National Committee on Environmental Planning and Coordination (**NCEPC**) in 1972.

The 7th and 11th PLAN plans were the continuation of previous plan with some new improvements. The basic approach to the 7th plan was sustainable development in harmony with

environment. With the realization that poverty and the state of under development led to many of the environment problems, that confronted with nature hence the understanding that development is the way of environmental management. However, another way of environmental problems have arisen as unintended side effects of the very attempts of development.

The scenario of environment and forests continues to cause concern and the destruction and degradation of forests are taking a heavy toll of our natural resources. In the 8th plan, in addition to a number of national level bodies which have been constituted by the Ministry on Environment and Forests, the Planning Commission had set up several expert group/committees to formulate long term sectoral policies and to reconcile the conceptual confrontation between environment and development. Submission of an environmental statement by the polluting units to the concerned State Pollution Control Board was made mandatory through notification under Environmental Pollution Act (1986).

One of the objectives of 9th five-year planning was to ensure environmental sustainability of the developmental process through social mobilization and participation of people at all levels. For ecological sustainability, different afforestation programs and all round development of the villages for the well being of forests were planned to initiate. Involvement of NGOs in areas of awareness building and community education was planned to encourage.

Environmental pollution is serious and growing hazard in India. Its impact on human health and well being is both direct (inhalation of polluted air or intake of contaminated water) and indirect (loss of soil fertility, death of aquatic life). The Central Board for the prevention and control of water pollution spearheads the effort such as assessment and control of coastal pollution and strengthening the National River Water Quality Monitoring.

A major program on prevention of pollution of Ganga was planned. It was proposed to induce socio-economic industries and department as well as different agencies whose projects impinge on environmental quality, to establish technical cells for

Environmental Assessment. Most of the programs for environmental management deal with pre-planning for eliminating or at least minimizing environmental degradation. One of the major objectives of Eco-development was restoration of already degraded ecosystem through practical field scheme such as land reclamation, afforestation and cleaning of water bodies etc.

Planning in a rational way constitutes an essential tool for all round development as well as to protect the environment. We can say that a development process must be ecologically viable. Yet on the policy level, Government of India has been focusing many environmental measures. But what lacks in the planning is a holistic approach and coordination between planning, law and implementation. After having an overall idea about the planning of India we can see that Government had taken several steps for overcoming the environmental problems in different five years plans. Though in first, second and third five years plans there were less emphasize on environmental concern. The sixth plan first drew attention on environmental planning. But less effort was given to financial help to the plan. Coming to the seventh plan it is evidenced that for the first time a provision for separate sector and financial outlay was made in the plan. Again in the ninth plan, provision for separate environment sector was evidenced. But in the latest plan i.e. the tenth plan we couldn't see any separate provision for environment, and it is merged with science and technology sector. That is the problem with India's planning. They are not maintaining a continuous plan for the environment. It is very much needed to establish a separate sector for environment and ecology, and to

inculcate the financial resource also. Fact is that Environmental Policy in India has relied only on command and control instruments.

The introduction of the concept of environment in the context of developments is in the process of formation. It has drawn our attention to the global responsibilities and indicated that human beings are interrelated with the eco-sphere. Certainly it has a clear role to play in Public Policy making. The green movements and environmental pressure groups have made environment a political and geographical issues. It would be wrong to think that ecologism's future is doubtful because its more radical demands like dismantling of industrialization, the examination of the assumptions of anthropocentrism and the move towards a decentralized, low impact society are not being given due consideration at present. While there is a great debate concerning anthropocentrism and biocentrism, it has no bearing whatsoever on the way environmental policies are being made or justified by the individual states. However, its actual future lies somewhere between two extremes, acting as a pure and good conscience for environmentalism which has become a part of the developmental policies of the present day nation-states. It will continue to play an active role in the environmental movements throughout the globe.

In spite of theoretical references, all ecological schools have questioned the limits of economic development in industrialized countries. This in turn leads to critical reflection on the nature of development such as production in industry and agriculture, energy use and the kind of technology, concept of work, consumption patterns, population growth etc. The ecology perspective also tends to combine both respect for local autonomy in communities and a global message. They all focus on the central theme of sustainable development, a development which will not damage but will exist harmoniously with the ecosystem.

The study see this as 'new age capitalism'. In short, the maximum sustainable view wants to reduce the rates of the depletion and pollution to a point where depletion is as close to the capacity of the environment to assimilate it safely.

Ecology movements have emerged all over the world in recent years. Their primary purpose is to protect nature and to strength people's collective rights to common resources. 'Environmentalism' has become part of the dominant discourse. 'Development' has given way to 'Sustainable Development' and 'growth' has given way to 'green growth'. Yet the ruling paradigm about environmental issues continues to be biased in favour of the North, and the cities of the South. This bias creates a number of misconceptions about environmental issues in the third world. The third world countries need 'development' and cannot afford the luxury of protecting nature's ecological solutions, they are merely a source of environmental problems.

After independence, India launched a series of economic plans for rapid expansion in agriculture, industry, transport and other infrastructure with a view to increase production and employment, to reduce poverty and inequality of incomes and to establish socialistic society based on equality and justice. But because of poor planning and in many cases because of mindless and ruthless exploitation natural resources we have degraded our physical environment. By environment, we mean the whole complex of climatic, soil, water and biotic factors on which we all subsist, and on which our entire agricultural and industrial development depends. Rapid economic development is turning India in to a vast wasteland. If poverty in pre-independence India was the result of under- utilization of resources, there is very possibility that poverty; unemployment and inequality would continue to persist due to destruction of environment³.

Environmental problems have become serious in many parts of the country and can no longer be neglected. These

problems in a country are affected by the level of economic development, availability of natural resources and lifestyle of the population. Poverty presents special problems for a heavily populated country with limited resources. We cannot afford to go on ignoring environmental issues as it may result in becoming more costly to society, through some problems reaching point of total disaster, claiming a heavy toll of life, productivity and quality of life in general. The growing activism of voluntary agencies, an explosion of Public Interest Litigation (PIL) and active interest shown by the courts to redress the situation, all call for a better implementation of existing laws as well as new regulations.

Urban air quality has deteriorated in all Indian cities. In particular, air pollution in our metropolitan, cities have reached intolerable levels. This reflects a combination of vehicular and industrial emissions. Vehicular pollution is related to the failure of public transport to cope with the transportation needs of the population. The root cause of the vehicular pollution is the poor pollution standards of vehicles sold in India and the extremely poor pollution standards of older vehicles on the roads. Even the rural population is not free from the ill effects of air pollution.

Rural population use substantial quantities of noncommercial fuel i.e. crop residues, animal dung or wood. Air pollutants due to bio fuels are largely released directly where the people are, inside or near homes at meal times everyday. The amount of health damage per unit of emission for pollution released indoors can be more than a thousand times greater compared to that from a smoke stalk outside a town.

Pollution of water is another growing problem in cities. Discharge of untreated sewerage and industrial effluents in water bodies including in some cases, ground water, have made water unfit for drinking and bathing. They aggravate the health of the poor who cannot afford to take defensive measures. They also affect the rich in less direct ways: fruits and vegetable are grown with

untreated water, and fish from such areas are diseased. As much as 28% of the urban population do not have organized piped water. The situation in rural areas is worse as almost all surface water sources are contaminated and unfit for consumption, by either humans or animals. In additions, deterioration of village commons, deforestation and soil degradation are other major environmental problems that affect a large part of the population directly. Finally, the loss of bio-diversity in our flora and fauna is a serious loss of national wealth. It is pointed out that 176 million hectares or 53% of the total land area in India is suffering from serious degradation. Area subject to water and wind erosion amounts to 150 million hectares. The annual soil loss from erosion is tremendous and the consequences are disastrous. There is probably no other area of India's environment that has been viciously attacked and destroyed in the late 56 years since independence than the country's forest.

It is observed that between 1951 and 2007, over 80% of forest area was lost to agriculture and another 20% was lost to river valley projects, industries, roads and communications. The process of deforestation has continued till today at the current annual rate of 1.3 to 1.5 million hectares every year. Even though current official statistics put the forest area at 67 million hectares of 22% of the total geographical area, the National Committee on Environment Planning states that no more that 12% of the country's land surface is under adequate tree cover. The progressive depletion of the country's forest wealth is literally driving the country towards ecological collapse. Increasing floods, soil erosion, heavy siltation of dams constructed at enormous cost, changes in the micro-climate, these are the consequences of deforestation. The environmental damage of mining is increased manifold when mining activity is accompanied by industrial activity. India's uncontrolled industries and badly maintained automobiles- though

relatively small in numbers are adding large amounts of pollutants to the atmosphere, triggering off a host of environmental problems. Ever since 1972, when the U.N. Conference on Environment was held in Stockholm, pointed attention has been paid to maintain ecological balance. In India, also we have a plethora of two hundred statutes passed by central and state governments with the objective of preventing or controlling pollution in various fields. However, the fact remains that environmental legislation has not been very effective and vested interests have obviated the rules there by endangering human life. Thus, it is a high time that our planners review the entire position of development and environment crisis and evolve a new process of balanced sustainable development which also preserve the environment⁴.

Scope of the Study

Harmony between man and environment is the essence of healthy life and growth. Therefore, maintenance of ecological balance and a pristine environment has been of utmost importance to human being. Environmental Management is not, as the phrase could suggest, the management of the environment as such but rather the management of humans ' interaction with and impact upon the environment. The three main issues that affect management are issues involving politics (networking), programmes (projects), and resources (i.e. money, facilities, etc). The need for environmental management can be viewed from a variety of perspectives. A more common philosophy and impetus behind environmental management is the concept of carrying capacity. Simply put, carrying capacity refers to the maximum number of organisms a particular resource can sustain. The concept of carrying capacity, while understood by many cultures

over history, has its roots in Malthusian theory. Environmental management is therefore not the conservation of the environment solely for the environment's sake, but rather the conservation of the environment for human kind's sake.

Environmental management involves the management of all components of the bio-physical environment, both living (biotic) and non-living (abiotic). This is due to the interconnected and network of relationships amongst all living species and their habitats. The environment also involves the relationships of the human environment, such as the social, cultural and economic environment with the bio-physical environment.

As with all management functions, effective management tools, standards and systems are required. An 'environmental management standard or system or protocol attempts to reduce environmental impact as measured by some objective criteria. The ISO 14001 standard is the most widely used standard for environmental risk management and is closely aligned to the European Eco Management & Audit Scheme (EMAS). As a common auditing standard, the ISO 19011 standard explains how to combine this with quality management. The UK has developed a phased standard (BS8555) that can help smaller companies move to ISO 14001 in six manageable steps.

The ISO 14000 environmental management standards exist to help organisations minimise how their operations negatively affect the environment (cause adverse changes to air, water, or land), comply with applicable laws and regulations.

ISO 14001 is the international specification for an environmental management system (EMS). It specifies requirements for establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programmes to meet objectives and targets, checking and corrective action, and management review.

ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process (the comprehensive outcome of how a product is produced) rather than to the product itself. The overall idea is to establish an organised approach to systematically reduce the impact of the environmental aspects which an organisation can control. Effective tools for the analysis of environmental aspect of an organisation and for the generation of options for improvement are provided by the concept of cleaner Production.

As with ISO 9000, certification. is performed by third-party organisations rather than being awarded by ISO directly. The ISO 19011 audit standard applies when auditing for both 9000 and 14000 compliance at once.

An Environmental Impact Assessment (EIA) is an assessment of the likely positive and/or negative influence a project may have on the environment. "Environmental Impact Assessment can be defined as : The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made.⁵" The. purpose of the assessment is to ensure that decision-makers consider environmental impacts before deciding whether to proceed with new projects.

The statement spells out the goal to be recognised as an environmentally responsive organisation. "Social and Environmental Concern" has been identified as one of the core values. A continuous proactive endeavour is made with a view to remain at a level above the requirements of the statutes and to set its own standard in expressing concern for the society at large.

An Environmental Management System (EMS) is a systematic approach to dealing with the environmental aspects of an organization. It is a 'tool' that enables an organization of

any size or type to control the impact of its activities, products or services on the natural environment. Pollution and destruction of natural resources have reached such dimensions in India that in some regions they pose an imminent risk to human health. Reasons lie on the one hand in poverty and underdevelopment, on the other hand in rapid and sometime uncontrolled industrialisation and urbanization. Urban conglomerations as well as rural areas are increasingly affected. Regarding these facts, India and Germany consider sustainable environmental development as the overall goal of a development policy. Germany is already making a considerable contribution in strengthening India's environmental management through supporting development projects related to environmental management, involving technical cooperation projects and financial cooperation projects.

Environment protection and industrial and urban environmental management are key elements of any international or national environment protection program. At the same time environment protection becomes more and more important for the Indian municipalities and industries either in order to meet high international business standards or to increase tourism or standards of living. For businesses this means increasing export opportunities. Hence, the overall aim of our activities is to assist Indian industries and municipalities to realize business and environmental benefits through adopting an environmentally friendly approach. By doing so, we aim to reinforce the efforts that India is already making by initializing activities and creating winning situations for all involved stakeholders.

Hypothesis

- The study differentiates between the regulatory, structural and consumption effects of globalization in India.

- ISO quality certification has caught up in India, so the environment-related ISO 14000 will find increasing acceptance leading to a spur in demand for hazardous waste management equipment, plant and services.
- India has 1,000 industrial estates in 11 major states: ripe situation for environmental damage.
- Environment-consciousness is gaining ascendancy thereby enhancing demand for hazardous waste management facilities.
- Environment-consciousness has been rising in India since 1989 when the government introduced Hazardous Waste (Management and Handling) Rules under the umbrella of the Environment Protection Act of 1986. The rules make it compulsory for industry to use specialised equipment and services for the storage, handling, treatment, transportation and disposal of hazardous waste.
- Pollution Control Boards, pressure from non-government organisations (NGOs) and environment activists and helping bring about stricter enforcement of pollution control rules.

Objectives of the Study

The objectives of the proposed study would be :

- To examine the environmental problems both in urban and rural India.
- To examine how India is the world's sixth largest and second fastest growing producer of greenhouse gases.
- To find out major pollution-causing industries in India.
- To highlight how Delhi, Mumbai and Chennai and three of the world's ten most polluted cities.
- To provide how Two-thirds of city dwellers lack sewerage; one-third lack potable water.

- To show how India urban population grows equivalent of another New York City every year. This equals to a projected urban population of over 500 million in 20 years.
- To focus environmental audit, its emergence, scope, objectives and applicability in a developing country like India.
- To document how the Indian government has been harmonizing domestic environmental legislation.
- To examine other effective environmental tools like Environmental Impact Assessment (EIA) and Environmental Management System (ESM) for better results of management.
- To examine the Effective implementation of environmental auditing it's helps in minimization of environmental risks at low cost.
- To explore the major usages are for land reclamation, structural land filling and road making by Government and Semi-Government Bodies.
- To explore community's role in pollution control managemet ad natural resources management.
- To analyse how the increase in urbanization and changing consumption patterns in the post-liberalization era in India have aggravated certain pollution problems.

Exploration of the Study

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Assumptions of the Study

- The study differentiates between the regulatory, structural and consumption effects of globalization in India,
- ISO quality certification has caught up in India, so the environment-related ISO14000 will find increasing

acceptance leading to a spur in demand for hazardous waste management equipment, plant and services.

- India has 1,000 industrial estates in 11 major states: ripe situation for environmental damage.
- Environment-consciousness is gaining ascendancy thereby enhancing demand for hazardous waste management facilities.
- Environment-consciousness has been rising in India since 1989 when the government introduced Hazardous Waste (Management and Handling) Rules under the umbrella of the Environment Protection Act of 1986. The rules make it compulsory for industry to use specialised equipment and services for the storage, handling, treatment, transportation and disposal of hazardous waste.
- Pollution Control Boards, pressure from non-governmental organisations (NGOs) and environment activists are helping bring about stricter enforcement of pollution control rules.

The present study of “Emerging Issues of Environmental Management in India” is both explorative and analytical. It is sought to construct, through the analysis of primary and secondary data, the history of Environmental Management⁹ in India and the reasons thereby. The documents of government policies would be analysed to find out the loopholes. Proper sampling shall be done in the concerned area to verify the extent of pollution and its protection and management.. In depth sample interviews, questionnaire and field study in India itself would provide primary data on which this whole research is based. Published works by eminent authors shall also be consulted during the research.

Methodology

The present study “Emerging Issues of Environmental Management in India” is both explorative and analytical. It is

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PLAN OF THE STUDY

The thesis has been divided into eight Chapters. Each Chapter starts with a brief introduction to the subject matter. The chapters are further divided into several sections, each with a distinct objective. An outline of the sections, presented at the beginning of each Chapter, is intended to serve as a roadmap for the reader.

The first chapter looks at the various forces that have led to changes in the environmental management, both in urban and rural India. Chapter second discusses the research methodology. Chapter three differentiates between, regulatory, structural and consumption effects of globalization in India. Chapter four focuses on environmental audit, its emergence, scope, objectives and applicability in a developing country like India. Chapter five documents how the Indian Government has been harmonizing domestic environmental legislation. Chapter six analyses how the increase in the urbanization and changing consumption patterns in the post-liberalization era in India have aggravated certain pollution problems. The seventh chapter looks at the community's role in pollution control

management and Natural Resources Management respectively. The last and eighth chapter contains some of the main findings and concluding observations. Besides, it also suggests some useful measures for environmental management.



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**Regulatory, Structural and Consumption Effects
of Globalization in India**

- Overview
- Effect of the globalization on the Environment
- Environmental Effects on Globalization
- Globalization and Global Governance
- Governance alternatives
- Moving Forward

3. Regulatory, Structural And Consumption Effects Of Globalization In India

In this chapter, we disaggregate the impact of globalization on the environment into economic, regulatory, information, and pluralization effects. We complement this structure with an analysis of how national and global environmental policies affect globalization. We then argue that there is a need for a revitalized governance regime to organize and maintain environmental cooperation at the global level. Such a global environmental mechanism (GEM) would provide a new model for collaboration, overcoming the shortcomings of existing bodies.¹ The GEM's core elements would be (1) a global information clearinghouse that provides a data and analytic foundation for environmental decision-making at the global, national, regional, and local scales, (2) a global technology clearinghouse to highlight tools and strategies for improved pollution control and natural resource management, and (3) a global environmental bargaining forum that would provide a catalyst for international negotiations. We conclude that the GEM approach with a 'light' institutional architecture that relies on global public-policy networks and modern information technologies offers great promise because of its response speed, flexibility, cost-effectiveness, and potential for broader public

participation – all leading to improved results and greater institutional legitimacy.

Globalisation has ushered in an era of contrasts – one of fast-paced change and persistent problems. It has spurred a growing degree of interdependence among economies and societies through transboundary flows of information, ideas, technologies, goods, services, capital, and people. In so doing, it has challenged the traditional capacity of national governments to regulate and control markets and activities. The rapid pace of economic integration has led to interlinked world markets and economies, requiring a degree of synchronisation of national policies across a number of issues. One dimension of this coordination concerns the environment – from shared natural resources such as fisheries and biological diversity to the potential for transboundary pollution spillovers across the land, over water, and through the air.² We now understand that governance approaches that are bounded by the traditional notion of national territorial sovereignty cannot protect us from global-scale environmental threats. An effective response to these challenges will require fresh thinking, refined strategies, and new mechanisms for international cooperation.

In this chapter, we address the relationship between globalisation and the environment, seeking to answer four key questions: (1) How does globalisation affect the environment? (2) Conversely, how does national environmental regulation affect globalisation, particularly economic integration? (3) When is a degree of international cooperation useful or even necessary? (4) What institutional structure would best manage interdependence and foster the opportunities that globalisation has the potential to provide? Globalisation can have both positive and negative environmental consequences. But the same forces can exacerbate existing environmental problems and create new ones, as well trade liberalization can generate new resources

that permit investments in environmental protection as well as faster and broader dissemination of pollution control technologies and new policy ideas. Environmental choices can likewise shape the path of globalisation. National regulatory choices may act as barriers to liberalised trade, or they may trigger a convergence towards harmonised international standards.³

The broad range of recent ‘trade and environment’ disputes at the World Trade Organization (WTO) – over beef hormones, asbestos regulation, genetically modified food, shrimp fishing, and endangered sea turtles, to name a few – highlights the dynamic complexity of these issues. For policymakers, the core challenge lies in finding an appropriate mix of competition and cooperation, market forces and intervention, and economic growth and environmental protection.

To maximize globalization’s upside potential, a fundamental reform of global governance structures in general and of the international architecture for *environmental* cooperation in particular will be required. Building greater environmental sensitivity into multilateral trade and financial institutions is necessary but insufficient. An equally broad-scale reform of the global environmental governance architecture is needed. We propose the creation of a Global Environmental Mechanism (GEM) to facilitate efforts to manage global-scale environmental risks; support bargaining and negotiation; promote sound management of the global commons; and advance dissemination of information, ‘best practices’ in policy-making, and new technologies.

EFFECTS OF GLOBALISATION ON THE ENVIRONMENT

Globalization presents a mixed blessing for the environment. It creates economic opportunities but also gives rise to new problems and tensions. By increasing the volume and decreasing the cost of information, data, and

communications, globalization also offers expanded access to knowledge, new mechanisms for participation in policymaking, and the promise of more refined and effective modes of governance. Understanding this array of effects – economic, regulatory, information, and pluralization – is essential if one is to make sense of globalization’s impact on the environment.

Economic Effects

Environmental impacts of expanded economic growth and trade can be understood in terms of scale, income, technique, and composition effects. Scale effects refer to increased pollution and natural resource depletion due to increased economic activity and greater consumption. Income or wealth effects appear when greater financial capacity results in greater investment in environmental protection and new demands for attention to environmental quality. With higher income, we observe two other, related phenomena – technique and composition effects⁴. Technique effects arise from tendencies towards cleaner production processes as wealth increases and, as trade intensifies, better access to economic base evolves towards a less-pollution intensive high-tech and services-based set of activities. The overall environmental impact of economic growth depends on the net impact of these four effects. If the income, technique, and composition effects overwhelm the negative scale effect of expanded economic activity, then the impact of growth will ultimately be positive. But in the early stages of industrialization, it may well be that environmental conditions deteriorate. The precise shape, duration, and applicability of the resulting inverted U-shaped environmental Kuznets curve has generated considerable debate.⁵ Grossman and Krueger found the critical income level at which pollution begins to diminish to be about \$5000/year per capita GDP.⁶ In trying to separate out the various environmental effects of economic growth, Antweiler, Copeland,

and Taylor found that, a 1 per cent increase in the scale of economic activity raises pollution concentrations by 0.25 to 0.50 per cent, but the accompanying increase in income drives concentrations down by 1.25-1.50 per cent via a technique effect resulting in improved conditions overall. It appears, however, that expanded trade and economic activity may worsen environmental conditions in other circumstances.

Carbon dioxide emissions do not, for instance, appear to fall at any known income level. Economic theory suggests that the free market can be expected to produce an efficient and welfare-enhancing level⁵ of resource use, production, consumption, and environmental protection if the prices of resources, goods, and services capture all of the social costs and benefits of their use. However, when private costs – which are the basis for market decisions – fail to include social costs, market failures occur, resulting in allocative inefficiency in the form of suboptimal resource use and pollution levels. Market failures are a hallmark of the environmental domain. Many critical resources such as water, timber, oil, fish, and coal tend to be underpriced. Ecosystem services such as flood prevention, water retention, carbon sequestration, and oxygen provision often go entirely unpriced. Because underpriced and unpriced resources are overexploited, economic actors are often able to ignore part or all of the environmental costs they generate. Globalisation may magnify the problem of mispriced resources and the consequent environmental harms.

Regulatory Effects

A primary goal of trade liberalisation is the reduction of barriers to market access. Thus, trade agreements often include “disciplines” on how the parties will regulate. Some environmental advocates decry this loss of regulatory sovereignty. Perhaps more importantly, freer trade promotes competition.

Increased competitive pressure may manifest itself in industry or governmental efforts to reduce pollution control compliance costs. This political dynamic could trigger a regulatory 'race to the bottom' in which jurisdictions with high environmental standards relax their regulatory regimes to avoid burdening their industries with pollution-control costs higher than those of competitors operating in low-standard jurisdictions. While there is little evidence that environmental standards are actually declining, the concern is not literally about a race to the bottom, but rather about a race toward the bottom that translates into suboptimal environmental standards, at least in some jurisdictions. Ample evidence exists to support the existence of a regulatory dynamic in which standards are set strategically with an eye on the pollution-control burdens in competing jurisdictions. The outcome may well be a 'political drag' which results in weaker environmental laws than might have otherwise been adopted and, perhaps more importantly, lax enforcement of existing rules or standards.

But, diverse national circumstances generally make uniform standards less attractive than standards tailored to local conditions and preferences.¹⁴ But not always. Divergent standards across jurisdictions may impose market access barriers on traded goods that exceed any benefits obtained by allowing each jurisdiction to maintain individualized requirements. In some cases, producers vying for access to high-standard jurisdiction will drive upward harmonization (a 'race to the top').¹⁵ But this logic applies only to product standards. Standards for production processes or methods (PPMs) are not subject to the same market pressures.

In an interdependent world, production-related externalities cannot be overlooked. Semiconductors produced using chlorofluorocarbons (CFCs), which contribute to the destruction of the ozone layer, should be treated as contraband.

Where international environmental agreements are in place, as with the Montreal Protocol regulating the use of ozone-depleting substances, a recognized standard is available. In such cases, trade rules should be interpreted to reinforce the agreed-upon standards. Recrafted trade principles and World Trade Organization (WTO) rules that accept the legitimacy of environmental controls aimed at transboundary externalities would make global-scale trade and environmental policies more mutually reinforcing and reduce the risk of the trade regime providing cover for those shirking their share of global environmental responsibilities.⁶

Information Effects

One of the key features of globalization is the expansion of communication networks across the globe. The increasing speed and decreasing cost of communication has virtually eliminated the traditional concept of distance. The Information Age has thus transformed space and time, drawing the world into networks of global communication though some parts are more tightly linked than others. This communication revolution has dramatically increased the intensity of national interdependence, fomenting a greater sense of international community and a foundation of shared values.

In turn, the incipient sense of a world community provides citizens with a basis for demanding that those with whom they trade meet certain baseline moral standards, including a commitment to environmental stewardship. As economic integration broadens and deepens, and information about one's partners becomes more readily available, what citizens feel should be encompassed within the set of baseline standards tends to grow. Increased access to data and information on economic and environmental performance allows for faster problem identification, better issue analysis, and quicker trend spotting.

It can also aid the identification of leaders and laggards in the international arena relative to various environmental or social criteria and spur competition (and thus improved performance) among nations, companies, or even communities. Information in and of itself is not, however, necessarily beneficial. Information overload could lead to a cacophony of voices in the policy realm and result in paralysis instead of action.

Such risks need to be kept in mind as the volume of internationally shared information continues to increase and appropriate devices for sifting through and filtering relevant and accurate information become necessary.

Pluralization Effects

Intensified interaction in the economic and political spheres coupled with rapidly diminishing costs of communication has increased the number and diversity of participants in global networks. This 'pluralization' is evident in the exponential growth non-governmental organizations (NGOs), their heightened levels of activity, and their increased access to the policy-making process at both the national and international levels. In 1990, there were about 6,000 international NGOs. By the year 2000, that number had reached 26,000.¹⁹ An elaborate organizational or institutional infrastructure is no longer necessary for an entity to have a global reach.⁷

With global interconnectedness on the rise, transparency, participation, and democratization have also increased, providing a broader constituency of concerned groups and individuals with access to global decision-makers. While national governments remain central to global-scale policy-making, many new actors now play a role and the governance process has become much more complex.²⁰ For example, the landmine treaty resulted from an internet-based campaign started in 1991 by several NGOs and individuals. Today, the treaty has been ratified or acceded

to by 141 countries. An NGO network, representing over 1,100 groups in over 60 countries, are now working landmines. The significance of NGOs as actors on the global stage was recognized in 1997, when the International Campaign to Ban Landmines and its coordinator, Jody Williams, received the Nobel Peace Prize.²¹ The downside of pluralization is that ability to participate in the policy process remains asymmetrical. Constituencies start out with unequal resources and the influence of special interests – which are often well financed and organized – may be magnified. Globalization by no means implies the end of politics. Quite to the contrary, power relations remain important and mechanisms for leveling the playing field become increasingly necessary.

ENVIRONMENTAL EFFECTS ON GLOBALISATION

Just as globalization will shape environmental protection efforts, so may environmental choices affect the course of globalization, particularly efforts to liberalize trade and investment flows. At one extreme, a rigid harmonization of policy approaches and regulatory standards could run roughshod over diverse environmental circumstances, resource endowments, and public preferences. At the other extreme, uncoordinated national environmental policies might become non-tariff barriers to trade that obstruct efforts to open markets. In these ways, national-level environmental policies may influence international action. Similarly, ecological realities may require policy coordination and collective action on the global scale.

National Activities with International Effects

National environmental performance may have international impacts. In an increasingly interconnected world, environmental harms, such as greenhouse gas emissions, left unattended at the local and national levels may result in global-scale problems, such as the global warming sea level rise,

increased intensity of wind storms, and changed rainfall patterns that may come to pass as a result of climate change. The failure to address such spillover of harm creates a risk for the international economic system of being weighed down by market failures. Transboundary pollution spillovers, which result in 'super externalities', are especially difficult to manage. The need to bring multiple countries together in a common response represents a much more difficult problem to address than national-scale environmental protection. As with any global public good, where costs are borne locally and benefits spread across the world, no single jurisdiction has an incentive to regulate such harms optimally. In the case of regular externalities (i.e., harms within one nation), there are many reasons why governments may not optimally regulate emissions or other harmful practices, but at least they have an incentive to do so in the face of the welfare losses of their own citizens. When harms span multiple jurisdictions or even the entire world, there is an increasing likelihood that the government whose facility is causing the negative impact will choose not to act because its own cost-benefit calculus does not justify intervention.

Tensions are also likely to occur when national-scale regulatory policies differ widely among countries that are closely integrated economically. Deeper economic integration makes countries more sensitive to the regulatory choices and social policies of their trade partners. For instance, in the 1970s, when China's trade with the United States (US) totaled less than US\$1 billion a year, few US citizens had reason to care about China's labor or environmental policies. Today, as China emerges as a major trade partner and competitor – and US-China trade had increased almost 100-fold to US\$92 billion in 2002 – these policies are subject to much greater American interest and concern. A key focus of trade policymaking thus centers on non-tariff barriers to trade and the need for a 'level' playing field in the global marketplace.

Because many domestic regulations could act as non-tariff trade barriers, trade agreements now routinely include market-access rules and disciplines that create a framework for national regulation. Public health standards, food safety requirements, emissions limits, labeling policies, and waste management and disposal rules – all national measures – may shape the flow of international trade. For example, the EU import ban on genetically modified foods has led to a 55 per cent decrease in US corn exports to Europe over the past five years and strenuous US objections to the EU treatment of GMO food.²⁵ Similarly, Venezuela objected to the discriminatory approach of the reformulated gasoline provisions of the US Clean Air Act of 1990 and won a WTO dispute settlement case restoring its access to the US gasoline market. From the ‘Tuna/Dolphin’ case²⁷ of the early 1990s to the recent ‘Shrimp/Turtle’ dispute, the number of trade-environment flash points has continued to grow. As noted earlier,

Environmentalists fear that liberalized trade might make it harder for high-standard countries to keep their stringent environmental requirements in the face of market-access demands from trade partners. The essential difficulty lies in separating legitimate environmental standards from protectionist regulations advanced under the guise of environmental protection. Few would argue, for example, that emission-control standards for cars are an unwarranted barrier to trade. However, the fear of protectionism in an environmental disguise is not unfounded and needs to be addressed, particularly if developing countries are to retain confidence in the fairness of the international trade system. The smooth functioning and efficiency of the international economic system cannot be maintained unless there are clear rules of engagement for international commerce, including environmental provisions.

Global Environmental Policies

Globalization is, in part, an ecological fact. There exist a series of environmental challenges that span multiple countries and even the globe. Polluted waters, collapsing fisheries, invasive species, and the threat of climate change are all realities that have been exacerbated by globalization. But, ecological realities also affect the pace and pattern of globalization. Scarce environmental resources, such as water, shape countries' perceptions of their independence or interdependence and consequently influence their economic and political interactions within the global community. The value that citizens around the world place on nature and biodiversity within foreign jurisdictions may spur international political pressures that limit a country's economic and regulatory choices. Protection of the shared resources of the global commons – the oceans, the atmosphere, etc. – provides a rallying point for NGOs aiming to promote worldwide collective action. Increased understanding of the interdependence of ecological systems contributes to establish a more robust global environmental regime.

Clearly, the primary responsibility for environmental protection rests with national governments and local communities. But some problems are inescapably regional or global in scope and cannot be addressed without international cooperation. Yet, incentives to pursue behavior that is individually rational but collectively suboptimal are especially strong with regard to the depletion of natural resources, which at once may be seen as belonging to everybody and nobody. It is rational for a fisherman, for example, to try to maximize his personal gain by catching as many fish as possible as quickly as possible. Collectively, however, such a strategy leads to overexploitation of the resource and a 'tragedy of the commons,' leaving the entire fishing community worse off than if it had found a cooperative arrangement to manage the fishery on a sustainable

basis. When extended to a global scale, the problem becomes even more acute and intractable in the absence of clear rules and institutions ensuring sustainable resource management. Such global-scale issues require responses aggregated beyond the level of national jurisdictions or, at the very least, coordinated national action.

While not strictly necessary, international cooperation is helpful in attacking a set of common problems encountered locally all across the globe and thus of concern to policymakers the world over. These problems – including control of air and water pollution, waste disposal, etc. – should be dealt with by local or national authorities. There is no inherent need for global-scale cooperation. But the fact that many countries face a problem in common creates an other logic for cooperation – the potential to gain from sharing data, information, and policy experiences. Comparative analysis often helps to illuminate issues and highlight best practices – policies and technologies – to be deployed in response. To the extent that a problem requires substantial scientific or technical analysis, cooperation may also generate economies of scale in data collection, analysis, and other research functions both benefiting from globalization and contributing to a deepening of interconnectedness and interdependence. and other research functions both benefiting from globalization and contributing to a deepening of interconnectedness and interdependence.

GLOBALISATION AND GLOBAL GOVERNANCE

Without effective international-scale governance, globalization may intensify environmental harms wherever national regulatory structures are inadequate. In strengthening competitive pressures across national borders, economic integration may help consumers by lowering prices, improving service, and increasing choice. But these same pressures at times

threaten to overwhelm the regulatory capacities of national governments and thus necessitate intergovernmental coordination of domestic policies and cooperative management of the global commons. As shown above, some problems are local and can best be addressed on that scale. But even in these cases, there is a clear advantage of learning from other countries and localities that have managed to address similar issues. In other cases, the problems are so inextricably international that a coordinated multi-country response is required. This response, however, must always be backed up by effective action at the national and local levels. Theory suggests that the solution to this policy dilemma lies in a structured program of collective action. But overcoming the collective-action problem is especially difficult in the international realm. There is no Leviathan or overarching authority. And while the number of beneficiaries and potential contributors to a global public good may be much larger than on the national scale, so too is the number of potential contributors to a public 'bad'. The spatial and temporal distribution of causes and effects makes it hard to identify those who fail to cooperate. Moreover, in the absence of an international authority, even if defectors were detected, there are scant means of discipline and sanction.

The problem, therefore, is one of organizing and maintaining cooperation. Absent institutional support and efforts at collective action tend to degrade towards what is called in game theory a lose-lose or Nash equilibrium. The situation must be converted from one in which decisions are made independently based on narrow self-interest to one in which actors adopt cooperative solutions serving a broader, common interest. The traditional policy prescriptions – a set of taxes or subsidies to internalize externalities – cannot be easily applied to a multi-jurisdictional context with a fragmented institutional structure. Successful intervention requires some mechanism for promoting collective action.

Fragmentation, gaps in issue coverage, and even contradictions among different treaties, organizations, and agencies with competing responsibilities have undermined effective, results-oriented action in the domain. As pointed out by Charnovitz, '[l]ike a city that does not have zoning ordinances, environmental governance spreads out in unplanned, incongruent, and inefficient ways.' A pervasive lack of data, information, and policy transparency adds to the challenge. An institutional structure is necessary that can provide: the data foundation needed for good environmental decision-making; the capacity to gauge risks, costs, benefits, and policy options comparatively; a mechanism to exert leverage on private-sector and governmental resources deployed at the international level; and means to improve results from global-scale environmental spending and programs.

Environmental and Economic Governance: Whose Reform?

While the UN Environment Program (UNEP) lies at the centre of the environmental regime, international environmental governance falls within the mandate of multiple organizations in the United Nations (UN) system. Hampered by a difficult mandate, a modest budget, and limited political support, UNEP competes with more than a dozen other UN bodies, including the Commission on Sustainable Development, the UN Development Program (UNDP), the World Meteorological Organization (WMO), and the International Oceanographic Commission on the international environmental scene. Adding to this fragmentation are the independent secretariats to numerous conventions, including the Montreal Protocol (ozone-layer protection), the Basel Convention (hazardous-waste trade), the Convention on International Trade in Endangered Species, and the Climate Change Convention, all contending for limited governmental time, attention, and resources.

The existing international environmental system has failed to deal adequately with the priorities of both developed and developing countries. The proliferation of multilateral environmental agreements has placed an increasing burden of collective obligations and responsibilities on member states. The toll on developing countries has been especially heavy as little assistance in the form of financing, technology, or policy guidance has been forthcoming. The inadequacy and dispersion of the existing financial mechanisms – scattered across the Global Environment Facility, UNDP, World Bank, and separate funds such as the Montreal Protocol Finance Mechanism – reinforces the perception of a lack of seriousness in the North about the plight of the South. Furthermore, fundamental principles of good governance such as participation, transparency, and accountability are still at issue in many of the institutions with environmental responsibilities. These procedural shortcomings undermine the legitimacy of the system as a whole.

In the absence of a functioning global environmental management system capable of addressing the growing number of international environmental issues, environmental groups have directed efforts towards the reform of international economic bodies, including the World Bank and the WTO. The WTO has been of particular interest as it has assumed responsibility for integrating the policy realms of environment and trade. Although the WTO has a Committee on Trade and Environment that has been meeting for a number of years, the WTO dialogue has been dominated by trade experts, has demonstrated little understanding of the impact of trade on environmental policy, and has almost nothing in the way of results to show for its efforts.

The role of the WTO as the principal forum for the discussion and resolution of trade and environment concerns has been contested by both the environmental community and

developing countries. Environmentalists perceive the WTO as an organization charged narrowly with the promotion of trade liberalization and argue that any attempt to mainstream environmental issues within the WTO inevitably privileges economic concerns over the environment. Free traders, on the other hand, regard the WTO as an inappropriate forum for environmental issues, which they see as burdening the trade regime. Developing countries, too, see the inclusion of environmental rules among the responsibilities of the WTO as a complication and a threat, potentially creating an excuse for protectionism and the exclusion of Southern goods from Northern markets. Nevertheless, discussion is taking place within the WTO, and pressure to 'green' the organization has resulted in a number of notable reforms. Recognition of the WTO's lack of capacity for addressing environmental issues and the undermining of its efficacy and legitimacy whenever the organization is forced to make decisions that go beyond the scope of its trade mandate and expertise have led a number of trade experts to call for the creation of a more robust environmental governance structure.⁸ The former WTO Director-General, Renato Ruggiero, and the current Director-General, Supachai Panitchpakdi, have both urged for the creation of a World Environment Organization to help focus and coordinate worldwide environmental efforts.

During the World Summit on Sustainable Development in 2002, French President Jacques Chirac called for the creation of a Global Environmental Organization that would bring greater balance to a multilateral system excessively focused on the economy. Similar calls have come from Mikhail Gorbachev, Lionel Jospin, The Economist magazine, and others.³⁹ It is becoming increasingly clear that successful reform of the trade and finance system needs to be coupled with an equally rigorous and fundamental reform of the global environmental regime.

GOVERNANCE ALTERNATIVES

Collective action in response to global environmental challenges continues to fall short of public needs and expectations as a result of the deep-seated weakness of the existing institutional architecture. The question, therefore, is not whether to revitalize the global environmental regime, but how. The integrated and interdependent nature of the current set of environmental challenges contrasts sharply with the nature of the institutions we rely upon for solutions. These institutions tend to be fragmented and poorly coordinated, with limited mandates and impenetrable decision-making processes.

Shifting from a prisoners'-dilemma world of free-riding and lose-lose outcomes to one where reciprocity is recognized and collaboration understood will require careful institutional realignment. We need an approach that acknowledges the diversity and dynamism of pollution control and natural-resource-management problems and recognizes the need for specialized responses.⁴⁰ The multi-faceted nature of the environmental challenge requires a multi-layered institutional structure that can address issues on various geographic scales⁴¹ and with a variety of policy tools.

Functions at Various Levels of Governance

We argue that there is a spectrum of global-governance responses ranging from very light to fairly robust. Amenable to a regime at the light end of the spectrum lie problems that are local in scope but can be found around the world (local water and air pollution, for example). As we move towards the more demanding side of the spectrum, regional issues such as international water-bodies pollution or regional fisheries management arise. At the most difficult end of the spectrum are issues that likely require a strong structure of global collaboration (climate change, ozone layer, ocean pollution). A number of

functions need therefore to be performed at the various levels of governance by different institutions. When dealing with global-scale problems, institutions need to possess several capacities, including the ability to identify and define problems, raise awareness about them in various forums, draft rules and create norms for behavior leading to the solution of these problems, formulate policy options, facilitate cooperative actions among governments and other actors, finance and support activities, and develop management systems. As will be elaborated below, we see an information clearinghouse, a technology clearinghouse, and a policy forum as central elements to the effective functioning of a global regime for resolution of environmental problems.

Global institutions also have an important role to play when the problems are primarily national in scale. They can serve as facilitators of information and knowledge exchange, promoting learning across contexts and among actors. The exchange of data, best practices, policies, and approaches could be an important tool in problem solving at the national level. National institutions also have roles to play, both at domestic and global levels of governance. National governments remain the primary actors charged with regulatory and enforcement powers to solve environmental problems. Functions such as standard setting, policy formulation, compliance monitoring, and evaluation are among their responsibilities. When the problems are of a global character, national governments are again key actors. Implementation of multilateral agreements is ultimately their responsibility. They also engage in information-sharing and exchange in the process of arriving at agreement on the global problems to be addressed, the policies necessary for their resolution, and the actions to be undertaken domestically.

Demands of transboundary issues requires a deft and agile structure able to hone in on the nature of problem and produce the right scale of activity while promoting worldwide

cooperation. There is no silver bullet. Various institutional and organizational designs are possible. We believe that the best strategy centers on a new environmental mechanism at the global level. Conceptually, a global environmental mechanism (GEM) would fundamentally need to focus on promoting collective action on the international scale. Practically, it offers the chance to build a coherent and integrated environmental policymaking and management framework that addresses the challenges of a shared global ecosystem.

We see three core capacities as essential: (1) provision of adequate data and information that can help to characterize the problems to be addressed, reveal preferences, and clarify reciprocity; (2) creation of a policy 'space' for environmental negotiation and bargaining; and (3) sustained support for national efforts to address issues of concern and significance. We identify data collection, monitoring, and scientific assessment as central in the information domain. A forum for issue linkages and bargaining, a mechanism for rule-making, and a dispute-settlement framework are essential to ensuring cooperative solutions. The continual development of technical, financial, human, and institutional capacities for addressing diverse challenges is another critical function requiring effective institutional mechanisms at the global level.

At present, various institutions and agencies ostensibly have many of the identified capacities. But the reality often falls short of the promise. And some are flagrantly absent. For example, a host of international organizations, scientific research centers, national governments, and environmental convention secretariats are carrying out data collection, scientific assessment, financing, and technology transfer with little coordination across jurisdictions. Compliance-monitoring and -reporting are unsystematic, scattered, and largely informal.

The participation of non-state actors requires further structural elaboration and institutionalization along with procedures for rule-making. A forum for issue linkage, bargaining, and trade-offs as well as a dispute-settlement mechanism is lacking. A more robust policy space for the environment is necessary to sustain efforts at environmental advocacy within the broader system of global governance and to ensure that environmental concerns are integrated into sustainable development policies.

Building on the expertise and capacities of existing institutions and creating new mechanisms where functions are not currently performed, we see three institutional elements as central to a successful global environmental system.

A Global Information Clearinghouse might represent a first step towards improved global environmental governance through provision of comparable data on environmental quality, trends, and risks. The coordination of existing institutional mechanisms for data collection, scientific assessment, and analysis might attract broad-based support. A Global Technology Clearinghouse, focusing on information-sharing, performance measurement and benchmarking, and dissemination of best practices, might also be launched as an early initiative with likely broad appeal. With competence established in these areas, a Global Bargaining Forum might be initiated with the capacity for rule-making and facilitation of burden-sharing. Progressive development over time, as the new system proves its capacity and value, is likely to make any governance-reform strategy more acceptable to nations reluctant to yield responsibility or control to any global entity.

Global Environmental Information Clearing-House

Better environmental data and information make it easier to identify problems and trends, evaluate risks, set priorities,

establish policy options, test solutions, and encourage technology development. A global information clearinghouse providing timely, relevant, and reliable data on environmental issues and trends could transform the policymaking process on the global scale. Better data, science, and analysis could shift assumptions, highlight preferences, and sharpen policies. In the case of acid rain in Europe, for example, knowledge of domestic acidification damage allowed for refined policies that triggered emission reductions in several countries. Simply put, data can make the invisible visible, the intangible tangible, and the complex manageable. Information on how others are doing in reducing pollution and improving resource productivity tends to stimulate competition and innovation. Comparative performance analysis across countries – similar to the national PROPER scheme in Indonesia⁴⁶ – could provide much greater transparency, reward policy leaders, and expose laggards.⁴⁷ Just as knowledge that a competitor in the market place has higher profits drives executives to redouble their efforts, evidence that others are outperforming one's country on environmental criteria can sharpen the focus on opportunities for improved performance.

The attention that the Yale-CIESIN-World Economic Forum Environmental Sustainability Index has generated demonstrates this potential. Data-gathering should primarily be the function of local or national organizations. But a central repository for such information and a mechanism for making the information publicly available could generate significant economies of scale, efficiently generate relevant comparisons, and expose slack performance. An information clearinghouse would not centralize science policy functions but create a centralized source for coordinating information flows among the institutions responsible for performing scientific aspects of policy-making.

Globalization is fuelled by and plays a central role in the diffusion of technologies. Technological advances are often the key to environmental gains. However, industrialized countries dominate the technology market and the generation of innovations. Some technologies and their environmental features may, therefore, be inappropriate for the economic and environmental circumstances of less developed countries.

Most multilateral environmental agreements contain provisions related to technology transfer as part of the incentive packages for developing countries to meet their obligations under the conventions. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Montreal Protocol on the Ozone Layer, the Convention on Biological Diversity, the Framework Convention on Climate Change and its related Kyoto Protocol all cite technology transfer as a critical method for achieving concrete environmental improvements.

Agenda 21 also underscores the importance of technology transfer to sustainable development. The existing strategies for technology transfer have, however, been less than effective. A new mechanism to bring technologies to developing countries must be part of any strategy to improve international environmental policy results. Establishing such a mechanism, however, presents a significant challenge. The empirical evidence shows that the gains from such cooperative arrangements have indeed been significant and beneficial for the environment. For example, the technology panel convened under the Montreal Protocol to report on the availability of CFC substitutes and the feasibility of larger production cuts generated new knowledge and new commercial opportunities for CFC reduction in a highly collaborative process.

Most technologies are, however, owned by private companies not governments. So some effort need to be put into

structuring incentives to motivate the private sector to disseminate technological advances optimally. An effective environmental technology clearinghouse is thus not only necessary but also possible. It could guide nations towards the use of appropriate technologies, support North-South partnerships, and provide a forum for coordinating financial assistance to developing countries. It would contain information on best practices around the world and facilitate technology development and continuous learning.⁹

Global Bargaining Forum

Successful responses to global-scale environmental problems depend on effective international agreements. To be workable, any such agreement must equitably distribute the burden of international collective action.¹⁰

Developing countries will often need support, subsidies, and other incentives to encourage their efforts to internalize externalities. In the past, issue linkage has been avoided in favor of lowest-commondenominator programs in the absence of funding to support those least well positioned to act. As Whalley and Zissimos argue, there would be great value in a forum for the facilitation of international deals on the environment that improve quality and result in positive cash flow to custodians of environmental assets. A global bargaining forum could act as a catalyst for action, facilitating financial discussion among countries or private entities. A government in one country might, for example, negotiate a deal to preserve a particular natural resource in another country in return for a sum of money or other policy benefits. Brazil might, for instance, commit to certain limits on development in the Amazon in return for guaranteed access to European and US markets for its orange juice. The forum might also provide mechanisms for verification, financial transfers, and dispute settlement.

Moving Forward

In designing a new global environmental architecture, form should follow function. We envision a 'light' institutional superstructure providing coordination through a staff comparable in size and quality to the WTO secretariat in Geneva. The secretariat's primary role would be to promote cooperation and achieve synergies across the disparate multilateral environmental agreements and other international institutions with environmental roles.

A properly designed structure would provide a counterpart as well as a counterweight to the WTO and an alternative forum for addressing tensions over divergent environmental values and approaches. The GEM we envision would neither add a new layer of international bureaucracy nor create a world government. Quite to the contrary, movement towards a GEM should entail consolidation of the existing panoply of international environmental institutions and a shift towards a more modern 'virtual' environmental regime. At the centre of our proposal lies a global public-policy network drawing in expertise from around the world on an issue-by-issue basis. By utilizing the resources of national governments, NGOs, private-sector enterprises, business and industry associations, think tanks, research centers, and academic institutions on an 'as needed' basis, the GEM would have far broader issue expertise and analytic capacity than has the existing environmental regime. Such a system for advancing international environmental agendasetting, analysis, negotiation, policy formulation, implementation, and institutional learning would be more flexible, cost-effective, fleet-footed, and innovative. The benefits of such a structure are increasingly clear.⁵⁶ Global public-policy and issue networks respond to an ever more complex international policy environment, taking advantage of Information Age communication technologies to draw in relevant expertise, analyze problems from multiple

perspectives, and build new opportunities for cooperation. Streamlining the environmental system would be especially beneficial to the South. In particular, a single venue for negotiations and international coordination would make it much easier for the overstretched environment ministries of the developing world to monitor the spectrum of environmental issues at play and to contribute thoughtfully to the global-scale debate even with a relatively small international policy-making team.⁵⁷ There would be no need to traipse around the world trying to keep up with an ever more extensive list of separate bodies and meetings. A network approach, drawing in diverse perspectives and expertise and using the Internet, could facilitate greater developing country participation in the international policy-making process.

Who will pay for global-scale environmental problem-solving stands out as a matter of particular importance to developing countries. Globalization, as noted above, puts increasing pressure on national governments to become more competitive in the global marketplace. Expending scarce financial resources for environmental protection is, therefore, often regarded as counterproductive by developing countries, especially if there is no urgent demand from domestic constituencies. By placing the principle of common but differentiated responsibilities at the centre of the new mechanism along with a real forum for bargaining and trade-offs, efforts to strike a fair balance of rights and responsibilities with regard to transboundary environmental issues might meet with increased success.

A more carefully considered and coherent set of international environmental standards would also alleviate fears in the South that the industrialized world seeks to impose unreasonably high standards – and perhaps trade penalties for noncompliance – on developing countries, all of whom have many competing demands for limited public resources. Moreover,

mechanisms to support technology transfers and to subsidize developing countries' environmental initiatives in pursuit of global environmental goals would help to alleviate North-South tensions.¹¹

A related question concerns the values to be promoted in a strengthened international environmental regime. It is essential that a GEM be seen as a transparent and inclusive forum that seeks to build consensus on a basis that respects the diversity of views across the world. Properly managed public policy networks create 'virtual public space' that is easier to enter than the established physical fora where decisions are currently made. An Information Age set of outreach mechanisms could also decrease the distance between decentralized constituencies and global decision-makers – making it easier to insert into the policy process the broad array of values, perceptions, and perspectives that are now often overlooked or incompletely considered. At the same time, these mechanisms would facilitate public understanding of the issues addressed and decisions made on the global scale.

Both economic and ecological interdependence require rigorous national policies and effective international collective action. Our increasingly globalized world makes new thinking about international environmental cooperation essential, both in its own right and to undergird further economic integration. An extraordinary mix of political idealism and pragmatism will be required to coordinate pollution control and natural-resource management policies on a worldwide basis across diverse countries and peoples, political perspectives and traditions, levels of wealth and development, beliefs and priorities.

But the gains to be achieved go beyond the environmental domain. Indeed, coordinated important set of ground rules for international commerce, serve as an essential bulwark against market failure in the international economic system, and make it more likely that globalization will yield broad benefits. It is time

to re-engineer the environmental regime, aiming for a new, forward-looking, sleeker, and more efficient architecture that will better serve environmental, governmental, public, and business needs. A new global environmental system need not compete with efforts to strengthen national pollution control and natural-resource management programs. It should, in fact, reinforce such efforts. Success in the environmental domain depends on a multi-tier governance structure supporting vibrant efforts on the local, national, and global scales.

The logic of a GEM is straightforward: a globalizing world requires thoughtful and modern ways to manage interdependence. The world community would benefit from a systematic mechanism to promote environmental cooperation in the international arena, a recognized forum for national officials and other stakeholders to debate and address global-scale issues, and an institutional mechanism designed to make economic progress and environmental protection mutually reinforcing.



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**Environmental Audit, Its Emergence,
Scope and Applicability in
a Developing Country like India**

- Overview
- Maintenance Techniques for Safety and Environmental Improvements
- Case Studies
- Its Emergence, Scope and Applicability in a Developing Country like India

4. Environmental Audit, Its Emergence, Scope And Applicability In A Developing Country Like India

In India, environment auditing practices have been started with a small beginning. Presently, it has been made mandatory for those industries who are identified as a polluting industries. But this is not the end of environment auditing in India.

“As we are committed to implement on the findings of the Earth Summit at Rio, we are spell bound to strengthen the environment auditing process, so that we may be able to take initiatives for environmental auditing to the local areas, to be conducted by the local government/authorities. Though it is done by some local authorities in a scattered way without naming that as “environmental audit”, it is necessary to be well aware, well informed and also to have systematic approach while auditing the local areas.

An environmental audit is useful in assessing which particular areas of your business impact on the environment, and to what extent. An audit is also an effective risk management tool enabling you to check how well you comply with environmental legislation.

An environmental audit assesses the nature and extent of harm to the environment caused by the activities, wastes or

noise from your business. You can use the audit as a tool to help you:

- assess how you can manage or influence the condition of the environment
- prioritise what actions you can take to reduce your impact on the environment
- demonstrate accountability to third parties such as government, customers and shareholders.

Environmental audits must be independent, objective, credible and transparent in order to be successful. Management of the modern business enterprise is not just the culmination of producing products and services to sell to the customers and make profit. Due to the intrinsic network of various stakeholders of an enterprise starting from the shareholders to the general public at large, a management has to not only look for immediate results like profitability but also take care of long term goals like customer satisfaction, public image and goodwill etc. The assiduously built reputation of a company can be destroyed by a single incident of accident in its premises. A recent example was the accident in Bhopal in the Union Carbide factory, which sullied its reputation worldwide. Similarly, Governments and the general public are demanding safeguards for environmental performance of the products and processes of a production operation. In view of these requirements, safety and environmental issues have assumed priority over many other requirements for a business enterprise.

The earlier thinking in the safety assurance of an operation system was to stress on creation of a separate safety specialization, which had been primarily made responsible for the safety of men and machines. Such attempts have often been found to be inadequate due to non-participation of the grass root level personnel of the plant. The modern concept of safety assurance tries to stress the importance of involvement of all

the people, right from the top most owner of the company to the lower most workers in the safety and environment movement of the company. Terminologies like 'Total Safety Management', 'Sustainable Development' etc are the result of such modern thinking to bring a holistic view into the subject. The analysis of the causes of many safety and environmental accidents, have invariably identified 'improper maintenance' as one of the major reasons. While simple preventive maintenance activities like inspections, timely replacements etc would be quite economical, the neglect of the same has been the reason for enormous loss of revenue running to million of rupees as a result of the accidents emanating from such causes, not to speak of the invaluable loss of precious lives. Needless to emphasize, safety and environmental issues need to be made an integral part of the maintenance management function, without which the basic objective of the maintenance function of assurance of plant availability is not complete. This unit tries to bring out the important facets of the interlinkage between safety and environmental issues and maintenance management.

There are various issues concerned with the safety and environmental performance of an enterprise. Each of these issues has also linkage with the operation and maintenance management functions. These are briefly described below:

Corporate Objectives and Goals : The top management of the organizations is expected to clearly specify the corporate objectives and goals it would like to practice in terms of environment and safety assurance. Many a times, this is done through a widely publicized policy statement. The policy and objectives of the operation and maintenance functions are expected to dovetail them into the corporate safety and environmental objectives. For example, a policy of strict environmental cleanliness in terms of carbon dioxide emission norms may mean operation and

maintenance policy practice of alternate use of clean fuels or the requirement for more frequent preventive maintenance overhauling.

Documentation of Process and Equipment : Another important requirement for the safety and environmental assurance for the company is the meticulous documentation of the vital specifications of the process and equipment in terms of their compliance to safety and environmental standards, statutory or otherwise. This documentation can be either independently prepared or integrated into the operation and maintenance manuals of the plant processes or equipment.

Risk Management : As it may not be possible to totally eliminate the risks to zero level, specifically in case of large complex process plants, it would be required to scientifically analyze the risks involved and prepare plans to mitigate them. Risk management involves use of multi disciplinary knowledge and participation to identify all possible hazards and also identify solutions to keep their risks at acceptable levels. The contribution of operation and maintenance in risk management is to contribute to the analysis process through inputs regarding various hazards of operation and maintenance processes. For example, many of the accidents in chemical process plants are due to typical maintenance operations like structure welding, catalyst change, overhauling etc. Hence the maintenance functions having intrinsic knowledge of these processes need to contribute in the process of study of these risks.

Change Management: In process plants, many of the environmental and safety failures arise from the failure to manage changes, both in the technology applications or systems. The Flixborough accident happened due to the failure to manage

properly the change required in terms of providing a bypass line to a reactor during shut down of a reactor. Hence process safety guidelines insist on well laid out procedures for change management. As maintenance activities are the most prominent examples of unknown changes, due to their unique nature each time, these requirements are mainly applicable to the maintenance function.

Human Factors: The untrained or improperly placed worker is likely to commit mistakes, which may lead to safety or environmental consequences. Apart from this, there are other human factors like attitude, ergonomics, work culture etc, which have great bearing on the safety and environmental performance. Nurturing the human factors to enable achievement of best safety results is equally applicable to all plant functions, including operation and maintenance.

Investigation of Incidents: There is requirement, statutory or otherwise, to intensely investigate incidents, so that underlying causes can be found out and corrective actions for future improvements can be prescribed. The role of operation and maintenance personnel are important in such investigations, as they have to provide the correct sequence of activities before, during and after the incident to the investigating team and also implement the suggestions emanating from such investigations.

Safety and Environmental Audits: As already explained in another unit, there is increasing tendency to integrate the safety and environment audit requirements in the maintenance audits. The audits are mainly to identify whether the existing systems, techniques and procedures comply with the stated and required standards and suggest improvements wherever required. The maintenance executive is an important team member of the

safety and environment audit team in many process plants.

MAINTENANCE TECHNIQUES FOR SAFETY AND ENVIRONMENTAL IMPROVEMENTS

The primary function of maintenance management is to ensure the availability of the plant and equipment. However, intrinsic to this requirement is the necessity to also provide maximum reliability and safety. Hence maintenance management needs to integrate their techniques to simultaneously improve safety and environmental aspects of operation and maintenance of plant and equipment. In this portion we would see what are the maintenance management techniques that can contribute in this direction.

Classification of Plant and Equipment

It is normally required for the maintenance management function to classify the equipment into various categories so that resource allocation can be facilitated according to their criticality. A factorization method is sometimes used to rank the equipment in term of their criticality. Apart from the conventional broad factors of Operational Criticality, Maintenance intensiveness, Quality of Products, it is emphasized that Safety and Environmental factor is also considered in such classifications. The sub-factors under this category could be the accident potential and severity, emission of pollutants, extent of exposure of human elements to the equipment etc.¹

Preventive and Predictive Maintenance Scheduling

Regular checklists and preventive maintenance schedules should include important safety and environmental checkpoints. Nowadays preventive maintenance is often supported by instrumentoriented measurements called Condition Monitoring. Many of these monitoring instruments can be used as dual purpose techniques, for example, measurement of thickness of reactor wall thickness using ultrasonic gauges not

only predicts wear and tear from maintenance replacement angle but also identifies potential dangerous situations of excessive material deterioration, cracks etc. Similarly, thermograph can identify both insulation wear and thermal breakdowns in high temperature reformers, furnaces etc.

Shutdown Maintenance Planning

Long shutdowns for annual turnarounds and major overhauls are important requirements of many process plants and heavier and complex equipment. Due to the tight time schedule under which such shutdown maintenance are executed, there are many possibilities of² compromises on safety and environmental features and standards. Hence the planning process of such activities needs to meticulously include the steps required to ensure safety and environmental standards.

Communication between Maintenance and other Departments

Many safety and environmental hazards have emanated from improper communication between maintenance and other departments, especially the operations department. Proper information systems like log book entries, work order systems, work permit systems, lock out systems in case of electrical hazards etc are some of the requirements to ensure communication, thus enabling safety.

Maintenance Training

All maintenance personnel working in plant facility should be trained in the basic understanding of the process and mechanical hazards. The training should include mechanical skills, theory, on-the-job / apprentice training, safe work practices training and specialized craft training. Maintenance staff often forgets after a period, thus the company often loses valuable work information. Several accidents have occurred due to such 'corporate memory lapses'. The techniques useful under such circumstances are:

- Refresher training of all staff
- Use of incident investigation in training

- Publicity campaigns on safety
- Close supervision of new staff
- Continuous updation of maintenance instructions
- Safety compliance audits
- Counseling poorly performing staff

CASE STUDIES

Case Study 1 : Piper Alpha Incident

On July, 6, 1988, a gas explosion occurred on the Piper Alpha Petroleum Production Platform in the North Sea. This explosion was followed by a fire in the adjoining production module and engulfed the entire platform. A total of 167 people lost their lives in the disaster. The investigation of the incident led to the finding that miscommunication between operations and maintenance personnel was the basic factor leading to the accident.

The Factual Description of the Incident: there were two pumps A and B for pumping gas condensate. During the day shift, pump A was operating while pump B was standby. The LPG was flowing through the piping network containing pump A. operators during the day shift noticed excessive noise emanating from pump A, so they scheduled pump A for maintenance repair services. The operators switched pump B instead and a maintenance work order was written to provide service to pump A. upon review of the maintenance records, a second work order was issued to calibrate the pressure relief valve on the pump A discharge line. During the day shift, pump A service was completed, therefore completing work order number one. However, work order number two on the adjacent relief valve was not completed because a crane was not available to help with reinstallation. The maintenance staff intended to reinstall the pressure relief valve on the discharge line of A the next day.

Shift change occurred at 6.00 PM. The new operators were of the maintenance performed on pump A, but did not understand that the pressure relief valve was not completely reinstalled. At about 10.00 PM, the pump B tripped. Having the efforts to restart pump B failed, the operators then began to switch the LPG flow to pump A but were unable to start pump A. electrical disconnects were observed, still in place following the earlier pump A maintenance, so electricians were asked to reconnect the motor.

The power was restored to pump A and the isolating valves were opened and attempts were made to start pump A. LPG escaped from the blind flange on the discharge of the pump A during these attempts. The initial indication of gas from the flammable gas detectors was immediate following the opening of the valves in pump A line. The explosion occurred when the LPG vapors contacted an ignition source. The major contributory factors to the above case were the inadequate permit to work system and shift handovers of work in progress. Procedures should have required the departing staff to make sure that the incoming shift knew about the status of all work in progress that would have eliminated the possibility of recommissioning the spare pump. Also it was found that the diesel fire pump was on manual mode, which inhibited fire fighting, and emergency drills have not been properly conducted at proper frequencies.

Case Study 2 : Breathing Air System Incident

A special system of piping was installed for compressed air to be used with breathing apparatus only. A branch was replaced, but no one appreciated why the original branch was on the top of the compressed air main. The replacement branch was installed at the bottom of the supply main. The system was used for years without any incident. Then one day a worker who was wearing a face mask while working inside the vessel, received a full blast of water that nearly drowned him. Fortunately, he

could get help and was saved. The investigation showed the compressed air main had been renewed and that the branch to the plant had been repositioned at the bottom of the supply main instead of the top. When a quantity of water entered the system, it drained into the breathing apparatus.

Key Issues in Maintenance

Management

The case explains the necessity for documented management of change procedures for maintenance actions which were not employed. Also safety knowledge are subject to loss of memory unless continuous process knowledge is documented and training imparted.

Case Study 3 : Pipe Repair Incident

A fitter was to repair a leaking joint in some pipe work carrying water on the pipe bridge. Staging was erected, but because of the difficulty of access, the process supervisor pointed out the joint to the maintenance supervisor from the ground. The maintenance supervisor, in turn, pointed it out to the fitter. The fitter opened a wrong joint in carbon monoxide line, was gassed and lost his life. The investigation of this case leads to the contributing causes that the work permit should have been properly implemented with proper safety procedures and proper tagging procedures.

Case Study 4 : Erroneous Maintenance Information Incident

Two pressure vessels, with similar identification numbers, had the same type of relief valves, but with different pressure settings. During the calibration of the one of the relief valves, the higher pressure setting, erroneously read from the maintenance files of the wrong vessel, was used. The error was not discovered until a few years later when the vessel was

damaged by unrelieved pressure. The case illustrates the problems of improper equipment identification and equipment maintenance files.

Case Study 5 : Improper Material Usage In Maintenance

In a crude production utility, a weld on a 12" pipe containing heavy hydrocarbons at high pressure and temperature was identified as close to failure. The section of the pipe was isolated and the pipe was rewelded; however, the new weld failed the post weld inspection. A decision was made to replace a section of the pipe. Because, proper materials control and an identification system was lacking, a section of pipe was fabricated from incorrect materials and installed. After the welding was completed and the weld tests were passed, the insulation was put back in place and the pipe was brought back into service. Two days later, the new section of pipe failed releasing a large quantity of flammable hydrocarbons. The ensuing vapors ignited, causing extensive property damage and seriously injuring several workers. The incident identified the improper material controls applied by the maintenance department and improper repair procedures.

In this chapter, the close correlation between safety and environmental issues and the maintenance management function has been explained. The factors that cause the safety and environmental and safety issues to be considered in importance and their relation to maintenance function were also brought out. The main management sub factors in maintenance management that can improve safety and environmental performance of plant and equipment have also been highlighted. Case studies were explained to extract the practical connotations of above factors.

Its Emergence, Scope And Applicability In A Developing Country Like India

Environmental audits are intended to quantify environmental performance and environmental position. In this way they perform an analogous function to financial audits. An environmental audit report ideally contains a statement of environmental performance and environmental position, and may also aim to define what needs to be done to sustain or improve on indicators of such performance and position.³

Environmental Auditors can get certified through written exam and acceptance of the Environmental Auditor Association code of ethics. Depending on the nature of the audit, there are several different designations to choose from. CECAB administers these designation ISO 14001 and evaluating evidence to determine whether specified environmental activities, events, conditions, management systems or information about these matters confirms with audit criteria, and communicating the results of this process to the client.⁴

Three types

Mattsson and Olsson (p. 178) say that there are three types of audit:

- 1. Liability audit
- 2. A management audit
- 3. A functional audit (sometimes called an activity or issues audit)

Liability audits assess compliance with legal obligations. Management audits verify that an Environmental Management Strategy meets its stated objectives. An activity audit may investigate a specific area such as energy or water use.⁵

An environmental audit differs from EIA which aims to predict environmental impacts, in that it is a multidisciplinary process of objectively reviewing the environmental performance

of an operating company including its processes, material storage, operating procedures and environmental management to identify potential environmental impacts and liabilities. Depending on the purpose of an audit, its aim and scope will vary. The main types of audit and their aims include:

- Phase I or contaminated land audit – to determine and define liabilities from ground and groundwater contamination on a site or within a building.
- Property transfer due diligence audit – to identify the risks and liabilities associated with a property, may include some compliance review.
- Compliance audit - to assess whether operations are undertaken in accordance with regulatory requirements and/or corporate requirements, if applicable.
- Auditing of “**Environmental management system**” (EMS) – a systematic process to check the conformance of the system with the international standard (ISO14001) or internal corporate standards and ensure continued effectiveness of an EMS.
- “**Environmental management plan**” (EMP) audit – review of the implementation of mitigation and monitoring recommendations made in the EMP. Under some circumstances the above audit types may be combined, for example a Phase I may include a compliance review. The detailed scope of the audit scope will vary according to specific objectives. In addition, more specific types of audits such as waste, wastewater and energy audits may be undertaken to assess compliance in detail or look for opportunities to reduce costs, environmental impacts and wastage. Environmental audits may be undertaken by independent environmental or specialist consultants or suitably trained internal company staff, depending on the purpose of the audit.

Depending on the scope of the audit and the nature and complexity of an industrial facility, it may take between one day and five days, perhaps longer to undertake an environmental audit. A one-day audit would essentially provide a limited baseline for future auditing or environmental improvements, whereas a longer audit could include a detailed review of current operations and environmental compliance at the site and detailed recommendations for remedial actions to resolve potential or actual environmental concerns identified.⁶

Why Auditing Beneficial

- ❖ Provides information on compliance with environmental legislation, thereby highlighting potential areas for improvement and reducing the risk of a company being accused of negligence;
- ❖ Facilitates comparison and exchange of information within and between companies, allows benchmarking between sites;
- ❖ External audits provide an independent opinion of the performance of an industrial facility and identifies areas which require attention, from either compliance or good management practice perspectives;
- ❖ Generates valuable data for regional or national state-of-environment reports;
- ❖ Can increase public awareness about a company's environmental performance and may encourage public involvement in environmental management of a company;
- ❖ Increase awareness of company management and personal about environmental issues, regulatory requirements, company policies and potential liabilities;
- ❖ Can identifies cost recovery and saving opportunities through minimisation of wastes, recycling, energy saving, reduction in use of raw materials, sale of byproducts, etc.;

- ❖ Supports and assists in fostering more open relations between the company and the authorities, by providing information about the kind of procedures adopted and company environmental performance.
- ❖ Opportunities
- ❖ Establishment of an effective environmental protection scheme for companies and local areas;
- ❖ Assistance in progressing towards achieving sustainable development both at a local level, and in the case of large international corporations, national level also.

There are a range of circumstances under which an environmental audit may be required, some of these are:

- ❖ Before a transaction takes place to reduce the likelihood of inheriting liabilities (e.g. contaminated land requiring remediation) and assess current practices at a site;
- ❖ As part of an insurance contract where are assessed the risks related with a given activity;
- ❖ In the scope of environmental adaptation contracts (compliance audits);
- ❖ As good management practice at industrial facilities, routine internal audits may be undertaken annually to assess current compliance, potential areas for improvement and to monitor implementation of recommended remedial actions;
- ❖ To identify potential opportunities for improvements in specific areas of the facility or process with a view to minimising waste (including wastewaters and energy), improving a product or for various other reasons;
- ❖ After an industrial accident, to determine the causes and liabilities, consequences for the company future management, and the environmental impact resulting from the accident;

- ❖ If a company aims to implement an environmental management system, the audit findings may help in determining future goals;
- ❖ To check whether all the elements of an EMS are implemented in accordance with the initial proposed scheme, including the identification and resolution of EMS deficiencies to ensure effectiveness of the EMS;
- ❖ As part of an initial or routine certification process for EMS certification by external accreditation body.

Generally an audit process entails several stages, including:

Scope definition

- ❖ Team establishment, including consideration of experience of previous facilities and similar processes and assignment of a lead auditor
- ❖ Audit planning, including communications with the site and preparation of an audit questionnaire
- ❖ Preliminary collection of background information on the facility and operations
- ❖ Site visit with collection or review of complementary information and documentation, discussions with site personnel, observations of current practices and review of conditions at the site and in the surrounding area
- ❖ Identification of corrective actions for areas of potential concerns
- ❖ Reporting including preparation of a corrective or remedial action plan.
- ❖ Follow-up work such as implementing corrective actions and regular audits.



Notes and References

- ¹ 1995, “*Guidelines for Safe Process Operations and Maintenance*”
– Centre for Chemical Process Safety AICE, pp-32-44
- ² Brian Rothery, 1995, “*ISO 14000 and ISO 9000*”, Gower Publications, p-5
- ³ Harrison, Lee (Ed) “*Environmental, Health and Safety Auditing Handbook*”, Second Edition, McGraw Hill, New York (1995) p-9
- ⁴ Mattsson and Olsson p.177)
- ⁵ ISO 14011, *Audit Procedures and Auditing of Environmental Management Systems*, p-78
- ⁶ European Commission : Consultation Draft : July 2000: version 1.0



Indian Government and Environmental Legislation

- Overview
- Prerogatives and Social Concerns
- Community Rights
- Ideologies of Environmental policies
- Conclusion

5. Indian Government And Environmental Legislation

The recent debates and developments with regard to the draft National Environment Policy (NEP), 2004 and the Scheduled Tribes (Recognition of Forest Rights) Bill (STB), 2005 are illustrative in different ways of the manner in which social concerns are dealt with in environmental policy and legislation in India [Lele and Menon 2005; Sarin 2005; Upadhyay 2004b].¹ Yet, while the pros and cons of specific policies and legislations have been central to the academic debates on the environment,² very little attempt has been made to trace the changes in environmental policy-making³ and the way social concerns have been problematised. Such an exercise is necessary to understand the possibilities and limits of policy pronouncements and legislative action given the current politico-economic disposition. This paper is an attempt to fill that void. By exploring the changing nature of environmental policy-making (with specific attention to natural resource management issues) since the late 1980s, I attempt to illustrate the shifts in the manner in which social concerns are addressed. These shifts are not unilinear in nature nor very obvious at times. In fact, my contention is that developments with regard to different environmental legislations and policies in particular sectors are often contradictory in

nature, sending confused signals as to the future of environmental policy itself.⁴ These different developments have been at least partly shaped by the legal character of the document, i.e., bills, acts or national policies. Nonetheless, there has been a movement towards a more neo-liberal discourse of development that emphasizes primarily good governance concerns.⁵ My specific focus with regard to social concerns is community rights to resources – a concern that is central to many of the debates on natural resource management.¹

Three arguments are put forth: (1) that while the environment has at one level assumed a non-negotiable presence in policy, social concerns are only highlighted to the extent that they are deemed not to be environmentally destructive, (2) that the discursive terrain through which social concerns are deemed harmful is overly simplistic and in need of re-examination and (3) that the changing nature of environmental discourse can only be understood within the wider shifts in development policy. Although there are many who would claim that the environment itself receives an inadequate attention in development policy,⁶ a contention that is at least partly true, I am concerned here with how emerging policies and legislations tackle social concerns given the socially constructed nature of the environment [Jeffery 1998]. This is necessarily central to imagining future possibilities linked to managing the environment for the poor instead of only imagining environmental management by the poor.

Prerogatives and Social Concerns

The environment assumed a central role in India, to a large extent, as a result of the first major international conference on the environment, namely, the United Nations Conference on the Human Environment (UNCHE) held in Stockholm in 1972. In preparation for this meeting, each member state was asked to prepare a report on the state of the environment. India set up a

committee on the human environment under the chairmanship of Pitambar Pant, a Planning Commission member. The outcome was three reports, one on the state of the environment, one on the problems of human settlement and one on the possible strategies to manage resources. Environmental goals were subsequently incorporated in the Fifth Five-Year Plan onwards. Legislations such as Wildlife Protection Act, 1972 and the Water (Prevention and Control of Pollution) Act, 1974 were passed soon after as well [Divan and Rosencranz 2001: 33]. While the discursive thrust of much of environmental policy-making in the late 1970s and early 1980s was on incorporating environmental principles in sectoral planning, something that was matched with legislative intervention, the latter part of the 1980s saw the focus shift towards sustainable development.² The importance of this shift was that the link between social and environmental concerns was more forcefully articulated. Again this was at least partly due to developments internationally. The World Commission on Environment and Development (WCED) published *Our Common Future* (the Brundtland Commission Report) in 1987, a report that highlighted the importance of both intergenerational and intra-generational equity with regard to environmental management. Equally important was the fact that the Brundtland Commission Report explicitly recognised the linkages between the rights of communities and the management of the environment [Lafferty 1998:267]. The 1988 National Forest Policy (NFP) was the first “environmental” policy document in India that explicitly recognised the linkages between environmental and social concerns in terms of community rights to natural resources [Ghate 1992: 54].

Unlike the previous forest acts that privileged revenue and commercial interests, the NFP was strikingly different. Section 4.6 of the policy highlighted the symbiotic relationship between tribals and forests and the need to involve tribal

communities in the management of forests. It also emphasised that domestic requirements of firewood, fodder and minor forest produce should be the first priority of forest management, not commercial or industrial needs. In that sense, it signalled a definite change of approach and was an indication of what was³ to possibly come. While broad-based sectoral policies outline the normative parameters in which specific government programmes should be located, in practice more immediate politicoeconomic and managerial concerns often have a bigger influence. As Sunder et al (2001: 13) highlight, a number of other factors (besides the normative thrust of the NFP) influenced the actual nature of forestry programmes soon after the NFP. The 1990 government order on joint forest management (JFM), while giving communities adjacent to reserved forests usufruct rights, was also aimed at improving the protection of forests. As Kolavalli (1995) has argued, citing a number of state-level government orders, JFM was the forest department's way to involve communities in the management of forests as it was incapable of doing it on its own. While proponents of JFM [Poffenberger and McGean 1996] often argue that it is far better than what preceded it, a number of other limits to JFM lend substance to the claim that social concerns have been imagined only in the context of "improved" environmental management [Sunder et al 2001]. First, until recently, usufruct rights were assigned mostly to degraded forest areas and thus forest protection committees (FPCs) were essentially getting access to forest produce in "degraded" tracts of land. Second, usufruct rights were assigned only to FPCs recognised by state forest departments. Third, JFM has remained a policy and has not been incorporated into the forest act. Thus, while the NFP recognised the symbiocity of forest dependent (tribal) communities with forests, rights afforded to these communities have been limited and often no more (sometimes less) than existing settlement rights. In the case of the water

sector and participatory irrigation management (PIM), the trajectory of policy pronouncements and legislative action have been different. Although mention was made in the 1987 National Water Policy (NWP) about farmers' involvement in various aspects of irrigation management and then the need for stakeholders' involvement in project-related irrigation management in the 2002 NWP, neither policy had a clear-cut mention of the specific responsibilities to be given to local communities [Iyer 2002]. On the other hand, as water is a state subject some state governments have taken legislative action to promote participatory irrigation management (PIM). In Andhra Pradesh, the Farmers' Management of Irrigation Systems Act, 1997 was passed whereas in Gujarat a government resolution was taken in 1995 [Parthasarathy 2002]. In different ways, both these statutory developments promoted water user associations (WUAs) to take over the management of distributaries (including charging for water use) in return for promises of improved supply. The story with regard to the limits of the community rights discourse, however, has been broadly similar to that of the forest sector. The PIM was meant essentially to improve irrigation efficiency and thereby decrease wastage of water by empowering the community through the formation of WUAs. The main criticism of PIM too has been that communities have not been given adequate powers in terms of involvement in the planning process and that the devolution of power to user associations has been primarily a means to an end, namely, efficient water use [Jairath 1999], and that too primarily for irrigation purposes. Little has been said about allocating rights for drinking water and other domestic purposes [Mollinga 2002: 276]. Water access for the landless furthermore is completely absent from the discourse though it has been central to the debates around water rights. Finally, as Iyer (2002) has highlighted, the fixation with irrigated agriculture has meant that the 2002 NWP has no mention about watershed development in dryland areas.

Community Rights

Biodiversity conservation offers a third interesting case in terms of how questions of decentralised community rights to natural resources have been dealt with. In 2000, the ministry of environment and forests (MoEF) actually gave an NGO Kalpavriksh, the coordinating role in preparing a national biodiversity strategy and action plan (NBSAP) in consort with a 15-member Technical and Policy Core Group [Kalpavriksh undated(a)]. The report which took three years to prepare and involved consultations with thousands of people was meant to serve as a blueprint for biodiversity conservation. The recommendations in terms of strategies and actions that emerged in 2003 were extensive and elaborate. A significant section of the report highlighted the importance of local community rights to biodiversity and the dangers that privileges corporate knowledge and private ownership (patenting). In terms of strategies, the report specified that “empowered local community institutions” should be the implementers of the plan. It would have resource management where communities were given rights to resources was on the anvil [Kothari 2004]. However, before the NBSAP was completed in 2003, the National Biodiversity Act, 2002 was passed. Although one of the explicit objectives of the act was the recognition of local rights to biodiversity, critical no doubt in the context of developments around intellectual property rights (IPRs), the act has been justifiably criticized for vesting most power with national and state biodiversity boards as had been the case with the Biodiversity Bill 2000 [Srinivas 2000; Kalpravriksh undated(b)]. Moreover, as others have already pointed out, the act is aimed primarily at addressing the concerns of industry [Srinivas 2000]. Although the National Biodiversity Act, 2002, does recognise the need for local biodiversity committees (BMCs), the actual powers given to these committees again are mostly managerial in nature. Under Section 41, these

committees are constituted for “promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity” [NBA 2004: 20]. What remains missing is any serious consideration of what the entitlements and rights of these committees are. These three cases have a number of things in common. First, different policies, programmes and laws within particular sectors are often not in consonance with each other in the headway by recognising tribal rights to lands of their normative position vis-à-vis community rights. For example, while the NFP has made some forest produce, JFM as a programme has actually given limited usufruct rights to only those who are part of FPCs. Moreover, the Forest Act has remained unamended with no room for community-based forest management except in the context of village forests.

In the case of water, some states have enacted laws supporting PIM while the centre’s policy document says little about it except in the context of “projects” The most striking example, however, is that of biodiversity where the Economic and Political Weekly January 21, 2006 state asks an NGO to coordinate a technical group meant to prepare a strategic action plan and then deems the report to be unscientific – largely no doubt because the NBSAP poses difficulties for the Biodiversity Act. Second, the nature of rights “given” to communities clearly privilege managerial concerns foremost. Whether it be usufruct right to forest produce to entice communities to manage forests better, WUAs to improve efficiency of water use or biodiversity committees to generate local knowledge about biodiversity, the main aim is to help manage, regenerate or make more efficient the use of natural resources. Rights are at best subsumed in that discourse. Third, rights to resources are not envisaged as

part of a broader strategy of livelihood enhancement that addresses critical concerns that plague rural India, namely, that of unsustainable livelihoods and high levels of underemployment. Ironically perhaps, when legislative steps are taken to address these above-mentioned concerns, they are derailed. In 1996, the Panchayat (Extension to Scheduled Areas) Act (PESA) was passed [Mukul 1997]. This act effectively gave tribal communities and tribal gram sabhas the power to oversee development within their jurisdiction and to act as a watchdog over possible government projects. Not only were gram sabhas given the power to preserve local culture and traditions, but also the power to prevent land alienation, and most importantly, the ownership over certain natural resources such as minor water bodies and minor forest produce. The STB similarly would empower tribal households considerably by giving them the ownership rights over cultivated lands that jurisdictionally are under the forest department. Seen together, they would go some way at least to address the concerns of tribal communities. But while PESA has either not been passed by state governments or not implemented by others [Upadhyay 2004a], the STB is being opposed tooth and nail in the name of the environment. With this background in mind, what is the future of community rights in terms of policy specifically? Developments with regard to the draft NEP gives us some indication. The draft NEP, India's first national environmental policy, which should set the vision for the future has decentralisation, equity in access and participation as central principles. Mention is also made of universalising JFM, people's participation in conservation and community reserves and the need to recognise traditional rights of forest-dwelling tribes. However, few details are given with regard to how these principles are going to be operationalised, criticisms of existing policies such as JFM have not been taken aboard and no mention is made to PESA at all. Given the current

state of most decentralisation co-management initiatives and the dilly-dallying approach to more progressive legislations, the future does not appear overly optimistic. The resolution of the controversy over the STB will give some indication whether this pessimism is warranted or misplaced.

Ideologies of Environmental Policies

How do we make sense of the manner in which policy is being formulated, at times diluted, finally framed and acted upon? It would be too simple to just argue that social concerns are completely marginalised. While it is true that some policies such as protected area policies are almost totally exclusionary to the extent that communities have been forced out or “rehabilitated” outside the protected areas, the above discussion suggests that a number of steps have been taken to seriously address community rights even if they are inadequate or remain unimplemented. Rather, a more nuanced analysis is required. First of all, how the social content of environmental policy is operationalised is partly at least linked to the “legality” of the policy, i e, whether it is a national policy, a bill or a law. While policies are meant to chart out a vision for the future, they are more prone to be watered down either at the stage of writing the policy or in the implementation of the policy, most likely because it is written by bureaucrats and does not enter the arena of “democratic politics”. In that sense, policies are most likely to be affected by wider development discourses that nation states such as India find themselves embracing. Bills and acts, on the other hand, as they are debated in Parliament appear to be more inclusive as politicians representing different constituencies have a better chance to influence its shape. Even bills and acts, however, are no guarantee that the law will be enforced. The watering down of the Biodiversity Act 2002 (given its own

limitations) in the biodiversity rules is an example of this [Kalpravriksh undated(b)]. Moreover, the PESA Act is illustrative of how individual states can sabotage well intended acts [Upadhyay 2004a]. Much more scholarship is required to disentangle the legal differences between policies, bills and acts and the manner in which the “legal character” of the policy influences its outcomes. One cannot escape, however, from the fact that all policies are being written, passed and acted upon in the context of a climate of neo-liberal development. Whereas the NFP 1988, drafted before the main onset of neo-liberal ideology, shifted the terms of discourse towards people’s rights and village needs, the NWP, 2002 and draft NEP, 2004, are clearly embedded in an ideology that sees a communitybased management of resources as a means towards good governance and marketbased economic instruments (valuation, tradeable permits, polluter pays principle) as a tool to internalise externalities and a means towards future sustainable growth. In the process, the state has clearly positioned itself in favour of certain actors at the expense of others. Though there is a line of argument that suggests the state’s positioning is based on the valid concern that giving full ownership rights to communities is a recipe for the large-scale environmental degradation, the alternatives remain unclear. At present, most co-management strategies have not been successful exactly because the questions of tenure and rights have not been adequately grappled with. A more substantive rights package (if not full ownership) would not be tantamount to open access degradation as existing legislation guarantees that such rights must not be at the expense of sustainable use of resources. Furthermore, it is somewhat ironic that while the state is reluctant to give substantial rights to communities, the corporate sector is playing an ever more important role in the management of degraded wastelands and land reform legislations reworked to enable such processes [Nair 1996; Pandian 1996]. Another

example of this ideological bias is the Biodiversity Act, 2002, which is much more friendly to industry than it is to local communities [Kalpravriksh undated(b)]. The draft NEP explicitly states that environmental legislation should not be at the expense of investments. There are a number of worrying dimensions to these developments. First, the “mainstreaming” of community-based natural resource management in the form of co-management partnerships has located the discourse of rights almost exclusively and consequently marginalised other normative concerns of equity and justice that rights discourses should address. Although managerial questions are no doubt important given concerns, for example, of biodiversity conservation and efficient water use, these must be considered in the context of enhancing rural livelihoods. By tying rights to good management, the latter concern is likely to be inadequately addressed. As worrying is the fact that in the meantime legislations are being watered down and reworked to open up for investment from the private sector. Second, the movement towards a market-based ideology of environmental management is filled with dangers. What is worrying about this ideology is not the use of market-based instruments per se nor necessarily addressing corporate concerns but the context in which these developments are happening. Market-based instruments are only a tool (replete with methodological challenges) to address environmental concerns – they need to be situated in a framework that prioritise (or rank) different group (or individual) interests. In other words, it is one thing to “value” water to reflect its “true” price but quite another thing as to who should have priority to that water. Such concerns need more attention but policy documents are relatively silent on these concerns or stated priorities are not followed up. To make things worse, reference to the increasing role of the private sector, etc, suggests what these priorities might be in the future [Lele and Menon 2005]. A third

major concern linked to the above is with the analysis in many policy documents. By focusing so much on economic instruments, one gets the impression that solving what the draft NEP calls the “deeper” causes of environmental degradation will adequately internalise environmental priorities. However, institutional or market failures, are often the result of political economy prerogatives as much as they are about market or institutional failures. India’s forests were degraded over time less because they did not have market values and more because development priorities privileged commercial and industrial concerns. Similarly, as important as creating WUAs for irrigation management is charting out the priorities for the water sector. One is increasingly witnessing cases where private sector companies are exploiting water resources while adjacent communities are water starved. This does not bode well for meeting the needs of rural communities.

Conclusion

The above narrative suggests at one level that however well-intended policies and laws are, they get diluted in course of time – largely because of other developmental priorities. These priorities themselves have changed in the last 15 years or so with a movement towards a neo-liberal regime. Moreover, talk about decentralised natural resource management and community-based management initiatives need to be taken with a pinch of salt as these are loaded terms that often lack substance in practice. The moot point then is what does the future hold in terms of environmental policy. If the past is anything to go by, the likelihood is that social concerns will continue to play second fiddle to the management of the environment. Yet, legal and policy spaces will continue to emerge through which proponents of an alternative vision of environmental management and development will launch their struggles. Such struggles must

engage more deliberately with existing neo-liberal discourses of good governance and the market instead of shy away from them.

Land is a component of environment. Topsoil of the land is an important input for agricultural operations. It is said that it takes about 400 to 1000 years to form one inch of topsoil. Loss of topsoil due to degradation of land due to natural causes such as wind and floods are well known. Apart from natural causes large scale developmental activities also cause loss of topsoil. Some of the major activities, which result in loss of topsoil, include the manufacture of clay bricks and construction of road embankments. For a country like India which has to feed one billion people, the loss of topsoil or conversion of agricultural land to non agricultural purpose are matters of serious concern. This has long term implications for sustaining our agricultural productivity. Keeping this in view the Ministry of Environment and Forests enacted a legislation whose primary aim is to conserve the topsoil, which *inter alia* incorporate a clause on prevention of disposal of fly ash on land.

A legislation to protect the environment entitled Environment (Protection) Act, was enacted by Government of India in 1986. The Section 3 of the Environment (Protection) Act states “Subject to the provisions of this Act, the Central Government shall have the power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.”

The GDP growth rate is expected to increase during the 11th (2007-2012) and 12th (2012- 2017) Five Year Plan and there will be large scale construction activities and infrastructure development. It means more and more land will be utilised for purpose other than agriculture or other food crops requirements. This requires huge land area, which is scarce. So, there is an urgent need to harmonise our development activities with the environmental concerns.

India is the home to almost every type of habitat - ranging from snow clad peaks of the Himalayas to the hot Rann of Kutch, from the Deserts of Rajasthan to the Tropical evergreen forests of Kerala. The vast landmass of 329 million hectares of the country and its water bodies sustain an extremely rich variety of flora and fauna, comprising over 47 thousand plant species and 81 thousand animals species, contributing to the rich biological diversity of the country. In recent years we seem to have lost touch with our glorious tradition and wisdom of protecting nature. Development based on exploitation of natural resources, industrial technology based on old models, the pressure of population and conspicuous consumption causing excessive demand on resources, have all taken a heavy toll of the environment.

For developing countries like India, managing the environment is not the only challenge. But the more challenging task is to strike the right balance between the demands of development and the imperatives of environmental management. It calls for reassuring sustainable development, which is a development process in harmony with environmental considerations. Sustainable development provides a framework for the complete integration of environmental management and developmental strategies and also lays down the path for conserving and promoting social and economic well - being in a democratic form. Environmental management encompasses environmental planning, protection, monitoring, assessment, research, education, conservation and sustainable use of resources and is now accepted as a major guiding factor for national development in our country.

However, it is to emphasize one point here that environmental management is not the sole responsibility of a single agency of Government and not even within the exclusive capability of the Government machinery as a whole. These issues

of environment management cannot be resolved without the wide-spread participation of the people. Therefore, Environment Education is the single most important factor that can influence and change the attitude and behavior of human beings.

Recognizing the importance of awareness creation, Government of India has been endeavoring to reach out to the masses through a National Environment Awareness Campaign (NEAC) every year, during the past one and a half-decade. Our school education system has infused environmental concepts in several subjects of studies in a substantial measure.¹ But it feels that the solutions to these complex problems will not come from awareness and legal measures alone. Solutions have to be relentlessly sought after by the collective churning of our minds.



Notes and References

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**Urbanization and Changing Consumption Patterns
in the Post Liberalization era and
Pollution Problems**

- Overview
- Sustainable Cities
- Complexity of Environmental Problems
- Pollutants to Air, Soil and Water
- Health Problems
- Housing and Homelessness
- Poverty

6. Urbanization and Changing consumption patterns in the post-liberalization era and Pollution problems.

As world populations have expanded over the past fifty years, there has also been a drift of people out of the city centers and countryside into the suburbs. This outward expansion of cities is called urbanization.

To meet the demand for more suburbs, industrial production has grown fifty times over the last century, 80% of it since 1950. This has resulted in vast amounts of raw materials being taken from the forests, earth and waters. Polluting industries are growing rapidly in the developing world as they rush to catch up with consumerism in the developed world. Cities around the world are sprawling, bursting at the seams with people, houses, cars and factories.¹

Concrete is replacing forests and wetlands, smog is replacing clean air, traffic noise is replacing peace, and housing is replacing agricultural land. As cities grow, ecosystems are lost. The systems that sustain life adapt or are destroyed. People and their domestic animals compete with wildlife for space.

Rapid population growth and limited land put a lot of pressure on politicians and planners to allow unlimited outward expansion of our cities. We must stabilize our population at a sustainable level. We must build cities for people by integrating

nature into their design, and we must increase the population density in cities to prevent urban sprawl. Higher density and nature appear to be contradictory forces but a balance is required between humans and nature if humans and the environment are to survive.²

Today, worldwide urbanisation seems to be inevitable and according to predictions, by the year 2025 at least 2/3 of the world's population will live in cities. Most of this urban growth is taking place in the developing world where 2 billion people already live in cities. In this context, it is easy to imagine the critical consequences of escalating urbanisation on urban planning and on the management of urban services.

Urban management requires numerous competencies and the mayors, chairpersons or councilors need extraordinary skills and knowledge to execute their municipal responsibilities. They are required to be professional city managers in order to establish competitive cities and to play an active role in accomplishing the Millennium Development Goals (MDGs), fighting against poverty, HIV / AIDS as well as other related challenges. Many city leaders are making efforts to gain knowledge and information to that end but opportunities are limited.

People have been moving from the countryside to the city for at least 9,000 years, but this key population trend has now become one of the most visible and profound forces on Earth: 2008 is the first year in which more than half of us have become city dwellers. The process of becoming a mainly urban species has accelerated during the past century and has now concentrated nearly three-and-a-half billion people on less than 3 percent of the planet's land surface. These monumental agglomerations of people, buildings, factories, roads, and vehicles-along with their associated social systems-have manifold and powerful environmental impacts, as well as effects on fertility and population growth rates, that we are only beginning to understand.

The urbanization trend is global, but rates of urbanization have varied significantly by country and region. The world's more developed countries (as classified by the United Nations) were predominantly urban by the 1950s, but the group of less developed countries is not projected to reach this point until 2019, with some important regional and country variations.³

Between 2007 and 2050, the UN projects that global population will increase by 2.5 billion (from 6.7 to 9.2 billion), while the global urban population will nearly double (from 3.3 billion to 6.4 billion), absorbing all increased population growth as well as inflows from rural areas. This enormous increase in the global urban population will be greater than the current populations of China, India, the United States, Indonesia, and Mexico combined. Further, this increase will be concentrated in the developing world, particularly in Asia and Africa. While developing countries will continue to be predominantly rural for some years to come, they are already home to over 70 percent of the global urban population, a proportion that will increase in the coming decades to over 80 percent by 2050. In contrast, the urban population of the highly urbanized developed countries represents less than 30 percent of global total, and its share will drop to less than 20 percent by 2050.

The Urbanization and Environment Program (UEP) conducts policy research on the relationships between urbanization, development and environmental sustainability. The aim is to provide management guidelines for innovative, cultural and technological solutions. UEP embraces a multi-disciplinary and multi-stakeholder participatory approach in addressing urban environmental challenges to achieve livable and sustainable cities. The management of the process of change, its impacts and the identifying of pragmatic options for improving the quality of urban life are key issues within the projects of UEP.⁴ The far reaching objectives of the Program ranges from

recommending policy options for the National Economic and Social Development Plan of Thailand, to working alongside local communities in building sustainable capabilities and in encouraging public participation and environmental governance.

One of the main current activities of the UEP is the participation in The Access Initiative. The Access Initiative relates to Principle 10 of the Rio Declaration and highlights three important elements for meaningful public participation: 1) access to information about the environment, 2) participation in decision-making affecting the environment, and 3) access to justice and remedy in environmental decision-making.

UEP is concentrating on four major areas of project implementation: sustainable cities , environmental planning , environmental governance and public participation , and the state of the environment .

Growing cities inflict profound changes on their local environments. The most well-documented change is the urban heat-island effect, which results in cities tending to have higher air and surface temperatures than their rural surroundings, especially at night. City size, land cover patterns (increased area covered with buildings, roads, and other surfaces impervious to water, and reduced area covered by vegetation and water), and the canyon-like heat-trapping capabilities of high-rise buildings all contribute to the formation of heat-island effects. These effects have impacts on water resources, biodiversity, air flow and quality, and ecosystem functioning, all of which can cause formation of some and promote dispersion of pollutants.

Urbanization also alters the circulation and conservation of water. Throughout history, cities have been constructed along rivers, deltas, and coastlines, which provide water sources, transportation routes, and power.⁵ These water sources have been modified to meet urban needs, often at the expense of local aquatic ecosystems, which help protect from natural disasters.

In India and Sri Lanka, for example, depleted mangrove forests left coastal communities vulnerable to the 2005 tsunami, while communities where those ecosystems remained intact fared much better.

Concentration of transportation and industry in urban areas also modifies biogeochemical cycles, or the flow of chemical elements and compounds. Cities concentrate sources of [CO₂] and other greenhouse gases and pollutants, which influence neighboring ecosystems. In the natural environment, accumulated air pollutants are removed as rainwater washes the air and then filters into the groundwater table, but in urban areas the pollutants run off the impervious surfaces and wash directly into rivers, streams, and oceans. The preponderance of cities along rivers and coastlines makes urban areas important contributors to the eutrophication (increase in chemical nutrients) of water bodies, which can reduce water quality and damage marine ecosystems.

Urbanization also fragments natural spaces and threatens biodiversity, as expanding cities exert pressure on ecosystems on the fringe of urban areas. However, rural-to-rural migration, including movement to remote areas, forest frontiers, and coastal areas with greater land and resource availability, is often more harmful to biodiversity

The growth rates of many cities in developing countries stress the ability of local governments to enforce environmental protections and cope with increased demands on related infrastructure. Most developing countries undergoing rapid urbanization do not have the resources to detect many modern chemicals or to establish facilities to treat hazardous wastes. In those cities, stormwater infrastructures often do not separate storm runoff from wastewater discharges, creating acute pollution problems in recipient waterways. Many cities have inadequate waste management policies and practices, even though solid-

waste management accounts for 20 to 50 percent of local government spending in developing countries.

Informal settlements and slums (which house over 1 billion of the world's urban dwellers) are often unconnected to even basic sanitation systems; in some African cities over 90 percent of the urban population lives in such areas. Rivers and canals in developing country cities often function as large open sewers. Sixty percent of rivers flowing through Chinese cities, for example, do not meet minimum drinking-water standards.

Air pollution from vehicles, industry, and households often exceeds the natural environment's ability to cope with it. Although automotive lead emissions have declined sharply in most developed countries, they are generally rising in developing countries, particularly in the very largest cities of some Asian countries that use leaded gasoline and have no plans to phase it out. Moreover, emissions of automotive sulfur dioxide, particulate matter, and lead are likely to be significantly higher in the future because of increasing car ownership in many cities—enabled by the introduction of cheap cars such as the Indian automaker Tata Motors' "Nano," whose US\$2,500 price tag makes it affordable to the country's growing middle class—as well as the more extensive use of diesel-powered vehicles and poor quality automotive fuel.

While urbanization is often blamed for environmental harm, cities offer many potential benefits, including some that can be environmentally benign or helpful. In much of the world, and in all countries that have attained high income levels, urbanization and economic growth have gone hand in hand. Technical innovation, access to information, efficient land and energy use, better living conditions, provision of clean water, and access to health care services can result from cities with good governance decentralized to the local level, and adequate funding for urban planning and infrastructure can lead to better quality

of life for residents and reduced damage to the environment. Increasing economies of scale resulting from urbanization can reduce per-capita natural resource consumption compared with rural areas and smaller towns or cities. In New York, for example, per-capita greenhouse gas emissions are now just one-third of the U.S. average (see sidebar, “Sustainable Cities,” for more information about making urban areas more environmentally benign).

Sustainable Cities

There are many examples of cities actively and successfully working to minimize their environmental impact. In the United States, actions to safeguard the environment at the city level in many metropolitan areas have outpaced leadership at the federal level. For example, 850 mayors have signed on to the U.S. Conference of Mayors Climate Protection Agreement, through which they pledge to attempt to meet Kyoto Protocol targets in their communities. These trends are even more pronounced in many European cities, where public transportation and alternative energy sources are even more common. And the trends toward environmentally friendly cities are not seen in the developed world alone; China is attempting to build the world’s first carbon-neutral city, Dongtan, on the outskirts of Shanghai. Work will begin this year and more eco-cities are planned in a country that already has 15 of the world’s 100 fastest growing cities. Dongtan will protect wildlife through such measures as migratory bird refuges and reduce energy use through high-density and energy-efficient housing, as well as implement systems for gray water reuse, recycling, and restrictions on cars.

Nor are environmentally friendly cities in low and middle income countries only a thing of the future. In the 1970s, planners in the Brazilian city of Curitiba developed an innovative bus rapid transit system (BRT) that proved able to move large numbers of

passengers quickly through the city at a fraction of the cost of a subway system. The bus line, with dedicated bus lanes throughout the complex route, eased congestion, reduced pollution, and encouraged ridership. Bogota, Colombia, has adopted the system successfully (naming theirs Transmilenio to combat the stigma associated with bus ridership) and even surpassed Curitiba's BRT in terms of speed and passenger capacity. Bogota has also implemented other transport reforms, including over 300 kilometers, of bike lanes in the city and building and improving sidewalks, which have resulted in fewer traffic accidents and more bike and pedestrian traffic.

In addition, the city has created or renovated 1,200 parks, planted over 100,000 trees, and involved communities in improvements in their neighborhoods. Bogota's charismatic former mayor, Enrique Penalosa, states, "In a city, parks are as essential to the physical and emotional health of a city as the water supply." By using public funds for parks and bike paths instead of costly infrastructure for cars, the city not only reduced congestion and pollution but explicitly affirmed the equality of its citizens in public spaces despite the economic differences that allow some to drive to work while others walk. Bogota still has many challenges to overcome, most notably poverty and informal settlements that expand faster than the government's ability to provide infrastructure. However, it has made significant steps toward improving the lives of its residents with relatively low-cost solutions, while relieving pressure on the environment—a trend taking shape in many cities around the world.

However, the relationship between urbanization and the environment is complex. Some economists argue that it changes over time: a growing economy, which often accompanies urbanization, leads to increased consumption and waste emissions. But when a certain level of wealth is achieved, waste emissions tend to decline. The formal statement of this theory is

called the environmental Kuznets curve, a bell-shaped curve that shows waste emission and pollution increasing with income in the early stages of industrialization and urbanization, but declining after reaching a certain threshold due to more efficient resource use and improved waste treatment. This theory has held for water pollution and some air pollutants (such as sulfur dioxide and soot), which directly affect local urban environments. However, the relationship becomes less clear when the impacts, such as biodiversity loss and global climate change, occur beyond local areas.

The environmental Kuznets curve phenomenon does play out in one study of urbanization and energy use in 237 countries between 1980 and 2005. After controlling for the income level of the countries, the analysis of relationships among urbanization, energy consumption, and carbon emissions showed that countries with higher levels of urbanization⁶ (as observed in virtually all high- and middle-income countries) have economies with high energy intensity (energy consumed to produce a unit of GDP). However, these countries emit less carbon per unit of energy used (termed carbon intensity). This occurs even though this group includes nearly all the world's highest emitters. Economies of scale, technological advances in energy efficiency, and the adoption of cleaner fossil-fuel and alternative energy sources mitigate these nations' emissions, although their contributions remain immense. On the other hand, rapidly urbanizing countries (including many low income countries, particularly in Africa and Asia) have less energy-intensive economies but emit more carbon for each unit of energy they consume. In effect, they are using "dirtier" energy, including burning coal and biomass.

The declines in fertility and slowed population growth associated with urbanization also have a complex relationship with the environment and emissions. In gross terms, fewer people

mean fewer carbon emitters, and potentially less greenhouse gases in the atmosphere. However, per-capita carbon emissions vary widely across and within countries. A comparison of future population growth in India under different scenarios of urbanization found that by 2050 total population will be 20 percent less under a medium urbanization scenario (assuming a population that is 45 percent urban) than under a low urbanization scenario (which assumes a population that is 35 percent urban). However, higher consumption of fossil fuels in India will produce 25 percent more carbon dioxide emissions under the more urbanized scenario by year 2100.

These results do not mean that developing countries should reduce energy consumption. In India, a large percentage of the population still lives in severe energy poverty (83 percent of the urban population and only 49 percent of the rural population have access to electricity), which slows advances in economic and human development. Rather, the studies demonstrate the imperative of providing modern, clean, and affordable energy resources to meet India's and the rest of the world's growing demands.

Urbanization is an inevitable, ongoing, and accelerating process, and almost all future population growth will occur in developing countries. Without significant and equitable economic growth to keep pace, the rapid urbanization of future populations will mean the urbanization of poverty—in that larger numbers and a larger percentage of the world's poor will live in urban areas—with cities in low-income countries increasingly afflicted with social and environmental ills. The relationships among urbanization, population growth, consumption, and environmental change are complex, and urbanization has both negative and positive aspects and consequences. ⁷Developed, largely urbanized countries are in a better position to achieve low carbon intensity by adopting new energy technologies, but

some still lack the political will to do so, even as the impacts of climate change begin to unfold. On the other hand, developing countries with relatively high urban growth rates will increase their carbon emissions through increasing energy use, which will boost their economies and improve standards of living, and will also contribute to global greenhouse gas emissions. This raises difficult ethical questions of equity in emissions between rich and poor countries, at a time when it is urgent to drastically reduce global emissions. It also highlights the importance of transferring cleaner and more efficient technologies without hindering development.

Since the advent of industrial and technological revolutions, economic indicators have been considered as the principal criteria for measuring progress. The industrial and technological progress however, has been accompanied by a growing negative impact on the environment in terms of its pollution and degradation. Industrialisation carries with it the seeds of environmental damage, assisted and abetted by both needs and greed of man.

Activities such as manufacturing, processing, transportation and consumption not only deplete the stock of natural resources but also add stress to the environmental system by accumulating the stock of wastes.

The productivity of the industries, however, depends on the supply and quality of natural and environmental resources. While water, soil, air, forest and fishery resources are productive assets, the pollution of water, air, atmosphere and noise are the by-products of economic development, particularly industrialisation and urbanisation. “Green house effects”, “global warming” and “acid precipitation” are cases in point. Pollution is an “external cost” (sometimes called a “spill-over cost” or a “neighbourhood cost”). Untreated or improperly treated waste becomes pollution, increasing not only private costs but also social costs.

Environmental degradation often tends to become irreversible and imposes damaging costs on the economy resulting in output and human losses, loss of labour productivity from ill- health and loss of crop output. The ecological and social costs of such unrestrained pollution and degradation have put a big question mark on the perceived notion of industrialisation as a way of economic development. ⁸

Industrialisation is on the increase, which of course is necessary for the progress of human civilization but so is the environmental pollution due to emissions and waste generated from these industries. The industrial pollution due to its nature has the potential to cause irreversible reactions in the environment and hence is posing a major threat to our very existence. Since the carrying capacity of the environment is not unlimited and some areas or ecosystems are more susceptible to adverse environmental impacts than others, unplanned and haphazard industrialisation has substantially increased the risk to the environment.

A number of studies have shown that air and water pollution are taking a heavy toll of human life, particularly, in the developing countries through ill-health and premature mortality. Pollution control, thus, assumes greater significance in the context of ensuring sustainable development through planned industrialisation.

The environmental pollution and ecological degradation because of unplanned industrialisation first became issues of international concerns in the 1970s when it was recognised that mass production by industry and mass consumption by society are depleting the resources and are generating huge amounts of solid waste and hazardous substances. The environmental challenges and the natural resources management were first focused in 1972 at the United Nations Human Environment Conference at Stockholm. Since then, a much greater awareness

has been created not only amongst the developed countries but also the developing ones with regard to the environmental issues. A number of international committees were formed at different levels to address the environmental issues and cope up with the fast development.⁹

The World Commission on Environment & Development issued a report titled “Our Common Future” and appealed for the application of principles of sustainable development in 1987, the Inter Governmental Panel on Climate Change, (IPCC) was organised jointly by the United Nations Environmental Programme (UNEP) and World Meteorological Organisation (WMO) with support from the G-7 nations in 1989.

The catastrophic social and economic consequences of global climate change by the end of 21st century were described in the first report of IPCC in 1990. As a result, the United Nations Conference on Earth & Development (Earth Summit) was held in Rio de Janeiro in 1992 where more than 180 nations participated. The Rio Declaration, Agenda 21, Framework Convention on Climate Change, Biodiversity Convention, and Forest Declaration were signed in a historic effort to cope with the global problem of the 21st century.

In the central Agenda 21, the concept of “Green Productivity” is a holistic evolutionary outcome of traditional principles and practices of productivity during the past half a century. It is seen as a key to achieving sustainable development at local, national and international levels. “Green Productivity” signifies a new paradigm of socio-economic development aimed at the pursuit of economic and productivity growth while protecting the environment. To combat the adverse effect of Industrialisation on the environment, India has initiated some major activities, a few of which are:

- Policy initiatives to improve environment like the National Conservation Strategy and Policy Statement for

Environment & Development, 1992, Policy Statement for Abatement of Pollution, 1992 and National Forest Policy, 1988

- Notification and implementation of emission and effluent standards for air, water and noise levels. Standards are formulated by a multidisciplinary group keeping in view the international standards, existing technologies and impact on health and environment
- Identification and Action Plans for 17 categories of major polluting industries
- Identification of 24 critically polluted areas for pollution abatement and improving environment
- Use of beneficiated coal with an ash content not exceeding 34% irrespective of their distance from pit head
- Action Plans for 141 polluted river stretches to improve quality of river water
- Identification of clean technologies for large industries and clean technologies/processes for small scale industries
- Setting up of Common Effluent Treatment Plants (CETPs) for clusters of SSI units
- Implementation of an Eco-mark scheme to encourage production/consumption of environment – friendly products
- Preparation of a Zoning Atlas, indicating status of the environment at district levels to guide environmentally sound location/siting of industries.
- Mandatory submission of annual Environmental Statement which could be extended into Environmental Audit
- Initiation of environmental epidemiological studies in seven critically polluted areas to study the impact of the polluted environment on health

- Setting up of authorities like the Environment Pollution (Prevention & Control) Authority for the National Capital Region for protecting and improving the quality of environment and preventing, controlling and abating environmental pollution.
- Provision of fiscal incentives for installation of Pollution control equipment and also for shifting of industries from congested areas

It is common knowledge that increased industrial activity worldwide requires the use of natural resources which are depleting day-by-day. It is also true that the need for resource conservation, efficient use of resources and environment friendly corporate policies and behaviour has now been recognised worldwide. In the industrial and business society, it is observed that many people are still half heartedly subscribing to the concept of sustainable development. They consider that sustainable development is a kind of compromise between industrial development and environmental protection. This perception must change.¹⁰ The ultimate objective of industrialisation is to achieve a better quality of life for everyone. A degraded environment means a direct threat to the quality of life and therefore poses a challenge to industrialisation. Industrialisation has to be there but not at the cost of the environment or for that matter our existence. For this, there has to be greater awareness about the need for protecting the environment, effective planning and the ability to strike a fine balance between industrialisation and environmental protection.

Water, resource and energy-intensive industrialisation is a prelude to ecological catastrophes as the emerging environmental facts from China amply demonstrate. According to a recent report by Greenpeace, China is the world's biggest destroyer of rainforests today. Logging in natural forests was banned in China after catastrophic floods in 1998. Since then, a

Greenpeace expert points out, “the Chinese are ripping the heart out of the world’s irreplaceable rainforests to make cheap products like plywood for Western consumer markets.” Forests in Russia, Burma, Indonesia and Guinea are suffering on account of the Chinese off-take. The Chinese plywood export market has grown by more than 1300% during the past decade, with customers mainly in the rich countries. Half the world’s tropical hardwood logs are headed for China, much of it illegally logged.¹¹

China already consumes more grain, meat, coal and steel (four of the five main basic goods) than the US and is slated to become the biggest consumer of oil in the foreseeable future and the largest emitter of greenhouse gases in the next few years itself. In another two decades its consumption of paper is expected to be twice the entire production of the whole world today. Will there be any forests and water left on earth if this is allowed to happen? And will global climate remain fit for human habitation?

Chinese authorities admit that 16 of the world’s 20 most polluted cities are now in China. Half of the water in its seven largest rivers is not even fit for industrial purposes. Over a quarter million Chinese die premature deaths every year on account of air pollution. There are 75 million attacks of asthma annually. One-third of the country’s land area receives acid rain. Parts of the world as far afield as Canada, California, Japan and the Korean peninsula now suffer the consequences of particulate pollution and acid rain because of rapid coal-fired economic growth in China (two coal-fired power stations are being commissioned in China every week). Chinese black carbon emissions are raising temperatures and impacting weather patterns throughout the Pacific Rim. Desertification in Northern China is growing at an alarming 3,500 sq km a year. Countries downstream from Chinese rivers complain of water shortages, siltation and pollution. The fish catch in the China seas has

been declining sharply on account of coastal pollution from industries and over fishing.¹²

Whatever is happening in China is happening in India too, albeit with a slight time lag, given that the Chinese are better organised and much more ahead in the race.

To take just one instance of the sort of problems India is confronted with, consider the growth in the automobile market. If our cities are not able to handle the little growth in traffic on account of the growing affluence and creditworthiness of merely the top 15-20% of our population, how can we expect them to deal with the traffic snarls that will arise from a situation in which 80-85% of the country - like in the West or in Japan - starts finding cars affordable? Success may here betray our greatest failures.

It is not just that urban space and infrastructure are in desperately short supply. The oil and gas resources of the planet are not there forever. Experts across the spectrum concur on the prospect of the coming scarcity of energy, fearing that many future wars will be fought to ensure access to energy reserves. Nor will the global (and local) atmosphere wait to heat up till after countries like India and China have caught up with the indulgent living standards of the West.

Assuredly, we need at least two more planets if the 40% of living humanity in India and China are to live like their counterparts in the USA - who, with just a quarter of the Indian population, are making full use of the planet we do have.

Evidently, if something (energy and resource-intensive industrialisation) was once good for the presently enriched nations it does not imply that it would be good for the impoverished nations and for the world as a whole. There may not be a world left to experience the benefit.¹³

Why lessons learnt from the Western historical experience do not apply to India

In relation to the pattern of industrial growth in India, consider another thought. Modern technology has evolved in labour-scarce economies. Thus, it has typically tended to substitute labour. Today, it is impossible to compete in the global market without adopting the latest methods of production, thus ensuring the highest labour productivity and the best quality - which naturally generate little fresh employment, given massive advances in automation. This has given rise to the phenomenon of 'jobless' (and in some cases, job-destroying) growth.

More of such industrialisation only displaces more labour. If it creates fresh employment opportunities it is for a far lower number of more highly skilled positions. Such a pattern of industrialisation gives the lie to the claims of inclusiveness that are made on behalf of it. It is starkly exclusive, not inclusive.

All this is bad news for labour-surplus societies like India where most people are all too dependent on agriculture and allied activities and are thus very vulnerable to dispossession and impoverishment (on account of takeover of their resource base by the state or the corporations) but are in no position whatsoever to step into the few high-skill jobs that are created, especially given the long neglect of primary education and vocational training.

The argument is all too often heard nowadays - sometimes from the highest quarters - that it does not pay to farm any more, that agriculture is unable to absorb so large a population as India's, that therefore, as in the historical economic experience of the now developed countries, labour must transfer from agriculture to industry and services over time.¹⁴

Such a seriously mistaken view ignores at least three key features of the Western historical experience which make a replication of those processes in an Indian setting most unlikely, even impossible.

Firstly, when the rich countries of today were setting off on the road to high economic growth, manufacturing industry was able to absorb much of the labour that was (forcibly) removed from the land because of very special circumstances. Markets were expanding, resources were not scarce (yet), there were no fears of environmental crises on the horizon and, as already indicated, industrial technology had not become as capital-intensive as it has today. The employment intensity of economic growth, to use the official parlance, was still high. This situation has changed dramatically in virtually all respects today.

Secondly, most significantly, the colonies and the settler colonies were there to absorb the labour that was thrown off the land in Europe . At least 50 million people migrated from Europe during the first few centuries of the industrial revolution. Migration softened the blows that industrialisation had delivered to the European peasantry. Countries like India and China do not have this luxury today. Legend has it that in the early days of the United States all a farmer had to do was let his horse run loose on an area of land to claim possession of it.¹⁵ Where are the Canadas , Americas and Australias that will absorb the surplus labour from India and China today?

Thirdly, the political context in which India is industrialising and urbanising today is perhaps unique in the history of nations. There is probably no case of a country industrialising and urbanising from a largely agrarian society under conditions of universal adult franchise in democratic political conditions. Western and East Asian elites were able to uproot huge rural populations and move them away from their homes and livelihoods through coercion by more or less authoritarian regimes. Recall that the political vote in Western democracies - when they were industrialising and urbanising - was restricted to property-owners till well into the 19 th century. Where labour immobility and resource pressures stood in the

way of capitalist industrial growth - as in the case of the US Cotton South in the middle of the 19 th century - civil wars were fought.

There are other arguments which give the lie to the view popular among our elites and their think-tanks today — that rural populations ought to be shifted from their present locations in order to improve their prospects. So many urban authorities in India are engaged in the task of “cleaning up” the cities, demolishing the homes and hutments of the poor after evicting them. When the rural agricultural poor are forced to migrate to the cities to look for better prospects in industry or in the service sector, they are thrown out summarily from their new abodes. Where - outside petty crime - are they supposed to find their new livelihoods?

It is also said that agriculture has become uneconomical for most cultivators in India . It is never pointed out what has made this so. As a concession to the rich countries under the new WTO regulations, Indian state policies over the past decade-and-a-half have liberalised the trade in agricultural products. Import duties have been reduced or removed from such goods as cotton and wheat, exposing farmers to the winds and vagaries of the world commodities market. Farmers are not offered the support prices they once got from the state.

Meanwhile, governments in enriched nations are routinely subsidising their agriculture to the tune of \$1 billion a day. All this is in conformity with the enriched-country definition of “free trade”. No one argues that agriculture is not an economical activity in the rich world. It may be the underlying truth that the comparative advantage of impoverished nations still lies in the production of agricultural items. But perceptions of comparative advantage are shaped by affluent nations and classes, who have the resources to manoeuvre policy levers in international economic institutions like the World Bank, the IMF and the WTO.

As a result, American agribusinesses have a free run at Indian agricultural markets, introducing to a labour-rich country a resource and capital-intensive agricultural technology at odds with its production conditions. If Indian agriculture gets industrialised in the coming years at the hands of global agribusinesses our people will reap the bitter harvest of a “disposable labour force”, at a time when 10 million young Indians are being added to the working population of the country. The readily foreseeable outcome will be unprecedented political and social tension.

Agriculture has been made even more uneconomical because of the collapse of public investment in rural infrastructure after the inception of the reforms in 1991. Irrigation falls severely short of requirements, especially in dryland agriculture. Power supply for agricultural operations comes at a premium. Credit for investment purposes is hard to come by, when cheap loans are readily available in the cities for housing, cars and other personal uses. In fact, with the introduction of Special Economic Zones (SEZs) and favoured industrial projects in the countryside, a growing fraction of rural infrastructure - meant for agricultural uses - is effectively being handed over for non-agricultural purposes and for artificially inflating real-estate values.

Simply because it obtains huge tax breaks, subsidies and other incentives, no one argues that IT is uneconomical in the country. Nor are so many other industries which receive sops from the state. But agriculture receives step-treatment. Well-informed commentators make gratuitous comparisons between the rates of growth in services and industry on the one hand and agriculture on the other when they ought to know better: agriculture is growing from an already large base (and thus cannot grow so fast) and is regulated by the weather cycles and natural limits: you cannot run three 8-hour shifts every day of

the year to accelerate the rate of production, as you can in industry. And nor does one have to wait patiently for harvests in industry whose timing is determined ultimately by nature, and not by working humanity.

Thanks to the cruel and foolish neglect and abuse of agriculture (on which much has been written elsewhere), exemplified by trade policy concessions (to the WTO) that have exposed our farmers to subsidised international competition from the West without creating any sort of safety net for them, over 100,000 peasants (according to the Union Agriculture Minister's speech to parliament last March) have committed debt-driven suicide across some of the traditional granaries of India, such as Punjab. Moreover, thanks to the collapse of rural purchasing power in the IMF-led deflationary environment that was created during the 1990s (NSS data for 2002-03 reveal that income was less than expenditure for 96% of farming households), food-grain absorption per capita has declined to levels that prevailed before Indian independence, bringing back fears of possible famines in the future - even in a democracy.

Finally, an even more sobering observation: thanks to the increasingly external orientation forced upon the agrarian economy (increasingly growing cash crops, flowers and vegetables for export) even the Union Agriculture Minister Sharad Pawar admits that the food security of the country is now under serious threat, even as a dark shadow appears over wheat imports from countries like Australia - suffering their worst drought in a millennia, thanks to global climate change.

The question is not whether industrialisation is a good idea. Rather, the issues relate to the kind and rate of industrialisation, where to locate industry and for whom?

If our policymaking elites in New Delhi and in the state capitals (not to forget the invisible hand in Washington) were genuinely thinking of sustainable development for the mass of

poor Indians - and not merely concerned with enriching the already rich and powerful classes of this world - they would be outlawing certain environmentally suicidal forms of industrialisation, locating industrial activities far from inhabited and agricultural areas, encouraging investments in labour-intensive, light (possibly low-tech) industries, controlling and moderating the rate of expansion of industry to keep pace with the regeneration of (renewable) resources, protecting our markets from dumping by Western businesses (especially agribusinesses) and investing heavily in health, primary education, the vocational training of our youth. They would not be offering financial support to leading capitalists acquiring large firms abroad, far from letting them fly around in fighter jets meant presumably for the public task of defending the country.

The fact that the economic policies of Indian governments both at the centre and at the states reflects little of all these desiderata reveals their priorities - accretion to the wealth and power of the already powerful classes appears to be the reigning concern. Industrialisation as if people mattered would be discernibly inclusive, in stark contrast to the violent exclusiveness which marks the reigning pattern.

Just how socially sustainable and consistent with a democratic political ethos such an approach to economic policy is, and how far the wounded elephant that Indian agriculture is today will accept its fate without striking back, only the future will tell. If “India Shining” was smashed by the results of the 2004 general elections, “India Poised” may be headed for a more violent nemesis.

Meanwhile, we must all agree to consume, obey and shut up, in keeping with the expectations of a cramped democracy under siege from corporate totalitarianism.

Economic liberalization has resulted in a desired growth of industry within the country. Industrial zones do combat to increase GNP but at the same time due care is not taken to select the newer type of technology. For a sustainable development the impact of industrialisation on community environment should be critically analysed and appropriate actions immediately be undertaken. This article gives an account of emerging scenario due to industrialization, its impact on occupational and environmental hygiene and advocates intervention strategies for minimising health risks in the working population.

The 1992 Rio Summit and subsequent literature and debate has focused on 'green' issues such as biodiversity, climate change and marine pollution. Much less has been written concerning the 'brown' agenda: factors such as poor sanitation and water quality, air pollution and housing problems which are particularly prevalent in Third World cities.

Sustainability, the Environment and Urbanisation provides a comprehensive overview of the brown agenda, with case studies and examples from a number of Southern countries. It looks at the broad economic context behind the problems and covers the conceptual issues of sustainability, infrastructure and health programmes, as well as assessing environmental appraisal methods.

Clearly written, with contributions from some of the leading experts in the field, the book will appeal to students on environmental and developmental courses, researchers, and all those concerned with the 'healthy cities' movement.

Complexity of environmental problems

Probably most of the major environmental problems of the next century will result from the continuation and sharpening

of existing problems that currently do not receive enough political attention. The problems are not necessarily noticed in many countries or then nothing is done even the situation has been detected. The most emerging issues are climate changes, freshwater scarcity, deforestation, fresh water pollution and population growth. These problems are very complex and their interactions are hard to define. It is very important to examine problems through the social-economic-cultural system.¹⁶ Even the interconnections between environmental problems are now better known, we still lack exact information on how the issues are linked, on what degree they interact and what are the most effective measures. One problem is to integrate land- and water use planning to provide food and water security **(UNEP 1999)**.

Overpopulation

The major cause of most environmental problems is the rapidly growing human population. About 90 million babies are born each year. At this rate, by the year 2050, global population will reach 10 billion. The current world population is on average very young and has many years of reproductive life ahead. Because of this the population will grow even the fertility rate seems to decrease. The population growth takes mostly place in developing countries. These countries are in charge of 90 per cent of current population growth. It has been estimated that by the year 2025 even 84 per cent of the world's people will live in developing regions **(ENCARTA 2001)**.

Growing demand for food and facilities

Due to the growing population, demands for water, food,

housing, heat, energy, clothing, and consume goods are increasing alarmingly. Rapid population growth not only lessens available calorie supply from food per person but also risks the present food production with pollution. Increasing demand forces farmers to exhaust the soil or to use marginal land. The only way to product food to all this population is to create more effective agricultural production. Irrigation is the most important way, because in the future the arable land is not increasing, probably decreasing, due to erosion and land deterioration (**ENCARTA 2001, Brookfield and Byron 1993**).

At this moment world's population is 6 billion people. The urbanization is about 50 per cent which means that half of the population is living in the urban areas and the other half in the rural areas. This means that the other half of the population, in rural areas, has to produce the food to the population in urban areas. Most of the population growth takes place in urban areas, which means more pressure to the rural people to produce food for the growing amount of urban people (**Varis 1998, Vakkilainen and Varis 1999**).

Growing urbanization means more consumption and need of different products. The production of these needs water and creates more pollutants. In developing countries where the urbanization is occurring most rapidly the technology is not high enough to take responsibility of water treatment and clean production. Many Western companies produce their products in developing countries because of more flexible environmental law and cheaper production costs. This puts extra pressure on the environment of the developing countries (**Varis 1998, Vakkilainen and Varis 1999**).

Problems to food production

Plants need water, solar energy and nutrients to grow.

Humans can only change few things to help plants to product more, the amount of water and fertilizer. In the areas where these are needed there is also often uncertainty of water supply and lacking of capital for fertilizers. Water and food availability is closely linked together because of the enormous need of green water. For example, each ton of grain needs 1000 tons of water for successful growth **(Allan 1997, Varis 1997b)**. The quality of water is often threatened in poor areas due to domestic and industrial wastes. Agriculture as well produces numerous side effects to water resources, including erosion, leaching of nutrients, accumulation and wash off of pesticides and heavy metals, increased salinity due to evaporation losses and spearing of various diseases such as schistosomiasis and malaria **(Vakkilainen and Varis 1999, Varis 1997b)**. Until now the increasing of the fertilizers have helped to produce bigger yields. The population growth is nowadays so fast that increasing use of fert fertilizers is not enough. The next step in producing more food will be different crops and irrigation methods, like drip irrigation and water saver plants **(Vakkilainen and Varis 1999, Varis 1997b)**.

Pollutants to air, soil and water

Even the industrialized countries, with higher standards of living and greater numbers of cars, produce far more air pollution and greenhouse gases than developing countries, they can reduce environmental hazards by using technology such as smokestack scrubbers, emission systems, and wastewater treatment plants. Developing countries do not have this new technology or capacity to do so.¹⁷ The consumption is far lower but the expensive energy-efficient or clean-up technologies are economically impractical for these countries. For these reasons

environmental problems occur more often in developed countries
(ENCARTA 2001).

Table - 1

EMISSION INVENTORY SOURCE CLASSIFICATION TOTAL SOURCES

Stationary sources		Mobile sources	
Point sources	Area sources	Line sources	Area sources
1. Industrial Processing	1. Residential heating Coal gas oil	1. Highway vehicles	1. Motor vehicles light -duty medium-duty heavy-duty
2. Power plant	2. Institutional & commercial Heating coal oil gas	2. Railroad locomotives	2. Railway locomotives
3. Fuel combustion (industrial) coal oil gas	3. On site incineration	3. Channel vessels	3. Port vessels
4. Solid waste disposal Municipal incinerators	4. Open burning		4. Aircraft (airport)
5. Miscellaneous	5. Evaporative losses 6. Miscellaneous		5. miscellaneous

Emissions (air pollutants) may be classified by source, as stationary or mobile. Another method of classifying emission sources is by:

Air pollutants

In many cities the air is already so polluted that it has been causing illnesses and premature deaths among elderly people and children. Studies show that disease rate rises when

the air pollution level increases. Air pollutants are also harmful for water and environment, for example, by causing acid precipitation and acidity of waters. Most of the ambient air-pollution in urban areas comes from the fossil fuels industry, motor vehicles, heating and electricity generation. In some cities the main air polluter is the domestic heating. Many people heat their houses with firewood and cheap coal.

This kind of heating method will decrease in the future. Although, new heating methods can be even worse polluters. Instead of carbon dioxide the emissions can include various toxic and carcinogenic chemicals, heavy metals, trace organic chemicals and fibers, photochemical pollutants, lead and carbon monoxide, which are much more harmful to human health **(HABITAT 1996)**.

Table - 2
Sources of Air Pollutions

No.	Class	Aerosols	Gases and vapours
1.	Combustion process (domestic burning, thermal power plants, cars, trucks, aero-planes and railways. Also refuse burning)	Dust, fume smoke	SO ₂ , NO ₂ , CO, organic vapours, odours
2.	Chemical processes (paper mills, cement, fertilizers, etc.)	Dust, fume, mist	Process-dependent (SO ₂ , CO, NH ₃ , NO ₂ organic vapours, odours)
3.	Petroleum operations	Dust, mist	SO ₂ , H ₂ S, NH ₃ , CO, hydro-carbons, mercaptans
4.	Metallurgical processes (aluminium refineries, steel plants)	Dust, fume	SO ₂ , CO, fluorides, organic vapours
5.	Mineral processing	Dust, fume	Process-dependent SO ₂ , CO, fluorides organic vapours)
6.	Food and feed operations	Dust, mist	Odourous materials
7.	Agricultural activities		
	(a) Crop spraying	Dust, mist	Organic phosphates, chlorinated hydrocarbons
	(b) Field burning	Smoke,	sulphur oxides

Air pollutants can be broadly classified into two general groups – primary air pollutants and

secondary air pollutants.

Primary air pollutants are those emitted directly from identifiable sources – e.g. sulphur compounds, oxides of nitrogen, carbon monoxide, halogen compounds. Secondary air pollutants are those which are produced in the air by the interaction among two or more primary pollutants. E.g. formaldehyde, ozone, photochemical smog etc.

Traffic

Almost all cities have changed to motorized road vehicles, which has increased the use of fossil fuels and increased greenhouse-gas emissions. This explosive growth in the number of road vehicles is a big problem in many cities. Many city centers have major difficulties trying to cope with the chaotic automobile traffic. The traffic jams are extremely bad in many cities and transport traffic in the city area at least during the rush-hours is really slow. The pollution is high due to constant traffic and causes respiratory diseases to city habitants (**HABITAT 1996**). Failed or non-existing urban planning is the main reason for these traffic problems. Rapid population growth has surprised the capabilities of many cities. Many urban plans have failed in practice because they have been over-ambitious considering the capabilities. The reasons for this kind of failure include the lack of proper legal and administrative framework, inadequate technical skills and financial resources (**HABITAT 1996**).

Table – 3

Emissions from a Typical Indian Car

Speed (kmph)	Hydrocarbons (ppm)	Carbon monoxide (%)	Oxides of nitrogen (ppm)
Idle	3200	3.50	75
32	2825	1.39	475
48	2475	0.28	1375
64	2175	0.18	1600
80	2000	0.18	1945

Diesel powered vehicles create relatively minor pollution problems compared to petrol powered ones. The diesel engine exhausts only about a tenth of the amount of carbon monoxide exhausted by a petrol engine, although its hydrocarbon emissions may approach those of the petrol engines. The major problems of diesel engines are smoke and odour.

Table – 4

Variation with Time of Roadside Carbon Monoxide Levels in Ahmedabad

Time	ppm Carbon Monoxide		
	Day 1	Day 2	Day 3
10 a.m.	9.3	8.0	
11 a.m.	9.0	11.8	3.6
12 noon	10.4	10.4	6.3
1 p.m.	8.7	8.2	11.1
2 p.m.	8.7	9.3	9.1
3 p.m.	7.9	10.5	5.2
4 p.m.	9.4	10.2	4.6
5 p.m.	12.4		7.4

The major toxic component emitted by vehicular traffic is carbon monoxide. When cars are cruising, the exhaust gases generally contain < 1% CO, but when engines are idling or accelerating concentrations can increase to 5% or more. Carbon monoxide levels in the air are thus much influenced by traffic density and the degree of stopping and starting. The table shows some results obtained in a shopping area and a succession of traffic control lights. It was noted that the levels vary each hour. Carbon monoxide has been an important gaseous pollutant injurious to health. Low level of CO poisoning may produce symptoms like reduction in reaction time, psychomotor impairment, headache and dizziness. At high level it may bring about nausea, heart palpitations and difficulty in breathing.

Water pollutants

The lack of sanitation and sewage treatment is the biggest factor regarding water pollution. Local water bodies are used as a dumping ground for untreated water from urban areas or industries. Chemical discharge is also a widespread problem. For example, in Bangkok, 90 per cent of industrial wastes, including hazardous chemicals, are discharged without treatment. On a positive note, many countries have introduced legislation to combat the problem (**UNEP 1999**). Many rivers in developing countries are more like open sewers than rivers. Most of the centers in these regions do not have drains or even service to collect the garbage. Fisheries are often damaged and destroyed by liquid effluents from city-based industries.¹⁸ Thousands of people may lose their livelihood, because of a

large city situated close to the world's productive fishing regions. The cities that are close to the coast often dump untreated sewage to the sea. Most of the coastal cities have serious problems with dirty, contaminated beaches and water which is a serious health risk to the bathers and for the whole city (**HABITAT 1996**).

Solid wastes

In many cities the solid waste disposal is inefficient or non-existing. Even more problematic than household wastes are the industrial, hospital and institutional wastes, which often contains hazardous and toxic chemicals, not to mention viruses and bacteria. These chemicals need special care when changing, storing, transposing and disposing them. Still they are allowed to go directly the water bodies from where they can contaminate the whole water cycle. The disposal of the solid wastes is often similar than with the liquid ones. They end up to the illegal dump on streets, open spaces, wastelands, drains or rivers. Sometimes they are collected to the land sites but the protection of water bodies and groundwater is not active (**HABITAT 1996, Ogu 2000**).

Table – 5

Percentage of solid wastes (in %) generated in an Indian city (Chandigarh)

Item	Chandigarh City
Paper	4 %
Vegetable matter	75%
Dust etc., under 10 mm size	12%
Metals	0.4%
Glass	0.4%
Textiles	3%
Plastics	7%
Others, stones, ceramics etc.	7%
Weight / person / day	414 g
Weight / dwelling / day	2.5 kg. (6 persons)

The main sources of those solid wastes for which a municipality normally assumes responsibility are domestic premises, shops, offices, hotels, institutions and small factories, together with

refuse swept from the streets. Domestic wastes often account for about 75% of the total.

The main constituents of solid wastes are similar throughout the world, but the proportions vary widely from country to country and even within a city, because the variations are closely related to income levels. As personal income rises, paper increases, kitchen wastes decline, metals and glass increases, total weight generated rises and the density of the wastes declines.

If solid wastes are left in the open spaces, wasteland and streets serious environmental problems will follow. With the rainwater much of this waste ends up swept into water bodies. This can lead to the pollution of ground- and surface waters because of leaching. Solid wastes are sometimes used for landfill but decomposed solid waste can similarly pollute groundwater through seepage, particularly in humid tropics. This can have enormous health impacts in developing countries where the use of well water as drinking water is common. The garbage combustion creates yet another environmental problem. People want to get rid of the wastes and they burn them in their backyards. The gases produced by burning can cause different respiratory diseases. Uncollected waste spoils also the aesthetic outlook of the city (**Kasarda and Parnell 1993, HABITAT 1996, Ogu 2000**).

The volume of per capita of waste is increasing with the income level due to higher consumption. This is a big problem in rapidly growing cities where it is really hard to keep up with the waste production. In the big cities the daily amount of waste can be enormous and hard to handle. In the lower-income countries the amount of waste is not so big but the problems have more to do with the collection system. The agencies that are responsibility for the collection and disposal of solid wastes are often understaffed and underfunded. Also the lack of equipment, like collection trucks, makes the service unefficient. Because many cities also have poor sanitation, wastes contain a lot of faecal matter. The risk from the uncollected waste is obvious for small

children playing in the streets and for waste pickers (**Kasarda and Parnell 1993, HABITAT 1996**).

Many city authorities face enormous challenges managing solid waste mountains. The collection and disposal of the solid waste needs effective co-operation with vendors and collectors. In developing countries it is normal that less than one-half of the solid wastes are collected. In some poor countries, for example in West Africa, only 10 per cent of the solid wastes are collected. Even the city provides waste service it is often spatially concentrated, leaving some parts of the city unserved (**Ogu 2000**).

Noise

In the urban environment there are many sources of noise. The most serious sources are aircrafts, industrial operations, highway traffic and construction activities. Current noise levels harm hundreds of millions people and create serious health treats to tens of millions. Sleep disturbance, loss of hearing, stress, poorer work performance and increased anxiety are effects from noise. The noise levels that the inhabitants have to suffer, varies between cities and also between different areas in the city. Especially in every mega-city people are under constant stress from noise, which has harmful effects on their health and level of living (**HABITAT 1996**).

Water Resources and urbanization

Water resources

The water resources on the earth are locally insufficient because water is not geographically equally divided and seasonal changes are extensive. Some parts of the world's water resources are inaccessible and cannot be used. In places where the lack of water is most severe the needed water rains so intensively and such a short period during the rainy season to the ground that

it will flood and cannot be stored. Heavy rain also fastens the erosion. Engineers are trying to do their best to level the uneven distribution by controlling even greater portion of nature's water cycle. Dams, water reservoirs and pipelines are also one way to store water for food production, industrial output, and urbanization **(Postel 1992)**.

Already 20 per cent of the world's population fall short of access to safe drinking water. This situation is set to worsen dramatically. If current trend holds, per capita water supplies worldwide will drop by more than a third by 2025. This means that 67 per cent of people will live in a waterstressed condition. The problem is most acute in Africa and West Asia. In Africa, 14 countries already experience water stress or water shortage. Another 11 countries will join that list in the next 25 years **(Somlyódy et al. 2001, Postel 1992)**.

Access to water

Even if there would be enough water for world population in the earth, it is not always sure that people can reach those supplies. The most important to the habitants are access to water, the price, quality and quantity of water. Even the people have an access to the piped water supplies it does not obviously mean that the water is pure, not contaminated and regular. Also the quantity of water available to the household and the price that has to be paid, can be even more important to a families' health than the quality of the water **(HABITAT 1996)**. If the area has a piped water service the service is not often regular. In many areas tap water is working only every other day or twice a week. If the area has piped water it means that water is piped to a housing unit or public standpipe is as close as 200 meters. In many areas, for example, in West Africa water has to be carried from wells and pipes from backyard or further. Women or children are normally responsible of fetching the water. Carrying water for

long distances needs a lot of physical effort and takes time. For example, if the water consumption of family water is 40 liters, which means 4 full buckets of water, the total weight of the carried daily water is 40 kilograms (**Kasarda and Parnell 1993, Harday et.al. 2001**). If people do not have an access to the water supply (public standpipes, yard taps, protected dug wells or bore holes/ hand pumps), they usually rely on one of two sources; water from the wells, streams or other sources which are often very contaminated; or water purchased from the vendors where quality is not either guaranteed. Often the price that these vendors are asking from the water is 4 to 100 times the amount that is paid by richer households for publicly provided piped water. Normally people buy water from vendors only for cooking and drinking, for other purposes they use water from poorer quality supplies. It is quite normal that a poor family has to use 5 to 10 per cent of their total income on the water (**HABITAT 1996, Harday et. al. 2001**).

Water quantity

Water quantity needed for humans

Adequate quantities of water are required for healthy living: for drinking, cooking and washing. The WHO recommends that the minimum daily amount per person is 27 liters per day. Because of the population growth and urbanization the gap between per capita water supply and demand is getting bigger. Population growth also has an effect on demand of food and sewage disposal facilities. This means bigger demand of irrigation water and bigger water resources. These days in many countries the water demand is between 20 to 40 per cent of the total runoff, even the sustainable amount would be 5 per cent. The demand nowadays in many countries is so massive that it needs investments and a large part of GNP has to be used for the water management (Vakkilainen and Varis 1999, Kasarda and Parnell

1993). People in developed countries use much more water than in developing regions. Likewise people with tap water facilities consume more water than people who have to carry or fetch the needed water. WHO has estimated that residents who depend on communal taps within 200 meters of their homes use 20 to 40 liters per capita per day. Households with a single tap on their yard consume 40 to 60 liters and in the high-income areas the consumption is around 200 liters per capita per day. It is evident that people who fetch their water or buy it from the vendors, consume too small amount of water in many regions **(Harday et.al. 2001)**.

Industrial need of water

Household and even municipal water needs are only a small part of the water supply problem. Globally the industrial water use is at least twice the domestic use. In addition to this use are vast quantities of water, which is used by power stations as cooling waters. Also from the domestic use half of the water is normally used for livestock (Clarke 1991). Many developing countries are still in the beginning stages of industrialization. These countries are likely to face severe water problems when they are trying to industrialize and modernize their economies. It is very likely that growing water scarcities will actually lead to substantial deterioration and perhaps, the demise of many existing and nebulous industries in some countries. The amount of needed water for production is sometimes really high. Because of heavy water demand from urban and industrial activities in Kuala Lumpur, water is stored in two dams upstream in the Kelang River. The stored water is rarely released which has resulted to the extremely low flows downstream of the dams. These too low flows are unable to dilute and flush the liquid and solid wastes generated by urban centers and Kelang River has been converted into an open sewer **(Kasarda and Parnell 1993, Davis 1993, Elhance 1999)**.

Quantity of product Quantity of water consumed

- ❖ 1 liter of petroleum 10 liters of water
- ❖ 1 can of vegetables 40 liters of water
- ❖ 1 kg of paper 100 liters of water
- ❖ 1 ton of woolen cloth 600 liters of water
- ❖ 1 ton of dry cement 4,500 liters of water
- ❖ 1 ton of kapron fiber 5,600 cubic meters of water

Water quality

Even our planet has a great physical, chemical, and biological systems to clean waters we humans are even more effective in dirtying it. Fast growth in population, more effective agriculture and industrial development are the main reasons for the growing amount of pollutants in the waters. Wastewater from the human settlements contains organic material and nutrients, industrial wastewater contains heavy metals and complexes, insoluble chemical compounds, which are harmful to people, animals and plants. Fertilizers and pesticides are used in the agriculture and they are harmful for the surface and groundwater, traffic loads air, soil and water and irrigation burdens water with salt. In the developing countries these agglomerations are even worse than in developed countries because they do not have proper sanitation and the technique are often too old and non-effective **(Bowman 1994)**.

The reduction of pollution, guarding of water resources and the quality of them does not have the priority in the developing countries that it should have. Even the effects of polluters seems to be local, the problems grow more often global, because of atmospheric transfer and water drifting. The bad water quality is limiting people's level of living. About 35 per cent of the deaths in the world are caused by water-borne diseases and diseases that transmitted by vectors which live in the water environment.

The quality of water is also important to agriculture, industry, and tourism. Polluted water is not good for agriculture either. When plants and crops are irrigated with polluted water, the pollutants may contaminate to the plants and be carried to human bodies by eating. This contamination can also happen in fishes and other animals. Polluted water may involve diseases or even deaths to farmers who are working in contaminated water (Bowman 1994). Water quality is not easy to measure. It is generally described through a set of variables relating to the physiochemical, and biological properties of water. The health effects are not the only reason to control water quality, the quality of goods and aesthetic beauty of water in the landscape are also important matters (**Bowman 1994**).

Salinity

Salinity of water is mainly caused by poor irrigation practice. Water logging followed by evaporation will deposit salt in the soil. A constant flow of irrigation water will strip salt from the soil and deposit it when the water evaporates. Soil salinity can not be fixed after it has occurred. Some of the plant species are salt-tolerant but none of them are important agricultural crops. Salinity is a very big problem for agriculture and food production now and in the future. Humans cannot either stand salt water.¹⁹ Drinking salt water causes vomiting, and when used continuously hypertension and madness (**Barke 1884**).

Acidity

Coal burning in power stations, factories, and for household usage has increased the quantities of sulphur dioxide in the atmosphere. Nitrogen oxides have also been emitted in the air from engines of different machines and vehicles. These

substances are moving with the wind and their influence can be global. When these substances react with water, rain and snow the results are harmful; acidity in water and soil (Bowman 1994).

Acidity of the water has an impact on which substances will dissolve into the water from the surrounding rocks and pipes. The health risks for humans are not only caused by the acidity but by the metals, which acid dissolves from the rocks. The most harmful metals are heavy metals and aluminum. Those accumulate easily to plants, fishes and animals. High concentrations of these metals can be injurious to humans. Industrial wastewater is a main source of these harmful metals and in developing countries the treatment of this kind of waste is often careless (**Bowman 1994**).

Organic and inorganic substances

In many cities wastewater treatment is not used at all. Rivers and water bodies are used like sewers. The high level of organisms in fresh water is related to human and animal excreta, rotten plants and other particles. These organic compounds use oxygen to break up. High amounts of organic substances lead to lack of oxygen in water, which is extremely harmful for plants and fishes living in the water. Chlorinated micro-organisms which are widely used in the industry cause, when leaked into the water, health problems to humans. These health risks cause cancer and birth abnormalities. Inorganic substances are in high amounts injurious to the human health. These substances are, for example, iodine, fluoride, iron, nitrates and selenium. Some substances, which are mutagens and carcinogens, are harmful at any level. Most of these fatal substances are released from agrochemicals used for pest and plant disease control and industrial chemicals (**Bowman 1994**).

Microbiological and biological organism

Fresh water contains naturally many organisms that have an effect on human health. These include species of viruses, bacteria, protozoa and algae. Some species, like parasitic worms, live only some stages of their lifecycle in fresh water. Not all of these organisms affect human health but they may still be hosts to a disease organism. The organisms end up into water from human and animal excreta by rain, floods or wastewater **(Bowman 1994)**.

Water can affect on human health on many levels; disease-causing agents (pathogens) or pollutants in water, insufficient amounts of fresh water per person, and physical hazards, like flooding. About 90 per cent of the child deaths in developing countries are due to polluted water. In the near future in the study regions half of the population will suffer from one or more of the main diseases associated with inadequate provision of water and sanitation **(Harday et. al. 2001)**. The water related diseases are caused by disease organisms (bacteria, virus, protozoa) as a result of ingestion, insects that transfer pathogens to humans, and ingestion of chemical pollutants or biologically produced toxins. Bacteria and viruses cause diarrhea.²⁰ This disease is very common, causing probably 5,000 million infections and 10 million deaths per year. Even the disease is considered common it is very dangerous disease in developing world when combined with malnutrition. On the other hand Cholera is not that hazardous but has gained a lot of attention in Africa and Asia. For comparison 50,000 people have died to Cholera yearly **(Bowman 1994, Hillary 1984)**. Bilharzia is a parasitic disease transmitted by snails. Over 200 million people are infected and one million die to this disease yearly. Malaria is transmitted by insects, mosquitoes. It is estimated to affect over 800 million people and cause 6 million deaths per year. The lack of water supplies affects on the amount of water used for washing of clothes and

food utensils. The various skin and eye infections, such as scabies and trachoma, are normal in these kind of areas. For example in Bamako which is Mali's capital 4 per cent of pupils suffer from scabies (**Bowman 1994, Harday et. al. 2001**).

Sanitation and waste water treatment

In the developing countries waste management, wastewater treatment and drinking water facilities are often underdeveloped. A big part of the population in these areas lives without access to safe drinking water and proper sanitation. Most of the urban centers in Africa and Asia have no sewers at all. This is not the problem in small cities only many cities with a million or more habitants have no sewers either. Even the adequate water supply has been taken care of, sanitation and wastewater treatment are unfortunately often delayed. Sanitation and wastewater treatment are the most important actions for the environment and consequently for the humans. These actions provide hygiene for users, avoid human contact with the excreta, reduce diseases and increase well being of the people (**HABITAT 1996, Varis 1997b, Harday et.al. 2001**). Sanitation and water supply have a strong effect on living conditions. The World Health Organization (WHO) estimated that, even 70 to 80 per cent of the developing countries' hospital beds are occupied by patients with waterborne diseases. Normally efficient water supply is positively linked with higher per capita income and therefore to urban areas. Although, the services in the city can be even worse than in rural areas, especially in slums and poor settlements (**HABITAT 1996**).

Urban sanitation

Developing countries' major sources of pollution are untreated or partially treated domestic sewage, industrial waste effluent, and domestic and industrial garbage. In urban centers, where the size and density of the settlements are high, sanitation

problems are very big. In many cities wastewater are discharged to the rivers, coastal water and water bodies often without any treatment at all. Even the city has central sewage system water can be only partially treated or just conveyed. The polluted water can travel long distances underground when conditions allow. For example laterite soils, commonly found in tropical climate, can allow the piping of water over significant distances. The safe distance between latrine and water source depends therefore on the soil conditions (Davis 1993, Kasarda and Parnell 1993). Wells and springs are open to contamination from pin latrines, septic tanks, and other waste disposal sites. Septic tanks and other sewage systems if not properly constructed, located, and maintained, can easily pollute the ground and surface water. Insufficiently treated or untreated industrial and municipal wastes discharged into water bodies pollute water supplies and pose risks to human health. Water supply facilities have advanced faster than wastewater management.²¹ In developing countries 75 per cent of urban dwellers had water supply facilities, and only 66 per cent had sanitation services (Davis 1993, Kasarda and Parnell 1993).

Many cities in Asia have no sewers at all. These are not only the smaller cities, many major cities with a million or more inhabitants have no sewers. If the city has sewers they often serve a small proportion of the population, typically those who are located in the richer residential, governmental and commercial areas. Most of the city inhabitants also lack connection to septic tanks. For example, Jakarta, and some smaller Indonesian cities have virtually no sewage disposal system **(Davis 1993, Kasarda and Parnell 1993)**.

Water reliability and sustainability

In most African and Asian cities recurrent supplies of piped water seem to be the norm, because of scarcity of needed

equipment, material, and skilled personnel. Power outages are also normal. This irregular electricity supply causes pumps to shut down and reduces water pressure, which creates problems by damaging the water pumps and water treatment plants. In many cities in developing countries piping systems are reasonably old, and non-effective. The loss of water by leaking is enormous. Leakage of water may make up as much as 40 to 60 per cent of the total water supply in developing cities. The personnel are inadequately trained and monitoring is non-existing (**Kasarda and Parnell 1993**). When considering the sustainability of water infrastructure, all the pieces of the puzzle have to be taken into account: water supply, quality, quantity, sanitation and irrigation. These pieces have to be balanced with all the other different sectors, political, economical, and financial realities, social issues, human resources, institutionalization and operations management, such as pricing, water and food availability and the importance of education.²² The connections between water supplies, their use and sanitation has to be remembered. Unfortunately this is not often custom in municipal water policies. The all too narrow development schemes have created more problems than they have created good. For example, boring of deeper wells has led to overexploitation of groundwater resources and enhanced desertification (**Varis 1997b**).

Land use planning in and around cities and suburbs is important when protecting the local water supplies. Unplanned development can end up paving over rainwater's main point of entry in a key drinking water source. Especially in the areas dependent on local groundwater, protection of these critical aquifer recharge areas is essential to ensure that water sources get replenished. Improvements in water supply of community have also a positive effect on community's social, economic and health conditions. The social improvements are reducing the effort and time required to collect water. This is mainly female work. By

this improvement the workload of women can be lightened. The amount of available water will also rise and have an effect on personal hygiene and health (**Davis 1993**).

Vicious circles

Vicious circles means that for instance population growth is closely linked to poor child health, low income, fertility, gender, poverty, education issues, etc. These vicious circles, holistic and integrated face of water has to be taken account. Water management is very much political, social and economical wholeness. For example, development of infrastructure in a city may raise ruralurban migration, which surpass the development. This reaction can be prevented only with some balancing actions in rural areas (**Varis 1999, 2001**). Similar reaction is happening in the case where water is considered as an economic good. This perspective forgets the needs of poor people and nature. Even water is sometimes perceived as an economic good, its priceless value has to be taken account. In many developing countries water is treated as an economic good, which is due to the inefficiency or weakness of the government to provide basic services. If water is been thought as an economic good, the side-effects have to be contemplated in scales and dimension which are far beyond financial rationality (**Allan 1997, Varis 1999**).

Groundwater

The overuse of groundwater resources is common in all the developing countries. The countries that suffer from the bad quality of surface water rely often groundwater sources. Overusing of these supplies causes land subsidence, which is a serious problem in some cities like Mexico City and Bangkok. Especially in soil, which is clay, is really hard to maintain the water level back to where it has been, because soil dries and it is not possible to fill the waterholes for the size they have been. The

growing urbanization and associated industrialization may result over-pumping of groundwater. This leads to the lower water tables and land subsidence. Groundwater levels decrease, the pumping of water from lower levels is more costly.²³ Groundwater is in many countries used for irrigation. In coastal areas, saltwater intrusion into the aquifers can occur. This process decreases access to water supply by lowering supply and increasing contamination **(Kasarda and Parnell 1993, Hillary 1984, Starke 2000)**.

The pollution of groundwater resources is one of the biggest problems in many regions.

Groundwater has often proven to be a clean and reliable source of water, but now it is threatened due to a careless disposal of organic and chemical wastes. The groundwater resources are also often taken for granted and not being protected **(Somlyódy et al. 2001)**.

Coastal waters

In many cities, located near coast wastewater are conveyed to the sea. Therefore this many coast areas suffer from pollution. The situation is the same in all the study areas: Latin America, West Africa and South- East Asia. In addition to the wastewater from the cities and industries many areas are under oil boring, or taking of gravel. Many regions also suffer from remains of the feed and medicaments used in aquaculture. The heavy traffic in the cities has an effect on the carbon dioxin amount of the sea, which has increased near the mega-cities. Some nuclear power plants discharge radionuclides especially strontium and cesium, that can convey to the coasts **(Hillary 1984)**.

Flooding

Construction activities increase impermeable or near-impermeable surfaces, which results in a reduction of infiltration into groundwater. Storm runoff increases and accelerates, and peak flows grow. Surface runoff from impervious areas may be hundreds of times greater than runoff from some natural areas. Coupled with the effects of soil erosion and sedimentation in rivers and canals resulting from urban construction, flooding in the low-lying areas is more frequent **(Kasarda and Parnell 1993)**.

City people

The city environment The problems that are facing cities, towns, and their people are inadequate financial resources, increased poverty and a widening gap between rich and poor, unsustainable use of land, uncoordinated development and insecure land tenure, lack of green spaces and inadequate water supply and sanitation. These main problems have related to many other smaller problems like, lack of jobs, spreading homelessness and expanding squatter settlements, growing insecurity and rising crime, inadequate and deteriorating building stock, services and infrastructure, lack of health and educational services, rising traffic congestion and more pollution **(UN 1996)**. The primary problem in the Third World is that the cities continue to grow even the city services are being narrowed. According to GEO-2000, “inadequate provision of water, sanitation, drainage and garbage removal” means many people’s lives and health are under continuous threat. The problems on the rural areas have driven people into the cities is also a part of the problem **(UNEP 1999, Gugler 1997)**.

Health problems

Environmental problems in most of the urban centers are

evident. Environment-related diseases or accidents remain among the major causes of illness, injury, and premature death. This is common in the poorer centers of urban areas. Most of these diseases are caused by pathogens in water, food, soil, or air. Burns, scalds, and accidental fires are common in overcrowded shelters, especially where five or more persons live in a small room (Gugler 1997). The cities have two general categories of human environmental risk: those that directly affect health, such as pollution, and those that may not be less damaging, but operate indirectly by worsen the ecosystem that human life depends on. The link between environment and health is evident. Poor environment, housing and living conditions are the main reasons to the diseases and poor health. Improvements in sanitation, sewage treatment and quality of food, will prevent diseases like cholera. The lack of these basic facilities is still general in developing countries. Because of this, diseases like tuberculosis and diarrhea continuous to be common in the developing world **(Kasarda and Parnell 1993)**.

Table – 6

Health Hazards of Laxmi Cement Factory, Okhla Industrial area, Delhi

Health Problems	No. of Workers	Percent
No. of Workers affected	42	80
Headache	15	35.71
Skin Irritation	6	14.29
Respiratory Disease	3	7.14
Eye irritation	8	19.05
Nausea	10	23.81
TOTAL	42	100

Workers in cement factory reported sicknesses like headache, nausea, breathing problems, skin irritation and eye irritation. About 42 out of 50 sample factory workers are affected by one ailment or other. The largest number of affected workers is in case of headache followed by nausea, eye irritation, skin irritation and respiratory problem. Working experience of the workers and incidence of health hazards are positively related.

Table – 7

Medical Expenses incurred by Sample Workers in Cement Factory

Medical Expenses	No. of Workers	Percent
<100	29	58
101 – 150	1	2
151 – 200	18	36
>201	2	4
Total	50	100
Average	138	

The table discusses the monthly medical expenses of families of cement factory workers, which is equal to or less than Rs. 100 for 58 percent of families. The average monthly medical expenditure of sample families is Rs. 138. It is highly correlated to the number of family members and proportion of infants and elder people in the family.

Crime

Violent crime is more visIn the study regions between 33 to 67 per cent of the population live in housing units that are in poor condition. These houses are often made of temporary materials, which do not provide proper protection against temperature changes, winds or rain. The houses are often small and overcrowdedand also lack facilities like; piped water supplies, the removal of excreta and solid wastes, drainage and roads. Many migrants move from countryside to live with their relatives, which increase the occupation of rooms. Still this kind of co-operation is the only way for many migrants to start their new life in the city (**Harday et.al. 2001, Sajor 2001**). ible in the cities than in rural areas and it affects people’s everyday life, their movements and the use of public ransportation. Crime in the city can create a sense of insecurity to its habitants.

This unsafe feeling in city streets will separate the living areas of the higher-income and lower income groups, which will reduce people’s solidarity and form areas with dissimilar incomes, costs and security level (**HABITAT 1996**). At least once every five

years, more than a half of the world's population living in the cities with 100,000 or more inhabitants are victims of a crime of some kind. Only in Asia this proportion is under 50 percent. Even the overall rate of crimes fell in Asia organized violent crime and drug trafficking have increased considerably. In the whole world urban violence is estimated to grow 3 to 5 percent every year, but this differs between regions and nations. Violent crime rates have been growing in the most cities and more slowly also in the rural areas (**HABITAT 1996**). Urban violence is a result of many factors and it could be considered as a public health problem. Inadequate income, poor and overcrowded housing and living conditions create fertile ground for the development of violence. Also the lack of children's social support in school and home by their hard working, usually poor parents are not provided. Immigration is also one reason to the crimes. Immigrants' original culture identity will be confound, finding an employment and housing is hard and racism will be expressed (**HABITAT 1996**).

Housing and Homelessness

In the study regions between 33 to 67 per cent of the population live in housing units that are in poor condition. These houses are often made of temporary materials, which do not provide proper protection against temperature changes, winds or rain. The houses are often small and overcrowded and also lack facilities like; piped water supplies, the removal of excreta and solid wastes, drainage and roads. Many migrants move from countryside to live with their relatives, which increase the occupation of rooms. Still this kind of co-operation is the only way for many migrants to start their new life in the city (**Harday et.al. 2001, Sajor 2001**). The slum areas are common in the mega-cities in the developing countries. For poor people and migrants these areas are the major place to live. Usually these slums are situated either in the surroundings of the city where the land is

cheap, deteriorated, polluted or then near factories or other work places. The facilities are non-existing in these areas. The location of the slum area is often hazardous for the health of the habitants. Governments do not want to increase the facilities, on the area trying to prevent people living there. These land properties are often owned by the governments.²⁴ The living areas can be badly polluted, suffer from floods, and locate near polluting and hazardous facilities. These are the places where nobody wants to live. This gives an opportunity to poor people to have an accommodation. The location is important, near the working places, because poor people have no money to pay for the transportation. Also the lack of proper infrastructure policies gives opportunities for poor housing **(Sajor 2001)**.

It is hard to say how many homeless people there are in the world because so many kind of homelessness exists. Some people live outside (in shop doorways, parks, under bridges), in public buildings (in railways, buses or metro stations) or in night shelters. There are also people whose accommodations are unsafe, temporary and often poor. It is said that there are one billion homeless people in the world, which is 16 percent of the whole world population (HABITAT 1996). Because of homelessness many urban dwellers lack adequate protection from rain, flooding, cold, and heat. Their health and even their lives are threatened by contaminated water and inadequate sanitation. Shelter also takes the major part of the budget for most urban dwellers and informal settlements are often the only way for them to get roof on their heads. Anything is good building material for these people; cardboard, plastic sheeting, plywood, corrugated iron. In every bigger city there are areas for these kinds of settlements, like Villa el Salvador in Lima, or Klong Toey in Bangkok **(Girardet 1996, Gugler 1997)**.

Mis- and unemployment

Besides normal employment so called “ misemployment “ is normal in the cities. It means that a person might be full-time employed, but the task performed promotes little to social welfare.²⁵ The example for this kind of job could be begging. There is also wide range of legal activities, which can said to be employment to these people. Working in these kind of jobs means working in informal sector, like selling food on the streets (**Gugler 1997**). Informal sector is very big in the cities of developing countries. Many migrants work within the informal sector -driving motorbike taxis, selling low-cost meals, driving tuc-tucs (open taxis) or collecting garbage. The informal sector is important to low income country the keep the economy running. For example, cookers of low-cost meals are the only way the poor factory workers can have their lunch or dinner. These cookers sell the food with so low price that almost all the city habitants can buy the food from these vendors. Even this low price from food gives cookers better level of living in the city than in rural areas. The amount of people who are working with the informal sector is growing because the population, especially the poor population, in the cities is growing (**Sajor 2001**).

Poverty

Poverty is common in developing countries, even in the countries, that are middle-income countries. For example in Thailand, which is middle-income country, about 16 per cent of people are qualified as poor. This means that their income level is below 900 baht in month (23 euros). With this amount even in Thailand it is impossible to have proper housing, food, pure water or social security. These people often live in the streets or parks, beg for food and do some temporary work in informal sector (**Sajor 2001, STT 2001**). The percentage of poor people is growing in many countries. Due to such a low income the main goal for the people is to get their daily meal, water and accommodation. For

these people the environmental problems are not in the front line. Because of this the solving of environmental problems in developing countries is not easy. The main questions that have to take into account are poverty and welfare of people.²⁶ Before the basic level of life will be in a bearable state, improvements in environmental conditions are impossible, at least the proper co-operation is not possible (**Sajor 2001**).

Table – 8

Wages and Salaries of Sample Workers in Cement Factory, Delhi

Wages and Salaries	No. of Workers	Percent
<3000	20	40
3001 – 4000	17	34
4001 – 5000	6	12
5001 – 6000	5	10
>6000	2	4
Total	50	100
Mean	3802	

About 40 percent of the sample workers received wages which equal to or less than Rs. 3000 per month. And 34 percent of sample workers received wages ranging from Rs. 3000 to 4000. About four percent of workers received higher wages, which is more than Rs. 6000 per month. Employees under the category of managers, accountants and other skilled receive higher wages. The average wage of cement factory workers is Rs. 3802.



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**Community's Role in Pollution Control Management
and Natural Resources Management**

- Overview
- Community's Role in Pollution Control Management
- Conflict and Natural Resource Management
- From Conflict to Collaboration
- Environmental Research Promotion: Thrust Areas of Research
- Environmental research Programme: Priority Areas

7. Community's Role in Pollution Control Management and Natural Resources Management

Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. Natural resource management is congruent with the concept of sustainable development, a scientific principle that forms a basis for sustainable global land management and environmental governance to conserve and preserve natural resources.

Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. The term Environmental management is also similar to natural resource management.

The Natural resource management emphasis on sustainability can be traced back to early attempts to understand the ecological nature of American rangelands in the late 19th century, and the resource conservation movement of the same time. This type of analysis coalesced in the 20th century, and took on a more holistic, national and even global form, culminating in the Brundtland Commission and the advocacy of sustainable development. Eco-tourism , to some extent can be

utilized as a tool for natural resource management. Research works are going on. Scientists from several sectors are indulged in this activity. Rwitabrata Mallick of Jadavpur University is doing research work on natural resource management and its relation with eco-tourism in Kurseong hill areas. Mi'kmaq First Nations in Nova Scotia are working on developing management plans for resources important to the Mi'kmaq people. Unama'ki Institute of Natural Resources

Worldwide people working on Community-Based Natural Resource Management (CBNRM), as practitioners, managers and researchers, are increasingly requesting better communication capabilities. Such communication and networking capabilities would make it possible for people to exchange experiences, manage relevant knowledge, and support learning across countries, sectors, cultures, and languages, and in this way achieve better results. The global context for these changes includes increased emphasis on culture, local institutions, traditional knowledge, participation and participatory approaches, and NGOs and civil society, within an overall nation-state framework characterized by an increasing weight placed on decentralization, governance, and transparency.

In recent decades India's environment has deteriorated as a result of conflict, neglect and uncontrolled resource exploitation. The sustainable use of renewable resource including surface and ground water, soil and land resource has been exceeded in some localized areas. Past policy has ignored environmental planning and the need for rehabilitation and protection.¹ This has led to both the depletion of natural resources and the degradation of environmental quality manifested in atmospheric contamination, surface water pollution, soil erosion and loss of forest cover.

The government goals and objective for environmental protection and conservation are to manage conserve and protect

India's environment and natural resources in an ecologically sustainable manner to assist in alleviating poverty throughout the nation. The medium-term objectives are to: develop coastal zone management, Enhance forest concession management Reduce urban and industrial pollution strengthen protected areas management. Improve management of the ecosystem and build the environmental planning capacity of core institutions.

The government environmental protection and natural resources management efforts are guided by the following principles:

- (i) Recognition of the link between poverty alleviation and the environment. To safeguard the environment the Government must increase economic opportunities to the rural poor. Natural resource degradation is in part due to exploitation of basic needs by the rural poor. Reducing rural poverty is essential to achieving sustainable management of India's environment.
- (ii) Recognition of the importance of communities Structured intervention to provided local communities with the skills to manage the natural resources base on which their livelihoods depend is the most effective way of achieving sustainable management of these resources.
- (iii) Recognition of the need for institutional capacity-building. The Ministry of Environment and other organizations lack the technical specialization to effectively protect, preserve and manage India's environment.
- (iv) Recognition of the importance of an integrated approach to environmental planning. Environmental issue is cross-sectoral and different institutions have responsibility and implement activities that concern the environment. The Ministry of Environment promotes an integrated and multi-disciplinary approach to environmental management. These principles serve as the framework

for addressing environmental priorities identified by the Ministry of Environment.

The Government recognizes that effective environmental protection and natural resources management is a cross-sectoral concern. Thus, many of the actions taken by the Government to protect the environment and manage environmental impact are integrated with investment and policy priorities in other sectors. ²The Government will, over the medium term, prepare and implement routine monitoring of the implementation of all public investment projects in order to ensure that their implementation is environmentally sound and with a view to strengthening the link between development planning and environmental protection.

The Government will increase environmental awareness and education with a view to building durable constituencies for the conservation, protection and sustainable management of natural resources. With external assistance, the Government will integrate environmental education into the schools and higher education curriculum to increase environmental awareness among teachers and students. Targeted campaigns will be implemented aimed at increasing public environmental awareness at home and at work.

Coastal area issues include depletion of the fish stock, coral reef exploitation and depletion of mangrove habitats. In addition, the potential for rapid tourism development in coastal areas and the prospects of oil and gas exploration necessitate the establishment of a comprehensive multiple-use plan for effective coastal management. ³

The aim is to prevent further degradation of the coastal environment rather than rehabilitating it later. This will be achieved by integrating environmental concerns with economic opportunities. With external assistance, the Government will commission the development of a comprehensive

mangrove habitat management plan that will provide for a mangrove restoration and preservation programme. This will provide the basis for subsequent zoning of all coastal activities and their development in line with economic and environmental priorities. ⁴

Waste management infrastructure and institutional capacity has not kept pace with rapid economic growth and urban expansion. The Government will introduce legislation to manage solid and liquid wastes. National discharge standards will be set and compliance and monitoring systems developed and established. A key element of the Strategy will be to promote environment awareness of the harm caused by the unmanaged discharge of pollutants.

With external assistance, the Government will accelerate efforts to protect the lake ecosystem. A strategic natural resource management plan will be developed to facilitate its implementation. The plan and the establishment of a multi-sector advisory and management body will also contribute to better co-ordination of interventions to protect the lake ecosystem.

Illegal logging, wildlife poaching and high poverty levels pose serious threats to the ecological integrity of protected areas. The Government will develop its capacity to better manage those areas designated as protected for bio-diversity conservation.

Why does conflict occur over the use of natural resources? How are external factors built into local conflicts? What governing mechanisms are conducive to equitable and sustainable natural resource management by communities? When do local strategies for conflict management need to be complemented or replaced by external or new mechanisms? How can research help identify opportunities for turning conflict into collaboration? Why is collaboration in natural resource management so difficult?

Community's Role in Pollution Control Management and Natural Resources Management

Receiving widespread endorsement during and since the 1992 Earth Summit, public participation has become a prerequisite for sustainable natural resource management (NRM), as governments and NGOs have increasingly come to realize that the protection of whole watersheds or catchments cannot be achieved without the willing participation of local people **(UN, 1992)**. Indeed, for sustainable solutions to emerge, local people need to be sufficiently motivated to use resource-conserving practices on their own region and this in turn, needs investment in participatory processes to bring people together to deliberate on common problems, and form new groups or associations capable of developing practices of common benefit **(Brooks and Eckman, 2000)**.

These efforts in achieving sustainable development have been centered on participatory and deliberative learning processes leading to local group formation in six sectors: i) watershed/catchment management; ii) irrigation management; iii) micro-finance delivery; iv) forest management; v) integrated pest management; and vi) farmers' research groups (Pretty and Ward, 2001). Following this line of thought, in Iran and in order to encourage local watershed management, CBOs like "cooperatives of watershed", "construction groups" and "watershed management groups" have been established to obtain resident's cooperation in activities connected with protection, reclamation and exploitation of natural resources in the basins that lead to sustainability on watershed management. Now, we wonder if these CBOs do their roles in attracting the residents' contributions and reach the expected targets. The present study represents an effort to explore the Sayed Nazari Group (SNG) impacts as a CBO in NRM at the "Kharkheh" sub-basin. "Kharkheh" sub-basin is an important part of the River Karoon

watershed and one of the main rivers flow into the Persian Gulf. government undertakes a number of natural resource management activities as part of their everyday operations. These include:

- **Strategic planning through zoning of land use** and statutory controls on all private land and locally managed open space.
- **Enforcement powers** for development consent conditions and unauthorised land uses.
- **Water management** is a local government responsibility. Local Government is responsible for stormwater management and control, sewerage and septic works and flood control and planning.
- As managers of public land, local governments must control **pest plants and animals**.
- Councils can influence vegetation management through **incentive programs**, such as rate rebates to the community in exchange for vegetation protection measures.
- Councils **manage local open space** to restore remnant vegetation and to provide habitat. These areas include bushland reserves, parks and playing fields.
- Pollution control and environmental management of land, water and air, including public health issues.
- Finally, councils may manage and **coordinate community groups**. They provide access to tools and facilities for volunteer groups and generally build the capacity of local communities to become involved in natural resource management activities.

In addition to implementing their own local plans and programs, local government also has responsibility for implementing state government planning instruments such as State Environmental Planning Policies, NPWS recovery plans for threatened species and relevant Regional Environmental Plans.

Involvement of users in watershed management has significant implications for watershed research, principally that improving the sustainability of watershed management will require not only better technologies and policies for resource use, but also better organizational mechanisms and processes through which stakeholders can come together to make decisions. There is a large literature on collective action in natural resource management (Johnson, 2001). In this regard, draws upon the theory of induced institutional innovation (Hayami and Ruttan 1985; North 1990), in associate with Pender and Scherr (1999) we hypothesize that organizational innovation responds to changes in the factors influencing the costs and benefits of organizational activity.

Although organizations and institutions are not identical, we posit that a similar process of induced change applies to organizational development as to institutional change. As in the case of institutional change, the process of induced organizational development is not likely to be automatic, occurring whenever the aggregate benefits of change exceed the costs, because of the high degree of uncertainty about the benefits and costs, the need for collective action to attain the benefits, and the presence of high fixed costs and other indivisibilities that may cause the process to be path-dependent. In our conceptual framework, changes in factor endowments, market access, economic opportunities, access to technology, interventions by external programs and organizations, local natural resource and socioeconomic conditions and other factors affecting the benefits and costs of organizational activity are hypothesized to induce local organizational change (Figure 1). Development of local organizations can influence natural resource management (NRM) by affecting collective or private actions.

Conflict and natural resource management

Conflict over natural resources such as land, water, and forests is ubiquitous (Anderson et al. 1996; Ayling and Kelly 1997; Ortiz 1999). People everywhere have competed for the natural resources they need or want to ensure or enhance their livelihoods. However, the dimensions, level, and intensity of conflict vary greatly. Conflicts over natural resources may have class dimensions, pitting those who own the resource against those who own nothing but whose work makes the resource productive (Chenier et al., this volume). Political dimensions may dominate where the state has a keen interest in a public good such as conservation (Fisher et al., this volume) or in maintaining the political alliances it needs to remain in power (Suliman, this volume). Differences in gender, age, and ethnicity may inform the use of natural resources, bringing to the fore cultural and social dimensions of conflict (Hirsch et al., this volume). Even the identification of natural resource problems may be contested in light of different information sources, world views, and values (Pérez Arrarte and Scarlato, this volume). Although each case study presented in this book does not explore all of these dimensions equally, the dialogue between them is multifaceted.⁵

Conflicts over natural resources can take place at a variety of levels, from within the household to local, regional, societal, and global scales. Furthermore, conflict may cut across these levels through multiple points of contact. Conflicts occurring mainly in local contexts may extend to national and global levels because of their special legal relevance (Talaue-McManuset al., this volume; Weitzner and Fonseca Borrás, this volume) or as a result of efforts by local actors to influence broader decision-making processes (Chenier et al., this volume; Oveido, this volume). All the cases presented in this volume pertain to conflicts that involve fairly localized, site-specific interactions among stakeholders. Most, however, stretch beyond local interactions to engage actors and processes at other levels as well.

The intensity of conflict may also vary enormously — from confusion and frustration among members of a community over poorly communicated development policies (Kant and Cooke, this volume) to violent clashes between groups over resource ownership rights and responsibilities (Chenier et al., this volume; Suliman, this volume). With reduced government power in many regions, natural resource management decisions are increasingly influenced by the resource users, who include small-scale farmers and indigenous peoples as well as ranchers, large-scale landowners, and private corporations in industries such as forestry, mining, hydropower, and agri business. Resources may be used by some in ways that undermine the livelihoods of others. Power differences between groups can be enormous and the stakes a matter of survival. The resulting conflicts often lead to chaotic and wasteful deployment of human capacities and the depletion of the very natural resources on which livelihoods, economies, and societies are based. They may also lead to bloodshed. Several of the cases presented here address the extremely difficult question of the limits of collaborative approaches to natural resource management and the role of violence in redressing entrenched economic and political interests.

Why does conflict occur?

The use of natural resources is susceptible to conflict for a number of reasons. First, natural resources are embedded in an environment or interconnected space where actions by one individual or group may generate effects far off-site. For example, the use of water for irrigation in the upper reaches of the Calico River, Nicaragua, pitted upstream landowners and communities against downstream communities in need of water for domestic use and consumption (Vernooy and Ashby, this volume). Linked biophysical or ecological processes in a specific

environment disperse cumulative, long-range impacts such as erosion, pollution, or loss of plant and animal habitats. The nature of the problem may not be apparent because ecological relationships are often poorly understood.⁶

Implicit conflicts are those in which communities are affected by a process of environmental degradation they do not recognize [or] although they might be aware of the degradation, they are unable to associate it with the activity of specific social agents. The environmental conflict is thus made explicit when communities establish an immediate logical connection between environmental degradation and the activities of certain social agents. (Ascerlad 1992, p. 35)

Research and communication can help establish this connection and may, consequently, become proximate causes of conflict, as well as catalysts for social learning about how to manage the resources and conflicts. Scientists showed that the proliferation of fish pens and fish cages for aquaculture in the Caquiputan Channel of Bolinao, Philippines, reduced water flow and the amount of dissolved oxygen in the water to levels that were lethal to fish (Talaue-McManus et al., this volume). Navigation was also impaired. This information helped to diffuse the growing conflict among resource users and provided guidance for the development of a plan for optimal resource use.⁷

Second, natural resources are also embedded in a shared social space where complex and unequal relations are established among a wide range of social actors — agro-export producers, small-scale farmers, ethnic minorities, government agencies, etc. As in other fields with political dimensions, those actors with the greatest access to power are also best able to control and influence natural resource decisions in their favour (Peet and Watts 1996). For example, absentee Jellaba landlords (merchants, government officials, and retired generals) in northern Sudan made use of their direct connections to the State Agricultural Bank to

channel international credit for mechanized farming into their operations in the Nuba Mountains in southern Kordofan (Suliman, this volume). The ruling government also helped divert attention and consolidate the Jellaba hold on the best lands in the area by inflaming historical tensions between Arab Baggara and the Nuba people.

Third, natural resources are subject to increasing scarcity due to rapid environmental change, increasing demand, and their unequal distribution (Homer-Dixon and Blitt 1998). Environmental change may involve land and water degradation, overexploitation of wildlife and aquatic resources, extensive land clearing or drainage, or climate change. Increasing demands have multiple social and economic dimensions, including population growth, changing consumption patterns, trade liberalization, rural enterprise development, and changes in technology and land use. Natural resource scarcity may also result from the unequal distribution of resources among individuals and social groups or ambiguities in the definition of rights to common property resources. As noted by Homer-Dixon and Blitt (1998, p. 8), the effects of environmental scarcity such as “constrained agricultural output, constrained economic production, migration, social segmentation, and disrupted institutions ... can, either singly or in combination, produce or exacerbate conflict among groups.”⁸

Intercommunity and interethnic conflict in the Nam Ngum watershed in the Lao People's Democratic Republic has resulted from diverse pressures causing greater natural resource scarcity (Hirsch et al., this volume). In some parts of the watershed, forced migration into areas already settled by other ethnic groups increased pressures on the forested land used in shifting cultivation systems. In other areas, the disruption of government institutions by reforms of the traditional economy led to redrawing of administrative boundaries of some villages and

the creation of a “noman’s land” where tenure rights are vaguely defined. Hydropowerdevelopment greatly reduced the resource base of villages affected byflooding, leading to deforestation of areas critical to the conservationof upstream water resources.

Fourth, natural resources are used by people in ways that are definedsymbolically. Land, forests, and waterways are not just material resourcespeople compete over, but are also part of a particular way of life (farmer,rancher, fisher, logger), an ethnic identity, and a set of gender andage roles. These symbolic dimensions of natural resources lend themselfesto ideologic, social, and political struggles that have enormous practicalsignificance for the management of natural resources and the process ofconflict management (Chevalier and Buckles 1995). Ideologic, social, andpolitical practices are contested in most settings, making it difficultto bring to bear on natural resource problems the diverse knowledge andperspectives of resource users. The viewpoint of local Chortis in Copán,Honduras, was suppressed by landowning elites anxious to deny their indigenousheritage (Chenier et al., this volume). Local perspectives were also initiallyignored by Chortis political representatives preoccupied with the nationalstruggle for legitimacy.

Because of these dimensions of natural resource management, specificnatural resource conflicts usually have multiple causes — some proximate,others underlying or contributing. A pluralistic approach that recognizes the multiple perspectives of stakeholders and the simultaneous effectsof diverse causes in natural resource conflicts is needed to understandthe initial situation and identify strategies for promoting change.

From conflict to collaboration

Conflicts over natural resources have many negative

impacts. However, people who study conflict also recognize its value as a catalyst for positive social change. Conflict is an intense experience in communication and interaction with transformative potential. For marginal groups seeking to redress injustices or extreme inequities in resource distribution, conflict is an inherent feature of their struggle for change. Although confrontation can lead to violence, avoiding and shunning conflict can be equally dangerous, as unresolved problems may flare up with renewed vigour. Misunderstandings or confusion regarding rights to natural resources and management responsibilities can escalate into more intense conflicts as the number of people involved and the problems multiply. As Lederach (1992) noted, problems become entanglements that turn into fights.⁹

Conflicts are only fully resolved when the underlying sources of tension between parties are removed, a state of affairs that may be antithetical to social life (Chevalier and Buckles, this volume). For those who view conflict as a normal and potentially positive feature of human societies, conflict should not be altogether eliminated through “resolution” but rather “managed” so that it does not lead to violence but can achieve change. Brown (1983, p. 9, quoted in Driscoll 1994, p. 8) goes so far as to suggest that “conflict management can require intervention to reduce conflict if there is too much, or intervention to promote conflict if there is too little.”

The field of conflict management draws many of its principles from North American experiences with alternative dispute resolution (ADR). In contrast to litigation and other confrontational modes of conflict resolution, ADR refers to a variety of collaborative approaches including conciliation, negotiation, and mediation (Pendzich et al. 1994; Moore 1996). Conciliation consists of an attempt by a neutral third party to communicate separately with disputing parties to reduce tensions and reach agreement on a process for addressing a dispute.

Negotiation is a voluntary process in which parties meet “face to face” to reach a mutually acceptable resolution of the issues in a conflict. Mediation involves the assistance of a neutral third party, a mediator, who helps the parties in conflict jointly reach agreement in a negotiation process but has no power to direct the parties or enforce a solution to the dispute. Through ADR, multiparty “win-win” options are sought by focusing on the problem (not the person) and by creating awareness of interdependence among stakeholders.

Although these approaches to conflict management are appealing, do the principles really work in conflicts involving natural resources? Techniques of ADR depend on both cultural and legal conditions, such as a willingness to publicly acknowledge a conflict, and administrative and financial support for negotiated solutions (Bingham 1986; Shaftoe 1993; Pendzich et al. 1994). They also depend on the voluntary participation of all relevant stakeholders. These conditions are not present in many contexts in both the North and the South. Enlightened self-interest among stakeholders may not be apparent or sufficiently urgent in situations involving the interests of national elites or others with coercive measures at their disposal. ADR may even be counterproductive if the process only manages to get certain groups together to mediate their differences when the causes of conflict and obstacles to resolution are beyond their control. Meanwhile, conflict management training based on ADR principles is promoted around the world, giving rise to a new class of development consultant —the mediator. ADR emphasis on the role of mediators in resolving problems can lead to dependence on “experts” and the neglect of processes that lead to enhanced local capacity to manage recurring conflicts. Given this trend, there is an urgent need to critically assess the approaches with a view to determining the conditions under which they lead to more stable, transparent, and inclusive decisions.

It is also critical to recognize that although negotiation, mediation, and conciliation are being promoted as “alternatives” in Western societies, they are not completely new. Castro and Ettenger (1996, p.1) argue that “all legal orders,” whether based on customary or state institutions, “rely, to varying extents, on the same basic procedural modes to handle disputes ... avoidance, coercion, negotiation, mediation, arbitration, and adjudication.” In addition, people in diverse societies use other “mechanisms to handle disputes at a local level, including peer pressure, gossip, ostracism, violence, public humiliation, witchcraft, and spiritual healing” (Castro and Ettenger 1996, p.7).

These local mechanisms of conflict management are not always equitable and effective, especially in conflicts involving multiple dimensions and increasing intensity. Some may hinder equitable and sustainable development and can be legitimately challenged. Nevertheless, Western traditions of conflict management need to be balanced with the systematic study of local practices, insights, and resources used to manage conflict (Chevalier and Buckles, this volume). Cultural, symbolic, and psychological factors that emerge from this analysis can be used to strengthen the integrity of local strategies and redress inequities in local forms of conflict management. Moreover, attention to local strategies is important because the diversity they embody is needed to keep methodological debates open to alternative voices and experiences. In an homogenizing world, diverse local insights and methods are critical sources of innovation.¹⁰

Multistakeholder analysis of problem areas and conflicts is a key step in catalyzing recognition of the need for change. The cases presented in this volume show that natural resource management decisions are made through complex interactions between actors and the natural resource base at various levels, from the farm and watershed to national institutions and beyond.

Problems and conflicts that arise as a result of these decisions are never entirely caused by one individual or group. Understanding and real solutions usually cannot emerge if all stakeholders do not see their own role in creating and perpetuating the conflict. Multistakeholder analysis is a general analytical framework for examining the differences in interests and power relations among stakeholders, with a view to identifying who is affected by and who can influence current patterns of natural resource management (Ramírez, this volume). Problem analysis from the points of view of all stakeholders can help separate the multiple causes of conflict and bring a wealth of knowledge to bear on the identification and development of solutions. Particular attention is paid to gender-based and class-based differences in problem identification and priority setting because in many societies these differences are systematically suppressed or ignored.

Various research methods can be adapted as part of this analytical approach, including participatory rural appraisal, participatory action research, gender analysis, and the analysis of differences in class interests and power relations. As Ramírez (this volume) points out, stakeholder analysis can be undertaken by external researchers, or it may be used by the stakeholders themselves as a participatory process in support of conflict management. When stakeholders come to recognize for themselves the common interests and strategic differences that connect them to each other, new opportunities can emerge for turning conflict into collaboration.

The limits to collaboration

Perhaps the most intractable yet critical challenge in the pursuit of collaboration in natural resource management is to engage the most powerful stakeholders in analysis of the causes and alternatives to conflict. Although in many settings

marginalized groups must be empowered to undertake problem analysis and formulate strategies for negotiation, change will only come about if the powerful are moved to act on the causes of marginalization, inequity, and mismanagement. The conditions, and related pressures, needed to accomplish this movement are not well understood and rarely studied. In short, how do you get the lion to sit at the table with the lamb (Thomas et al. 1996)?

Research by Scott (1987, 1990) suggests that sources of power are nearly always available to marginal stakeholders, if only as an undercurrent or “hidden transcript.” In response to a very articulate proposition, dead silence can, at times, make an equally forceful point. The challenge is to enhance the capacity of marginal groups to use their power effectively to engage the overtly powerful in meaningful negotiation. It is this challenge that tests the limits of collaborative approaches to natural resource management and shows why real collaboration is so difficult.

Several of the case studies in this volume note that a show of strength through confrontation may be needed to get the attention of key stakeholders who can redress power imbalances. In the Galapagos Islands, Ecuador (Oveido, this volume), and in Cahuita, Costa Rica (Weitzner and Fonseca Borrás, this volume), the threat of violence by local stakeholders drew in remote government and international stakeholders with the power to change the distribution of natural resource rights and responsibilities.

Violent confrontation may prove to be unproductive, however, and “is prone to generating consequences that are unanticipated, unintended, and uncontrollable” (Bush and Opp, this volume, p. 189). It usually leads to suffering when used against an opponent that uses similarly blunt tools. In a case involving bloody armed conflict in the Sudan (Suliman,

this volume) change is coming about very gradually as people's perceptions of the causes and effects of conflict over natural resources change. The fragile peace that is emerging between the Nuba and the Arab Baggara is sustained by recognition that both sides are losing everything important to them (people, cattle, trade). Attention is shifting to external political and economic causes of their violent confrontations.¹¹

Contrary to the confrontational scenario, local alliances with advocacy groups, international bodies, and academics offer some scope for dealing with power imbalances more imaginatively and more productively. Widespread screening of two films on threats to an environmentally sensitive wetland in Uruguay posed by the practices of commercial rice growers was critical in swaying public opinion (Pérez Arrarte and Scarlato, this volume). The momentum created by this campaign was then used by research nongovernmental organizations (NGOs) and local governments to change patterns of public and private investment in development and conservation.

The opinions of academics can also influence key stakeholders, such as legislators and senior government officials, when based on solid experience, detailed information, and lucid analysis (Williamson 1999). In the Nusa Tenggara of eastern Indonesia, an informal network of individuals from NGOs, research institutions, government agencies, and local communities is facilitating an ongoing regional process of community consultation, research, mediation, and negotiation that engages multiple stakeholders in the management of conflicts over forest resources (Fisher et al., this volume). Through this process, the unintended impacts of national policies at the community level were brought to the attention of senior government officials, opening the way to government recognition of the need for flexible policies and the value of bringing previously excluded groups into the decision-making process. Research played a

catalytic role by helping to make implicit conflicts explicit and by providing credible and detailed information needed to understand the dimensions and various levels of the conflicts and opportunities for change.¹²

Alliances with broader social movements that articulate demands for democratization and environmental accountability can also enhance the voices of the marginal in ways that engage people in dialogue and generate popular discussion. Coalition-building between local groups and progressive social movements is critical to redefining the terms of debate over access to and use of natural resources and to creating or enhancing spaces and mechanisms for negotiating the diverse interests that separate farmers from ranchers, loggers from indigenous peoples, men from women, local officials from national policymakers, and primary producers from financiers. To sustain and inform popular discussion, more research attention needs to be paid to how external factors (structural adjustment, trade agreements, domestic policies, etc.) are built into local conflicts. Drawing out the historical and structural relationships between communities and the broader processes affecting society opens up the possibility of identifying fundamental problems and formulating alternative social discourse.

Constructing an environment in which conflicts over natural resources can be dealt with productively will also require new structures and processes for governing natural resources management decisions (Agarwal 1997; Kothari et al. 1998). Given the multiple dimensions of natural resource management, negotiating for change can be wasted effort if policy, administrative, and financial factors at higher levels block or contradict the decisions made locally (Tyler, this volume). Changes to national policies and legal frameworks are needed to accommodate the development of relations between formal and informal institutions at various levels. As noted by Ashby (Eberlee

1999, p. 4), "The critical problem is not so much capacity at the micro level, but the incapacity of governments to provide effective public sector counterparts to community-based organizations."

Experiences from Indonesia (Fisher et al., this volume), India (Kant and Cooke, this volume), the Philippines (Talaue-McManus et al., this volume), and Costa Rica (Weitzner and Fonseca Borrás, this volume) suggest that governing structures and processes that bring previously excluded groups into decision-making offer new opportunities for improving natural resource management decisions and finding better ways to avoid, resolve, or manage conflict. The joint forest management (JFM) policy in India calls for the involvement of a wide range of stakeholders, including women, in resource management decisions. In some settings, the policy has resulted in new local mechanisms for reaching agreement on procedures, power sharing, and dispute resolution (Kant and Cooke, this volume). The policy is incomplete and inflexible, however, often leading to contradictions between formal and informal decision-making processes. For example, in some villages the regulation banning the sale of fuelwood under JFM undermines the livelihood strategy of poor caste groups who depend on this resource. Although the decision-making process of village leaders could accommodate these needs based on customary law and locally accepted behaviour, the local JFM committees lack the power to adapt the norms of the policy to local circumstances.

In Cahuita, Costa Rica, a local committee set up to handle a specific dispute over services to visitors to Cahuita National Park evolved over a few years into a management committee involving local people and government officials concerned with the management of the natural resources of the park (Weitzner and Fonseca Borrás, this volume). An executive decree outlining the mandate of the committee helped create an environment

conducive to local participation in natural resource management decisions. Although the decree fell short of full devolution of administrative authority to the committee, local actors effectively exploited the legitimacy it provided. Conflict was resolved effectively, and resource management decisions were made to the satisfaction of government officials. These successes are opening the way to the development of a co-management regime with profound implications for the way parks are managed in Costa Rica. The experience suggests that although consensus is not always possible, governance that is more inclusive, transparent, and efficient can help groups in conflict accommodate some differences, find some common ground, and improve key decisions affecting their livelihoods.¹³

Although the development of transparent and participatory structures for governing natural resources is an essential step, several other challenges arise. New and multiple roles for local and external stakeholders will need to be negotiated and implemented. As the familiar workings of existing institutional arrangements are replaced and the status of stakeholders is transformed, the development of social relations of trust will become even more critical (Seligman 1997). Farming women and men will need to be sincerely recognized and listened to as site experts. Local governments and organizations will need to develop new communication and training systems to enhance community capacity to generate information and knowledge relevant to stakeholders. Government officials will need to act as facilitators and implementors of decisions emerging from local systems of governance rather than as decision-makers per se (Tyler, this volume). The extent of “readiness to learn” and — because challenging and learning new roles is a risky undertaking — the “margin for learning” (Bernard and Armstrong 1997) will be critical factors affecting who participates in collaborative natural resource management and how. Our hope is that this

volume points to relevant new research needed to support this process and enhance the capacity of communities to manage and transform the conflicts that affect their lives.

Environment and Natural Resources

As governments, donors and citizens become increasingly concerned with the environment and with natural resources, there is a growing realization that many of the binding constraints they face are managerial and political, not scientific. MSI has developed expertise in addressing these issues in the areas of fish and wildlife conservation, parks and protected areas, community-based natural resources management, eco-business, and urban pollution control. Areas of specific MSI experience include:

- **Planning, Monitoring and Evaluation.** MSI has specialized experience in the design and implementation of participatory planning, monitoring and evaluation systems for activities and organizations concerned with environment and natural resource management. A particular strength of the company is its expertise in the use of innovative and practical methods for involving key stakeholders and the broader public in these exercises.
- **Policy and Regulatory Reform.** MSI has led efforts to identify and overcome the political and organizational obstacles to effective implementation of environmental policies and regulations. This experience includes the effective use of collaborative approaches such as negotiated rulemaking and cross-agency working groups. Read more about [Implementing Environmental Policy change](#).
- **Management of Environmental Consortia.** Environmental and natural resource management efforts typically require the active involvement of many

governmental, private, non-profit, and community organizations. MSI has successfully facilitated in a number of settings the formation and functioning of the complex, multi-organizational networks needed to carry out these activities. With the USAEP project, MSI currently plays a key role in managing the process of transferring U.S. best practices, experience and technology throughout Asia.

- **Capacity Building.** MSI has specialized expertise in strengthening local and national organizations concerned with environment and natural resource management, helping these organizations to focus their objectives, improve their governance procedures, form strategic alliances, and develop clear and broadly supported performance standards.
- **Endowments.** MSI has helped establish environmental and educational endowments in several parts of the world, and assists international donor agencies to develop innovative strategies for promoting the financial sustainability of the organizations they support.

ENVIRONMENTAL RESEARCH PROMOTION

Objectives and Scope

Environmental research and development programmes aim at developing strategies, technologies, methodologies, information and data dissemination for better environment management permitting sustainable development. These also seek to develop infrastructure and trained manpower for undertaking environment research. The R & D projects particularly aim at attempting solutions to the practical problems of resource management and provides necessary inputs for development and formulation of Action Plans for conservation of

natural resources, and restoration and improvement of environmental quality, while permitting sustainable development.

The Ministry of Environment and Forests supports research in various universities, and colleges recognized by UGC, institutions of CSIR, ICAR, ICMR, ICSSR and recognized non-governmental scientific organizations. The environmental research in the Ministry is being supported under various sub-schemes which are given below:

1.1.1 Environmental Research Programme (ERP)

The ERP specifically deals with brown agenda i.e. problems related to pollution, hazardous waste management, agro-chemicals, waste minimisation and reuse, carrying capacity studies and development of eco-friendly and cleaner technologies and providing scientific inputs and remedies for urgent and critical problems relating to Environmental Pollution Controls and management.

1.1.2 Ecosystems Research Scheme (ERS)

The Ecosystem Research Scheme (ERS) is an interdisciplinary programme of research which emphasizes ecological approach to the study of inter-relationship between man and the environment and seeks to generate scientific knowledge needed to manage the natural resources wisely.

1.1.3. Eastern and Western Ghats Research Program (E&WRP)

The Research programme on Eastern & Western Ghats is intended to promote research and to evolve scientific inputs and technology packages for solving location specific problems in the fragile areas of Eastern and Western Ghats. The information generated out of these projects will be used for developing strategies for conservation and management of natural resources of these areas.

Biosphere Reserves

Biosphere reserve (BR) is an international designation made by UNESCO for representative parts of natural and cultural landscapes extending over large area of terrestrial or coastal / marine ecosystems or a combination thereof. BRs are designated to deal with one of the most important questions of reconciling the conservation of biodiversity, the quest for economic and social development and maintenance of associated cultural values.

Research on various aspects of conservation and management of Biosphere Reserves area is being promoted through academic research **institutions**.

Mangroves and Coral Reefs

The scheme on conservation and Management of Mangroves and Coral Reefs was initiated in 1986 for - Conservation and protection of the mangrove ecosystems from further degradation, afforestation of degraded mangrove areas, maintenance of genetic diversity, especially of the threatened and endemic species, and creation of awareness among the people on importance of mangrove ecosystem and the need for conservation.

Wetlands

Fresh water wetland resources which exhibit a great ecological diversity are of great economic, aesthetic and ecological importance. Research on various aspects of conservation and management of wetlands including enhancements of their productivity are promoted through appropriate agencies.

National Natural Resources Management System (NNRMS)

The need for national development makes it imperative to adopt a comprehensive approach to the management of natural

resources. NNRMS is a hybrid system and emphasizes optimum integration of conventional and remote sensing techniques for the survey, monitoring and mapping of natural resources.

Ganga Action Plan / National River Conservation Programme

Research on various aspects of pollution monitoring, water quality monitoring, impact analysis etc. is being promoted through academic and research institutions.

Thrust Areas of Research

Ministry of Environment & Forests has been funding research in multi-disciplinary aspects of environmental & ecosystems protection, conservation and management at various universities, institutions of higher learning, national research institutes and non-governmental organizations. The primary objectives are to develop strategies, technologies and methodologies for better environment management and also create infrastructure and a pool of trained manpower to shoulder the responsibility of environmental management in the country. Environmental Research particularly aims at attempting solutions to the practical problems of resource management and provides necessary inputs for the twin objectives of conservation of natural resources and restoration of environmental quality. The Research Division after Consultation with other divisions in the Ministry, experts on subject & gauging other emerging areas; has decided thrust areas for the next 2 years i.e. up to 2001 A.D. The following 21 * areas have been proposed for priority action by this Ministry.

Area 1 : Development of biological & other interventions for pollution prevention and control, including waste recycling.

- Development of microbial and other biological methods for

treatment of solid and liquid waste, and hazardous industrial effluents.

- Improvement of processes for low or no wastes.
- Heavy metals uptake by aquatic and terrestrial plants & other remedial measures for separation of heavy metals.
- Waste recycling, product recovery and use with emphasis on such wastes as red mud, fly ash, phospho-gypsum, useful metals etc.

Thrust Areas are merely serial numbered and are not in the order of their priority. All areas carry equal weightage.

Area 2 : Development of strategies/technologies for prevention and/or control of pollution

- i. Assessment of air and water pollution in select sectors/ areas
- ii. Pollution modeling & validating mathematical models in predicting pollutant concentrations. The validation to be confined to two or three models most commonly used in EIA.
- iii. Monitoring of Surface Ozone spatially & temporally over urban, suburban & rural areas.
- iv. Assessment of the effectiveness of green belts for air pollution control. Assessment of plants sensitive to Pollution, as also identification of resistant plants suitable for raising green belts in critically Polluted areas.
- v. Bio-monitoring of pollution.
- vi. Study of groundwater pollution selected industrial, areas & around ash dykes, acid mine drainage, red mud ponds etc. to determine the need for liners based on the attendant hydro-geological conditions to prevent fluorosis etc.
- vii. Pollution impact on health via transport sector & mitigation measures thereto.
- viii. Development of eco-friendly industrial and municipal waste treatment, disposal & reduction technologies.

Area 3 : Clean Technologies for Sustainable Production Patterns

- i. Review of sectional policies For ensuring long term sustainability.
- ii. Use / application of renewable resources for processing industries covering technologies such as gasification, pyrolysis etc.
- iii. Development of Fuel-efficient engines in transport sector.
- iv. Energy, Material, Environmental Resources Consumption and Performance audits in small, medium & large scale enterprises for improving productivity.
- v. Development of sectoral guidelines for Environmental Management Systems (e. g. ISO- 14001) for major polluting industries such as fertilizer plants, chemical industries, refineries, integrated steel plants etc.
- vi. Innovations in common effluent treatment plants.
- vii. Life cycle assessment studies on various consumer products core Sector Polluting processes.
- viii. Time series studies based on remote sensing and field validation for environmental monitoring of ecologically sensitive areas.
- ix. Eco-cultivation in agriculture sector including use of bio-pesticides organic manure, including treatment of Municipal solid wastes to produce Farmyard manure, vermiculture etc. Carbon flow, Interecosystems, transfers & energy flows in agro-ecosystems.
- x. Eco-friendly building materials and construction technologies with emphasis on low cost housing, and cement industry.
- xi. Carrying Capacity Studies to evolve Sustainable development portfolios for different regions and Natural Resource Accounting in selected ecosystems to reduce consumption (wastage of finite natural resources).

Area 4 : Restoration of degraded ecosystems

- i. Development of techniques for restoration of mine affected areas, arid & semi-arid lands(including cold and hot deserts).
- ii. Studies on Ecological Succession in normal, degraded & restored ecosystems.

Area 5 : Conservation and enhancement of biological diversity (Excluding the mandate given to BSI, ZSI, WLI, ICFRE & GBPHIED).

- i. Inventorising and regular monitoring of Bio-diversity as required under Convention on Biological Diversity and Data Base Development.
- ii. Structure and functioning of various ecosystems for understanding the vital ecological links and principles.
- iii. Conservation and management of living resources and their augmentation with emphasis on cultivation packages for medicinal and other economic plants.
- iv. Food habits and migration routes of Wild Life (especially mammals) in the Eastern, Western and North Eastern region.
- v. Bio-diversity utilization and promotion of bio-diversity based enterprises.
- vi. Study of behaviour, ecology, life history & population, dynamics of important economic, threatened & endemic species.
- vii. Propagation, multiplication and replenishment of rare, threatened, endangered and endemic living resources.
- viii. Development of methods for rehabilitating threatened plant and animal species and their status validation by population studies.
- ix. Identification of indicator species for understanding ecosystem health so as to evaluate the efficiency of management interventions.

- x. Characterization and taxonomic studies in terrestrial marine & other ecosystems.
- xi. Research in hotspot areas for conserving the endemic species, and also on micro-organisms to understand their role in litter decomposition, nutrient recycling and ecosystem functioning.
- xii. Impact of alien invasive species on ecosystem structure & species composition.
- xiii. Size of biosphere reserves (single large or several small) and the role of species in maintenance of ecosystem health and their response to natural and anthropogenic disturbance (s) regime.
- xiv. Environmentally Safe Biotechnologies and interaction of GMOs (Genetically Modified Organisms) or LMOs (Living Modified Organisms) in natural ecosystems & otherwise with emphasis on applied research for increasing the efficiency of food crops, animal husbandry and other domestic sectors that bring down the pressure on natural forests.
- xv. Socio-economic variables and their interaction with biological component of various ecosystems with special attention to ethnobiology, tribal livelihood and dependence on forests.
- xvi. Targeted research on genetic resources of lower plants and animals with promising economic value. Present-day status of Flora & Fauna, level and magnitude of threat they face, alongwith possible remedial measures.
- xvii. Screening, testing and development of biologically active compounds / principles.
- xviii Coordinated research on mangroves with special attention to their taxonomy, distribution, status, effect of aqua-culture in mangrove areas and impact of mangrove afforestation in flood damage control and prevention of coastal erosion & scientific inputs for Integrated Coastal Management Plans for mangrove belts.

- xix. Co-ordinated research on coral reefs with special emphasis on their taxonomy, health status, bleaching and other diseases including coral regeneration, rehabilitation and impact of socio-economic activities on coral reefs ecosystems.
- xx. Research on Wetlands with emphasis on their structure, functioning & management including education & awareness about wetlands.
- xxi. Research in protected areas like Sanctuaries, National Parks and Biosphere Reserves to monitor & assess changes and for remedial measures / packages.

Area 6 : Development of National Natural Resource Management System for accurate inventory of land, water, forests, mineral water, forests, mineral resources etc. and for monitoring changes in ecological systems.

- i. Use of remote sensing and GIS techniques for mapping of landscape units and habitat classification.
- ii. Environmental impact of mining.
- iii. Impact assessment of various developmental projects.
- iv. Monitoring and assessment of bio-geographic zones of the country.
- v. Education, Training and Endogenous Capacity Building in Remote Sensing and Satellite Imagery Techniques in the environment sector.

Area 7 : Instrumentation Development

- i. Development of reliable Water and Air Pollution Control and Monitoring Equipments / instruments.
- ii. Cleaner Production Technologies.

Area 8 : Climate Change

- i. Response of living organisms.
- ii. Study on shift of cropping pattern, irrigation systems etc.

- iii. Impact of projected climate change on Agriculture & Forestry in the Indian context.
- iv. Development & use of IAMs (Integrated Assessment Models).
- v. Economic analysis of Kyoto Flexible Mechanisms.
- vi. Preparation of national inventories & their periodic updation.
- vii. Professional and Analytical Support on Global Warming, Climate change, Convention (UNFCCC), Kyoto Protocol & matters relating to Technology Transfer.

Area 9 : Development of biodegradable plastics / eco-friendly alternatives

- i. Impact of ban on certain categories of plastics.
- ii. Plastic recycling and development of biodegradable plastics.
- iii. Alternative packaging and carry-bags etc., degradable material promotion.

Area 10 : Health and toxicology

- i. Air-borne microbes, bio-allergens heavy metals in air / water, noise pollution.
- ii. Effect of Air and Water pollution on human health, bio-magnification in food chains etc.
- iii. Epidemiological studies covering radiation, heavy metals, pollutants through various media i.e. water, air and food.

Area 11 : Research on Land-use and Land-use Changes

- i. Soil erosion and development of packages for its reversal.
- ii. Process of siltation of reservoirs and technologies for their desiltation / prevention.
- iii. Study of chemical pollution of soil from point and non-point sources and development of mitigation packages.

Area 12 : Mining

- i. Impact on Environment and Mitigation measures thereto.
- ii. Rehabilitation of mined areas / over burden-dumps.
- iii. Air, Water and Soil pollution due to mining.

Area 13 : Impact of Tourism, religious pilgrimage and development of eco-tourism

- i. Different facets to Tourism and their bearing on environment.
- ii. Development of guidelines for Eco-tourism.

Area 14 : Impact of developmental activities on drinking water resources.

- i. Methods for sustained ground water recharge.
- ii. Ground water pollution monitoring & modelling.
- iii. Empirical and novel techniques for rain water harvesting in arid and semi-arid regions.
- iv. Impact of water storage reservoirs and dams on local climate, water table and other environmental aspects.

Area 15 : Habitat fragmentation, human nature interaction and management of wildlife with special attention to large mammals as well as rural and urban issue related to wildlife.

- i. Man-wildlife conflicts and remedial solutions thereto.
- ii. Habitat destruction and species loss.
- iii. Management of wildlife reserves.

Area 16 : Monitoring and management of hazardous substances .

- i. Biodegradation of recalcitrant molecules and pollutants (pesticides, heavy metals, polymers, detergents and oils).
- ii. Micro-pollutants hazardous to human beings in biota, fauna and in air, water and soil.

Area 17 : River conservation and aiming to maintain their pristine state.

- i. Bio-monitoring and bio-conservation of major riverine ecosystems for knowing and maintaining their hydro, biological status.

- ii. Assessment of pollution in rivers from solid waste discharge.
- iii. Socio-economic and environmental impacts of Action Plans for all rivers under NRCP.
- iv. Utilization of results of studies on control of Bacterial Pollution for testing and up scaling to field level.
- v. Utilization of treated sewage from UASB plants for irrigation.
- vi. Interception, diversion & treatment of river waters.

Area 18 : Conservation, Enhancement and Utilization of Forests and their resources (excluding the mandate given to ICFRE and GBHIED)

- i. Inter-sectoral linkages in forests development particularly with reference to the level of community development and sustainability of forest management and forest protection attempts.
- ii. Impact of JFM on the protection and development of forests.
- iii. Socio-cultural and economic studies relating to forest protection issues.
- iv. Impact assessment of Forest Fires on the Biodiversity of forest, regeneration of species and productivity of the forest resources.
- v. Monitoring of Forest Fires, their causes, and extent of damage in terms of net monetary loss.
- vi. Studies on biological and other forms of control of forest pests and diseases.
- vii. Benchmarks and Parameters for socio / ecological / economic assessment of people's participation and effect on forest / tree resources.
- viii. Species mix and models for agroforestry in various agro-ecological zones.
- ix. Study of demand, withdrawal and end-use of non-timber forest products from forest areas.
- x. Institutional development for successful implementation of JFM.

- xi. Utility of JFM in community mobilization and study of their effectiveness.
- xii. Use of GIS as a management tool for JFM areas.
- xiii. Genetic diversity of indigenous trees & shrubs with special emphasis on their reproductive biology, seed-set, seedling recruitment, growth etc.
- xiv. Developing alternatives of forest products to reduce pressure on forests.
- xv. Research on indigenous sources of timber and non-timber forest produce (NTFP).
- xvi. Studies on forest species and their products essentially needed by traditional artisans.
- xvii. Studies on improving propagation management harvesting, utilization, value addition and marketing of bamboo, canes and some other multi-purpose palms with promising economic value.
- xviii. Seed collection, treatment, storage, certification and supply of forest species.

Area 19 : Research on mountain ecosystems (excluding the mandate given to GBPHIED).

- i. Unique terrain, geomorphic features.
- ii. Biotic, abiotic resources and methods for their optimal utilization and conservation.
- iii. Paradigm shift to renewables.

Area 20 : Research on Islands and Coastal Zones.

- i. Mapping and Zonation.
- ii. Human settlements and demography.
- iii. Salinity ingress and protection of sweet water aquifers.
- iv. Conservation and enhancement of unique coastal and Island flora and fauna.
- v. Impact assessment studies.

- vi. Integrated coastal and marine area management (ICMAM) with participation of local communities.
- vii. Sustainable Development and Utilization of Coastal and Marine Resources including Technology Development and Transfer for optimal aquaculture.

Area 21 : Research on Environmental Legislation / Socio-economic issues

- i. Unification of laws (State & Central Government Perceptions).
- ii. Promulgation of Bills / Acts out of needs arising from international treaties / conventions.
- iii. Legal, endogenous capacity-building for implementation of enforcement mechanisms.
- iv. Socio-economic issues arising out extant as well as newly contemplated legislation (s).
- v. Tribal, Rural, Urban issues vis-à-vis legislation(s).
- vi. Role of Gram Panchayats and Civil Society in the implementation of environment legislation.

Environmental Research Programme

The scheme for Environment Research Programme (ERP) has been going on in the Ministry since its inception. In fact, the scheme started in the Department of Science & Technology in 1976 and later on transferred to the newly created Department of Environment on November 1, 1980. The programme is directed and technically guided by an Expert Committee called Environment Research Committee (ERC). At present, the Committee is being chaired by Dr. B.B. Sundaresan, former Director, NEERI and former Vice-Chancellor of Madras University. The ERP specifically deals with problems related to pollution, hazardous waste management, agro-chemicals, waste

minimization and reuse, carrying capacity studies, rehabilitation of mined areas, instrument development, and development of eco-friendly and cleaner technology.

Priority Areas

The list of current priority areas is given below:

1. Development of biological and other interventions for pollution prevention and control including waste recycling.
2. Development of strategies/technologies for prevention and/or control of pollution including air and water pollution, municipal waste treatment, disposal & reduction technologies.
3. Development of clean technologies for sustainable production patterns.
4. Development of instruments for air and water pollution control.
5. Development of biodegradable plastics/eco-friendly alternatives.
6. Health and toxicology including epidemiological studies due to, food radiation, heavy metals and other pollutants through various media i.e. air, water, etc.
7. Mining including air, water and soil pollution due to mining.
8. Research on landuse and landuse changes including study of chemical pollution of soil.
9. Monitoring and management of hazardous substances including biodegradation of micro-pollutants (pesticides, heavy metals, detergents, oils).
10. Impact of developmental activities on drinking water resources including ground water pollution monitoring and modeling and novel techniques for rain water harvesting in arid and semi-arid regions.
11. River conservation and aiming to maintain their pristine state.

1.2.3 Research Programme on Eastern and Western Ghats Regions

The Eastern & Western Ghat regions were given special focus in view of their fragility and over-exploitation of natural resources. This Ministry initiated an action oriented programme in 1984 to undertake research and attempt solutions to these problems. The origin of the programme is, linked with the need for scientific input in development schemes and programmes of the ecologically sensitive areas of Eastern & Western Ghats. While taking initiative in this regard, the Planning Commission initially identified three ecologically sensitive areas viz. the Himalaya, Ganga and Western Ghats. After transfer of the scheme from Planning Commission to the Ministry of Environment during 1982, separate Expert Working Groups were constituted by the Ministry to help the Ministry for implementation of the Scheme. Thrust areas were discussed and identified and various organisations located in the regions were invited to submit proposals in priority areas. During last more than a decade, over 100 projects were sponsored by the Ministry in Western Ghats and 50 projects in Eastern Ghats. There is a need to reorient the scheme in such a way that the scientific inputs needed in development activities of these ecologically fragile areas are made available in usable form. Or in other words, the research supported should be such that it should be of applied nature and has linkages with the user agencies.

The findings of the research projects, are brought out as a departmental publication. Besides the results, both of the academic and practical importance, are disseminated by means of research publications brought out by the investigators of the projects in the leading National and International Journals which are widely consulted by scientists and other user agencies. The outcome of these projects has lead to development of scientific, data and the basis of environmental, planning and related

management. While some projects have direct applicability, some of them are exploratory in terms of assessment of the studies of the environment and impact of the developmental activities, thereby promoting remedial action.

New Delhi, June 29 As monsoon plays truant in India and fertile lands get parched for want of nourishing water, and with most of the diverse geographical regions reeling under unrelenting heat, the climate issue gets climactic.

Equally significant is the posturing of countries, including India, in the run-up to the Copenhagen Climate Summit as none of the stakeholders are keen on doing much to decarbonise its economy to ensure sustainable development.

India, along with G-77 plus China – the so-called developing countries, has been playing an active part in the multilateral negotiations under the UN Framework Convention on Climate Change to ensure that the 15th Conference of Parties in Copenhagen in December this year “delivers an ambitious but also an equitable outcome”, as stated by the Prime Minister’s Special Envoy on Climate Change, Mr Shyam Saran.

As the climate issue impinges on everyone, wisdom demands that nations sink their petty differences in approach and strategy to stem the danger from spreading further and squeezing the survival prospects of one and all.

Principally, the efforts boil down to reduction of greenhouse gas (GHG) emission, caused primarily by accelerated economic development through exploitation of fossil fuels rich in carbon dioxide. Hence, the need for mitigation measure, as also for increasing the capacity to meet the consequences of climate change that has already supervened and is likely to persist (adaptation). Both mitigation and adaptation call for sufficient financial resources (finance) and technology transfers from developed to developing countries.

The environmental battle revolves around mitigation, adaptation, finance and technology, in which developing countries including India seek to work in concert with the canon of “common but differentiated responsibilities and respective capabilities”, clearly signalling past polluters to pay to clean the table even as every one will put in place nationally appropriate mitigation actions (NAMAs) as they are so maladroitly called. But at a 17-nation Major Economies Forum (MEF) in Mexico recently, mitigation targets continued to be the bone of contention, even as the talks on the other two pillars – technology and funding of emission cuts in developing nations – were on course.

Sceptics snidely say that parallel processes outside the UN system, such as the MEF, amount to nothing substantive, if the major players do not regard UN remit to find a lasting solution to the adverse planetary problem. But the talks ended in a deadlock as most of the rich world proposed a cut in the range of 17 to 26 per cent of 1990 GHG levels by 2020, while a 2007 UN report sought a 25-40 per cent cut.

Prior to this MEF, more than 45 non-governmental leaders across the world cobbled together some components of the Draft Copenhagen Climate Treaty on June 8 at the Bonn Talks (June 1-12), held under the aegis of UNFCCC, unveiling an action plan to convert the globe into a zero-carbon economy by 2050.

The unique NGO-sponsored draft has proposed to update the Kyoto Protocol in order to strengthen the industrial world’s obligations in cutting down GHG. It also said that a new Copenhagen Protocol must be in place that has legally binding commitments for the US and sets out low-carbon pathways for developing countries, backed by the industrial world.

Even as the views of civil societies and communities often got brushed aside in the tortuous climate negotiations in the past, the fact that the draft treaty from Bonn has been presented to bureaucrats from over 190 countries with some inputs from

NGOs speaks the change of attitude and the importance civil societies have come to occupy. They have a big task cut out for themselves to give an impetus to their proposals with their respective governments to ensure that well-meaning proposals in the draft are not watered down.

Delhi-based Centad, a civil society forum to make trade work for development, contends that this draft treaty provides “a host of fresh doable ideas which have the potential to break the existing deadlock and to counter climate change threats in post-Kyoto regime (2012).”

Ultimately, nations need to be altruistic to understand the underlying threats to their very survival if they fritter away their energy by being picky, ecologists caution, adding that the Union Minister for Environment and Forests, Mr Jairam Ramesh, has his litmus test in the onerous negotiations to present the country’s case without diluting India’s historic concern for universal safety and security for a sustainable life to all.

Community-based sustainable natural resources management and development in Northeast India

In Northeast India, the biological diversity and variability of the ecosystems are used and conserved by traditional communities through various informal institutions and using traditional ecological knowledge systems. These communities have diverse food habits, culture and linguistic variations complemented by community knowledge and informal rural social institutions, which determine the access and conservation of natural resources. To explore, document, validate, conserve and commercialize these knowledge systems and simultaneously reward and assure the intellectual property rights of tribal communities who have been using such knowledge for their sustainable survival, is the prime need of the hour. Looking at

the importance of biological diversity and the role of community members of Northeast India, a national seminar was organized, where the role of community knowledge and informal rural social institutions in sustainable management of biodiversity, mobilization of the community for sustainable use and conservation of natural resources, equitable benefit share arising from indigenous natural resources, validation and value addition, and IPR and conservation of indigenous biodiversity of Northeast India were covered.

The uniqueness of this seminar was the interaction and learning with the community people and 'Gaon Burhas' (village customary chief of traditional communities), grassroots conservators and traditional knowledge holders, who are the real custodians of sustaining the natural resources. Bosiram, Honorable Member of the Legislative Assembly, Pasighat in his inaugural address, emphasized that Northeast India in general and Arunachal Pradesh in particular, is famous for the diverse species and varieties of flora and fauna. This region is also blessed by the diverse culture and communities that make the NE region unique in India. Over the years, people of the NE region have been surviving with nature and have developed location-specific traditional ecological knowledge systems tuned to culture and nature.

The survival strategies of these communities were of subsistence in mode, without greed of destroying biodiversity and other resources. However, now the acculturation, commercialization and modern technology- led developmental processes have weakened the dynamics of sustainable conservation of biodiversity and other natural resources.

The work on community mobilization through indigenous institutions, is the need of the hour to change the attitude of the people and involve them in conserving biodiversity of the region. Programmes like biodiversity contest and quiz among villagers

and school children, indigenous plant-based traditional food competition among rural women along with integrated approach of exploring biocultural knowledge systems may be started on a wider scale, to make people realize the value and potential of such natural resources. In his keynote address, T. K. Mukherjee (NISCAIR, CSIR) emphasized that we can explore community and traditional knowledge of the northeastern region for wealth creation and also to ensure benefit shares to the knowledge holders. He also emphasized that collecting information on biocultural resources using local language could help in wider applicability and diffusion of the message. In this way, the knowledge of traditional communities relating to bioresources may be protected from permanent loss. R. Mili (GBPIHED, Itanagar) discussed the role and value of traditional institutions of the Adi community in conserving natural resources of Arunachal Pradesh, and mentioned that most of literature reported from South East Asia regarding the destruction of natural resources is not primarily due to the shifting cultivation, but due to modern constructions and developmental works.

Jhum cultivators manage more than 30 indigenous crops and other biodiversity. The indigenous institutions found in the Adi community help significantly in managing natural resources and biodiversity. The role of indigenous institutions in conserving the 'Mithun' in some parts of Arunachal Pradesh like Rungong, Boleng, etc. attracted the attention of participants. The role of such institutions is pertinent in the changing socio-political system of the region. G. Lego (Pasighat) who is a conservator of the dekanng tree, reciprocated the information on Kebarang He mentioned that socio-political indigenous institution of the Adi community is divided into various levels, namely Dolung Kebarang (village level), Banggo Kebarang (inter village) and Bogum Bokang Kebarang. He further added that luring system (maintenance of traditional land and related resources) is maintained more in Pasighat socio-ecological systems during the winter.

The Gam (member of Kebang) is nominated by the villagers. Every person has the right to say before the Kebang. In every village there are more than 4–5 Gams (members of Kebang) and there is no hereditary system. Dolung Kebang depends upon a number of houses in a village and the heads of all families are members of the Kebang system. If the population of a village is large, then more number of Gam Burha can be selected. Bango Kebang consists of more than one village. In this, all heads of village-level Gams meet together to solve any problem relating to land and other natural resources, including forests. Bogum Bokang Kebang consists of many heads of all Banggo Kebangs of the entire state.

In the changing socio-political scenario of the state, now women can also be a Gam Bura. Dotum Koyu (a political interpreter and local resource person) further added that in their area of Koyu too (dominated by Galo community), in case of any dispute on natural resources like land and forest, the cases are placed before the Kebang to solve the problem. In case the Kebang is unable to settle the dispute, then the case is referred to the district civil judiciary.



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Summary, Findings and Suggestions

- **Main Findings and Suggestions**

Findings of the Study

This research proposal discusses the various issues of the emerging concept, “Environmental Management”, its thrust, scope, objectives and applicability in a developing country like India. This proposal also aims at improving industrial and urban environmental management and promoting the management of all natural resources to their best use. The study also provide state of the art solutions to the complex problems of environmental management in India, to look ahead and understand how concerns in environmental management can be anticipated and procedures for addressing them by integrating the environmental aspect into the economical and social context to achieve this objective.

India’s environmental problems are gaining global significance because of the rapid and aggressive speed of urbanization and lack of infrastructure. Increasing urbanization, industrialization, deforestation and transportation, the second cousins of economic development put tremendous pressure on natural resources and therefore there is a pressing need to strike a balance between developmental planning and urgency to safeguard the environment. As a means of self-preservation, people in India, as in other parts of the world, have been denuding the forests, digging up the land, mining the mountains and farming the seas and so forth. While they were inflicting serious damages to the ecosystem, the regenerative power of the nature, were generally able to heal the environmental damage **T**oday,

people are destroying faster than nature can replenish, because of our numerical strength of ten million people, and our insatiable desire of producing more and more effective tools for conquering nature. We in India have been polluting the water and air and degrading land faster than nature can purify them.

In India, the environmental problems are caused because of under development. Millions of our people still continue to live for below the minimum levels required for a decent human existence; deprived of adequate food, clothing, shelter, education, health and sanitation. Poverty and lack of alternatives are the forces which drive rural people in India to the burning of forests, tilling of marginal lands, the over dependence of on finding grazing land for cattle, the over cutting of trees for fuel. We can see the other part of the coin also. Over technological and economic development leads people to live in poor environmental condition. Increasing number of vehicles, construction of industries and dams are the causes of environmental degradation in country like India. Both urban and rural areas in India are overwhelmed by large numbers of people, who no doubt are looking for opportunity to join the process of development. Green revolution has already forced large numbers of rural people to migrate to cities. In India, we are faced with the size of the population and its uneven distribution; poor housing conditions, slums, squatter settlements, inadequate water and sanitation **(Farnandes, 1996)**. The man-made environment of our cities is undergoing violent changes to the extent that authorities seem powerless in grappling with the situation.

India is facing an alarming situation in environmental condition in present day. India ranks the sixth largest and second fastest growing producer of Green House Gases (GHGs) in the world. Three of India's largest cities are considered among world's 10 most polluted cities. Nearly 12 years since the disastrous Union Carbide Chemical leak in Bhopal and after 5 years of

economic resurgence, environmental awareness is high, titled GREEN – India (Growth with Resource Enhancement of Environment and Nature). A report by TERI (Tata Energy Research Institute) focusing on the state of the Indian natural resources and environmental pollution was released recently. According to the study, India is losing at least 10 % of its natural income due to environmental degradation. The study of the report reveals that, the availability of fresh water declined by two-thirds. The water requirement of major water consuming industries such as agro based, refineries, petrochemicals, fertilizers has grown 40 times but these are not yet treating the huge waste water generated. Indoors and out door air pollution result in the nation almost 2.5 million premature deaths. The total sewage generation from the urban centers has grown six times in the last 60 years

More than two decades ago the United Nations' conference on the "Human Environment" in Stockholm (1972) drew attention to the government and people of world to the increasing evidence that our activities were producing deleterious effects on the natural and man made environment, and creating serious risks for the survival and well-being of people themselves and also to provide the basis for international cooperation, to meet this new challenge of the 20th century.

India is the first country, which has provided for the protection and improvement for the environment in its constitution and has taken several steps in planning and policies to overcome the environmental problems. If we go to back we can have the idea that there is an evolutionary process in India's planning from the beginning.

After the formal independence the Planning Commission of India prepared the first documented plan in 1952 under the chairmanship of the then Prime Minister of India. The main objective of this plan was to raise the living standard of people and to increase the National Income and Per capita Income by

20% and 17% respectively and open revenues for all people. But in the first and second plan there were no concrete steps for environmental degradation. Only few scattered forest and soil conservation policies were undertaken. The Forest Policy Revolution act of May 12, 1952, suggested maintaining one thirds of its total land area under forests. In the third 5-year planning it was proposed not only to intensify some of the programs initiated under the first and second plans, but also to put special emphasize on more intensive forest and soil conservation programs. Steps were taken both for utilization of forest resources as well as to protect the forests. Different afforestation programs and river valley projects were in focus.

The fourth 5-year plan showed no new dimension in environmental concern. Only some few forests policies and programs were merged with Animal Husbandry and Fisheries section. Fifth plan also goes to same direction. There were no such new areas. Only some few forestry programs had taken place. But in this plan emphasize was given to improve urban environmental condition basically in the slum areas.

Concern of environmental problem made its first footsteps in the 6th five-year planning. For the first time, in India's planning there was separate provision for environmental degradation. Steps were taken for water pollution, air, noise and land pollution separately. Though plans and programs in the field of soil conservation and public health forests and wild life protection, industrial hygiene etc. had been in existence in India for many decades, but the first formal recognition of the need for integrated environmental planning was made when the Govt. of India constituted the National Committee on Environmental Planning and Coordination (**NCEPC**) in 1972.

The 7th and 11th PLAN plans were the continuation of previous plan with some new improvements. The basic approach to the 7th plan was sustainable development in harmony with

environment. With the realization that poverty and the state of under development led to many of the environment problems, that confronted with nature hence the understanding that development is the way of environmental management. However, another way of environmental problems have arisen as unintended side effects of the very attempts of development. The scenario of environment and forests continues to cause concern and the destruction and degradation of forests are taking a heavy toll of our natural resources. In the 8th plan, in addition to a number of national level bodies which have been constituted by the Ministry on Environment and Forests, the Planning Commission had set up several expert group/committees to formulate long term sectoral policies and to reconcile the conceptual confrontation between environment and development. Submission of an environmental statement by the polluting units to the concerned State Pollution Control Board was made mandatory through notification under Environmental Pollution Act (1986).

One of the objectives of 9th five-year planning was to ensure environmental sustainability of the developmental process through social mobilization and participation of people at all levels. For ecological sustainability, different afforestation programs and all round development of the villages for the well being of forests were planned to initiate. Involvement of NGOs in areas of awareness building and community education was planned to encourage.

Environmental pollution is serious and growing hazard in India. Its impact on human health and well being is both direct (inhalation of polluted air or intake of contaminated water) and indirect (loss of soil fertility, death of aquatic life). The Central Board for the prevention and control of water pollution spearheads the effort such as assessment and control of coastal pollution and strengthening the National River Water Quality Monitoring.

A major program on prevention of pollution of Ganga was planned. It was proposed to induce socio-economic industries and department as well as different agencies whose projects impinge on environmental quality, to establish technical cells for

Environmental Assessment. Most of the programs for environmental management deal with pre-planning for eliminating or at least minimizing environmental degradation. One of the major objectives of Eco-development was restoration of already degraded ecosystem through practical field scheme such as land reclamation, afforestation and cleaning of water bodies etc.

Planning in a rational way constitutes an essential tool for all round development as well as to protect the environment. We can say that a development process must be ecologically viable. Yet on the policy level, Government of India has been focusing many environmental measures. But what lacks in the planning is a holistic approach and coordination between planning, law and implementation. After having an overall idea about the planning of India we can see that Government had taken several steps for overcoming the environmental problems in different five years plans. Though in first, second and third five years plans there were less emphasize on environmental concern. The sixth plan first drew attention on environmental planning. But less effort was given to financial help to the plan. Coming to the seventh plan it is evidenced that for the first time a provision for separate sector and financial outlay was made in the plan. Again in the ninth plan, provision for separate environment sector was evidenced. But in the latest plan i.e. the tenth plan we couldn't see any separate provision for environment, and it is merged with science and technology sector. That is the problem with India's planning. They are not maintaining a continuous plan for the environment. It is very much needed to establish a separate sector for environment and

ecology, and to inculcate the financial resource also. Fact is that Environmental Policy in India has relied only on command and control instruments.

The introduction of the concept of environment in the context of developments is in the process of formation. It has drawn our attention to the global responsibilities and indicated that human beings are interrelated with the eco-sphere. Certainly it has a clear role to play in Public Policy making. The green movements and environmental pressure groups have made environment a political and geographical issues. It would be wrong to think that ecologism's future is doubtful because its more radical demands like dismantling of industrialization, the examination of the assumptions of anthropocentrism and the move towards a decentralized, low impact society are not being given due consideration at present. While there is a great debate concerning anthropocentrism and biocentrism, it has no bearing whatsoever on the way environmental policies are being made of justified by the individual states. However, its actual future lies somewhere between two extremes, acting as a pure and good conscience for environmentalism which has become a part of the developmental policies of the present day nation-states. It will continue to play an active role in the environmental movements throughout the globe.

In spite of theoretical references, all ecological schools have questioned the limits of economic development in industrialized countries. This in turn leads to critical reflection on the nature of development such as production in industry and agriculture, energy use and the kind of technology, concept of work, consumption patterns, population growth etc. The ecology perspective also tends to combine both respect for local autonomy in communities and a global message. They all focus on the central theme of sustainable development, a development which will not damage but will exist harmoniously with the ecosystem.

The study see this as 'new age capitalism'. In short, the maximum sustainable view wants to reduce the rates of the depletion and pollution to a point where depletion is as close to the capacity of the environment to assimilate it safely.

Ecology movements have emerged all over the world in recent years. Their primary purpose is to protect nature and to strength people's collective rights to common resources. 'Environmentalism' has become part of the dominant discourse. 'Development' has given way to 'Sustainable Development' and 'growth' has given way to 'green growth'. Yet the ruling paradigm about environmental issues continues to be biased in favour of the North, and the cities of the South. This bias creates a number of misconceptions about environmental issues in the third world. The third world countries need 'development' and cannot afford the luxury of protecting nature's ecological solutions, they are merely a source of environmental problems.

After independence, India launched a series of economic plans for rapid expansion in agriculture, industry, transport and other infrastructure with a view to increase production and employment, to reduce poverty and inequality of incomes and to establish socialistic society based on equality and justice. But because of poor planning and in many cases because of mindless and ruthless exploitation natural resources we have degraded our physical environment. By environment, we mean the whole complex of climatic, soil, water and biotic factors on which we all subsist, and on which our entire agricultural and industrial development depends. Rapid economic development is turning India in to a vast wasteland. If poverty in pre-independence India was the result of under- utilization of resources, there is very possibility that poverty; unemployment and inequality would continue to persist due to destruction of environment.

Environmental problems have become serious in many parts of the country and can no longer be neglected. These

problems in a country are affected by the level of economic development, availability of natural resources and lifestyle of the population. Poverty presents special problems for a heavily populated country with limited resources. We cannot afford to go on ignoring environmental issues as it may result in becoming more costly to society, through some problems reaching point of total disaster, claiming a heavy toll of life, productivity and quality of life in general. The growing activism of voluntary agencies, an explosion of Public Interest Litigation (PIL) and active interest shown by the courts to redress the situation, all call for a better implementation of existing laws as well as new regulations.

Urban air quality has deteriorated in all Indian cities. In particular, air pollution in our metropolitan, cities have reached intolerable levels. This reflects a combination of vehicular and industrial emissions. Vehicular pollution is related to the failure of public transport to cope with the transportation needs of the population. The root cause of the vehicular pollution is the poor pollution standards of vehicles sold in India and the extremely poor pollution standards of older vehicles on the roads. Even the rural population is not free from the ill effects of air pollution.

Rural population use substantial quantities of noncommercial fuel i.e. crop residues, animal dung or wood. Air pollutants due to bio fuels are largely released directly where the people are, inside or near homes at meal times everyday. The amount of health damage per unit of emission for pollution released indoors can be more than a thousand times greater compared to that from a smoke stalk outside a town.

Pollution of water is another growing problem in cities. Discharge of untreated sewerage and industrial effluents in water bodies including in some cases, ground water, have made water unfit for drinking and bathing. They aggravate the health of the poor who cannot afford to take defensive measures. They also affect the rich in less direct ways: fruits and vegetable are grown

with untreated water, and fish from such areas are diseased. As much as 28% of the urban population do not have organized piped water. The situation in rural areas is worse as almost all surface water sources are contaminated and unfit for consumption, by either humans or animals. In additions, deterioration of village commons, deforestation and soil degradation are other major environmental problems that affect a large part of the population directly. Finally, the loss of biodiversity in our flora and fauna is a serious loss of national wealth. It is pointed out that 176 million hectares or 53% of the total land area in India is suffering from serious degradation. Area subject to water and wind erosion amounts to 150 million hectares. The annual soil loss from erosion is tremendous and the consequences are disastrous. There is probably no other area of India's environment that has been viciously attacked and destroyed in the late 56 years since independence than the country's forest.

It is observed that between 1951 and 2007, over 80% of forest area was lost to agriculture and another 20% was lost to river valley projects, industries, roads and communications. The process of deforestation has continued till today at the current annual rate of 1.3 to 1.5 million hectares every year. Even though current official statistics put the forest area at 67 million hectares of 22% of the total geographical area, the National Committee on Environment Planning states that no more that 12% of the country's land surface is under adequate tree cover. The progressive depletion of the country's forest wealth is literally driving the country towards ecological collapse. Increasing floods, soil erosion, heavy siltation of dams constructed at enormous cost, changes in the micro-climate, these are the consequences of deforestation. The environmental damage of mining is increased manifold when mining activity is accompanied by industrial activity. India's uncontrolled industries and badly

maintained automobiles- though relatively small in numbers are adding large amounts of pollutants to the atmosphere, triggering off a host of environmental problems. Ever since 1972, when the U.N. Conference on Environment was held in Stockholm, pointed attention has been paid to maintain ecological balance. In India, also we have a plethora of two hundred statutes passed by central and state governments with the objective of preventing or controlling pollution in various fields. However, the fact remains that environmental legislation has not been very effective and vested interests have obviated the rules there by endangering human life. Thus, it is a high time that our planners review the entire position of development and environment crisis and evolve a new process of balanced sustainable development which also preserve the environment.

Harmony between man and environment is the essence of healthy life and growth. Therefore, maintenance of ecological balance and a pristine environment has been of utmost importance to human being. Environmental Management is not, as the phrase could suggest, the management of the environment as such but rather the management of humans ' interaction with and impact upon the environment. The three main issues that affect management are issues involving politics (networking), programmes (projects), and resources (i.e. money, facilities, etc). The need for environmental management can be viewed from a variety of perspectives. A more common philosophy and impetus behind environmental management is the concept of carrying capacity. Simply put, carrying capacity refers to the maximum number of organisms a particular resource can sustain. The concept of carrying capacity, while understood by many cultures over history, has its roots in Malthusian theory. Environmental management is therefore not the conservation of the environment solely for the environment's sake, but rather the conservation of the environment for human kind's sake.

Environmental management involves the management of all components of the bio-physical environment, both living (biotic) and non-living (abiotic). This is due to the interconnected and network of relationships amongst all living species and their habitats. The environment also involves the relationships of the human environment, such as the social, cultural and economic environment with the bio-physical environment.

As with all management functions, effective management tools, standards and systems are required. An 'environmental management standard or system or protocol attempts to reduce environmental impact as measured by some objective criteria. The ISO 14001 standard is the most widely used standard for environmental risk management and is closely aligned to the European Eco Management & Audit Scheme (EMAS). As a common auditing standard, the ISO 19011 standard explains how to combine this with quality management. The UK has developed a phased standard (BS8555) that can help smaller companies move to ISO 14001 in six manageable steps.

The ISO 14000 environmental management standards exist to help organisations minimise how their operations negatively affect the environment (cause adverse changes to air, water, or land), comply with applicable laws and regulations.

ISO 14001 is the international specification for an environmental management system (EMS). It specifies requirements for establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programmes to meet objectives and targets, checking and corrective action, and management review.

ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process (the comprehensive outcome of how a product is produced) rather than to the product itself. The

overall idea is to establish an organised approach to systematically reduce the impact of the environmental aspects which an organisation can control. Effective tools for the analysis of environmental aspect of an organisation and for the generation of options for improvement are provided by the concept of cleaner Production.

As with ISO 9000, certification. is performed by third-party organisations rather than being awarded by ISO directly. The ISO 19011 audit standard applies when auditing for both 9000 and 14000 compliance at once.

An Environmental Impact Assessment (EIA) is an assessment of the likely positive and/or negative influence a project may have on the environment. “Environmental Impact Assessment can be defined as : The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made.” The. purpose of the assessment is to ensure that decision-makers consider environmental impacts before deciding whether to proceed with new projects.

The statement spells out the goal to be recognised as an environmentally responsive organisation. “Social and Environmental Concern” has been identified as one of the core values. A continuous proactive endeavour is made with a view to remain at a level above the requirements of the statutes and to set its own standard in expressing concern for the society at large.

An Environmental Management System (EMS) is a systematic approach to dealing with the environmental aspects of an organization. It is a ‘tool’ that enables an organization of any size or type to control the impact of its activities, products or services on the natural environment. Pollution and destruction of natural resources have reached such dimensions in India that

in some regions they pose an imminent risk to human health. Reasons lie on the one hand in poverty and underdevelopment, on the other hand in rapid and sometime uncontrolled industrialisation and urbanization. Urban conglomerations as well as rural areas are increasingly affected. Regarding these facts, India and Germany consider sustainable environmental development as the overall goal of a development policy. Germany is already making a considerable contribution in strengthening India's environmental management through supporting development projects related to environmental management, involving technical cooperation projects and financial cooperation projects.

Environment protection and industrial and urban environmental management are key elements of any international or national environment protection program. At the same time environment protection becomes more and more important for the Indian municipalities and industries either in order to meet high international business standards or to increase tourism or standards of living. For businesses this means increasing export opportunities. Hence, the overall aim of our activities is to assist Indian industries and municipalities to realize business and environmental benefits through adopting an environmentally friendly approach. By doing so, we aim to reinforce the efforts that India is already making by initializing activities and creating winning situations for all involved stakeholders. We implement development projects in cooperation with various stakeholders aimed at strengthening environmental conscious industrial and municipal activities. Each project aims to set an example and to create multiplier effects within the Indian industry and Indian municipalities or in other countries through networking.

Management of environment is carried out mainly in the following areas:

Waste management is the collection, transport, processing, recycling or disposal of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial, producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

Pollution and destruction of natural resources have reached such dimensions in India that in some regions they pose an imminent risk to human health. Reasons lie on the one hand in poverty and underdevelopment, on the other hand in rapid and sometime uncontrolled industrialisation and urbanization. Urban conglomerations as well as rural areas are increasingly affected.

Environmental planning aims to merge the practice of urban planning with the concerns of environmentalism. Essentially speaking, while urban planners have traditionally factored in economic development, transportation, sanitation, and other services into their decisions, environmental planners add sustainable (social, ecological & economic) outcomes as important factors in the decision-making process. What exactly constitutes the "Environment", however, is somewhat open to debate among these practitioners, as is the exact scope of the

intended environmental benefits. Chief concerns among environmental planners include the encouragement of sustainable development, green building technologies, and the preservation of environmentally sensitive areas.

Cleaner technologies are playing a role in enhancing the sustainable environment. **clean technology** is the application of the environmental sciences to conserve the natural environment and resources, and to curb the negative impacts of human involvement. Sustainable development is the core of *environmental technologies*. When applying *sustainable development* as a solution for *environmental issues*, the solutions need to be socially equitable, economically viable, and environmentally sound.

CDM allows industrialised countries to meet their emission reduction targets by paying for green house gas emission reduction in developing countries. At present, developing countries such as India have no obligations to constrain their GHG emissions. But they are still able, on a voluntary basis, to contribute to global emission reductions by hosting projects under the Clean Development Mechanism. The CDM has two key goals, (i) To assist developing countries who host CDM projects to achieve sustainable development; (ii) To provide developed countries with flexibility for achieving their emission reduction targets, by allowing them to take credits from emission reducing projects undertaken in developing countries. 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.

ISO 14001 is an internationally accepted standard that sets out how you can go about putting in place an effective Environmental Management System (EMS). The standard is designed to address the delicate balance between maintaining profitability and reducing environmental impact; with the commitment of your entire organization, it can enable you to achieve both objectives. Environment protection and industrial and urban environmental management are key elements of any international or national environment protection program. At the same time environment protection becomes more and more important for the Indian municipalities and industries either in order to meet high international business standards or to increase tourism or standards of living. For businesses this means increasing export opportunities. Hence, the overall aim of our activities is to assist Indian industries and municipalities to realize business and environmental benefits through adopting an environmentally friendly approach. By doing so, we aim to reinforce the efforts that India is already making by initializing activities and creating winning situations for all involved stakeholders.



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