



# ***Environmental Impact Assessment – Mining Sector***



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# WHY ENVIRONMENT NEED TO BE MANAGED ?



**OPEN ACCESS & COMMON  
PROPERTY RESOURCES**



# OPEN ACCESS RESOURCE

**If a thing belong to  
everyone  
It really belongs to no one**

**HARDIN. G  
TRAGEDY OF THE COMMONS.**





# Environmental Concerns are

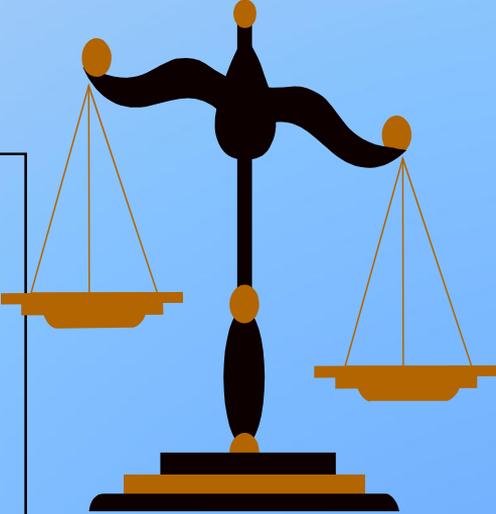
- **Highly complex**
- **Greater uncertainty**
  - ✓ ecological
  - ✓ economic
- **Long term oriented**
- **High involvement of interested parties**
- **Challenge orthodox economic notions**
- **Have an ethical dimension**



# Environment Vs Development

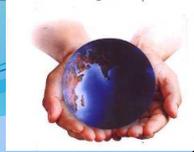


- Survival**
- Profitability**
- Growth**
- Public Acceptance**





# Inclusive Wealth



Social Value of  
Manufactured Capital

Social Value of  
Human Capital

Social Value of  
Natural Capital

Inclusive Wealth

## Capital Types

### **Manufactured Capital**

Investment  
Depreciation rate  
Assets lifetime  
Output growth  
Population  
Productivity

### **Natural Capital**

Fossil fuels  
Minerals  
Forest resources  
Agricultural land  
Fisheries

### **Human Capital**

Population by age and gender  
Mortality probability by age and gender  
Discount rate  
Employment  
Educational attainment  
Employment compensation  
Labour force by age and gender



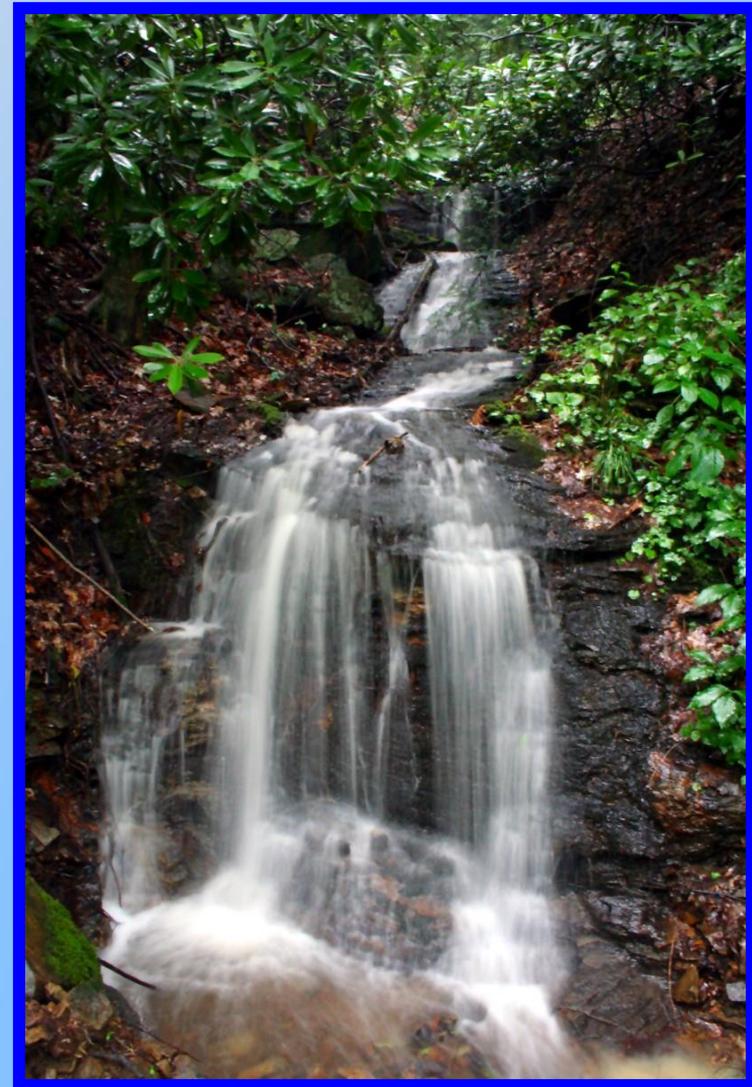
## RESOURCE ACCOUNTING

- Valuation of the Renewable and Non- renewable resources
- Valuation of water
- Valuation of land, soils and forests
- Valuation of biodiversity
- Valuation of pollution impacts
- Valuation of eco-system services





# What is the Value of Water ?





# Value a TREE

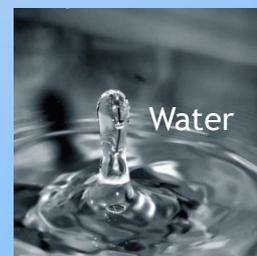


**THE AXE EFFECT**



# No price, No value?

- Many **non-market goods** and services often have **multiple positive economic values** even if they have no market price
  - Conservation of forests / protection of species / clean air & water
  - Conservation of historic buildings
  - Reduced days of respiratory illness
  - Reduced fear of crime
- Public **good characteristics / externalities**



Non-market goods

From Orapan (2009)



# Total Economic Valuation

**DIRECT USE VALUES** = derived from direct use, consumption or interaction with a tropical forest's resources and services.



**Recreation**



**Timber**



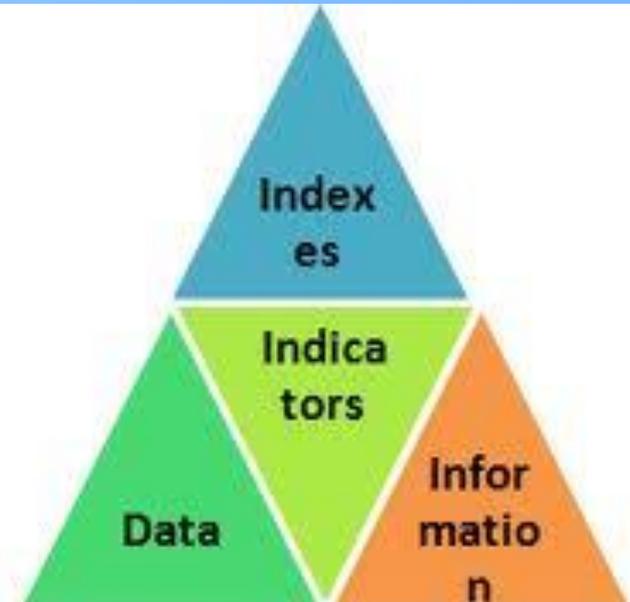
**Non-timber forest products**





# INDICATORS

- Gross National Happiness (GNH)
- Human Development Index (HDI)
- Ecological Footprint (EF)
- The Happy Planet Index (HPI)
- Sustainable Development Goals (SDG)



Source: Modified based on Spreng & Wils (1996)



# Economic & Social Indexes



- Economic and social indexes include economic and social data (such as income, educational attainment, health, etc.)



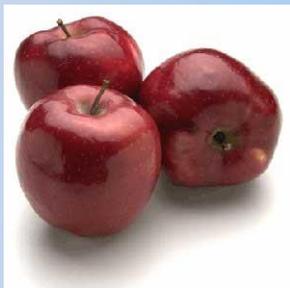
# The Human Development Index (HDI)

...is the best known composite index of social and economic well-being...

"The basic purpose of development is to enlarge people's choices. In principle, these choices can be infinite and can change over time. People often value achievements that do not show up at all, or not immediately, in income or growth figures: greater access to knowledge, better nutrition and health services, more secure livelihoods, security against crime and physical violence, satisfying leisure hours, political and cultural freedoms and sense of participation in community activities. The objective of development is to create an enabling environment for people to enjoy long, healthy and creative lives."



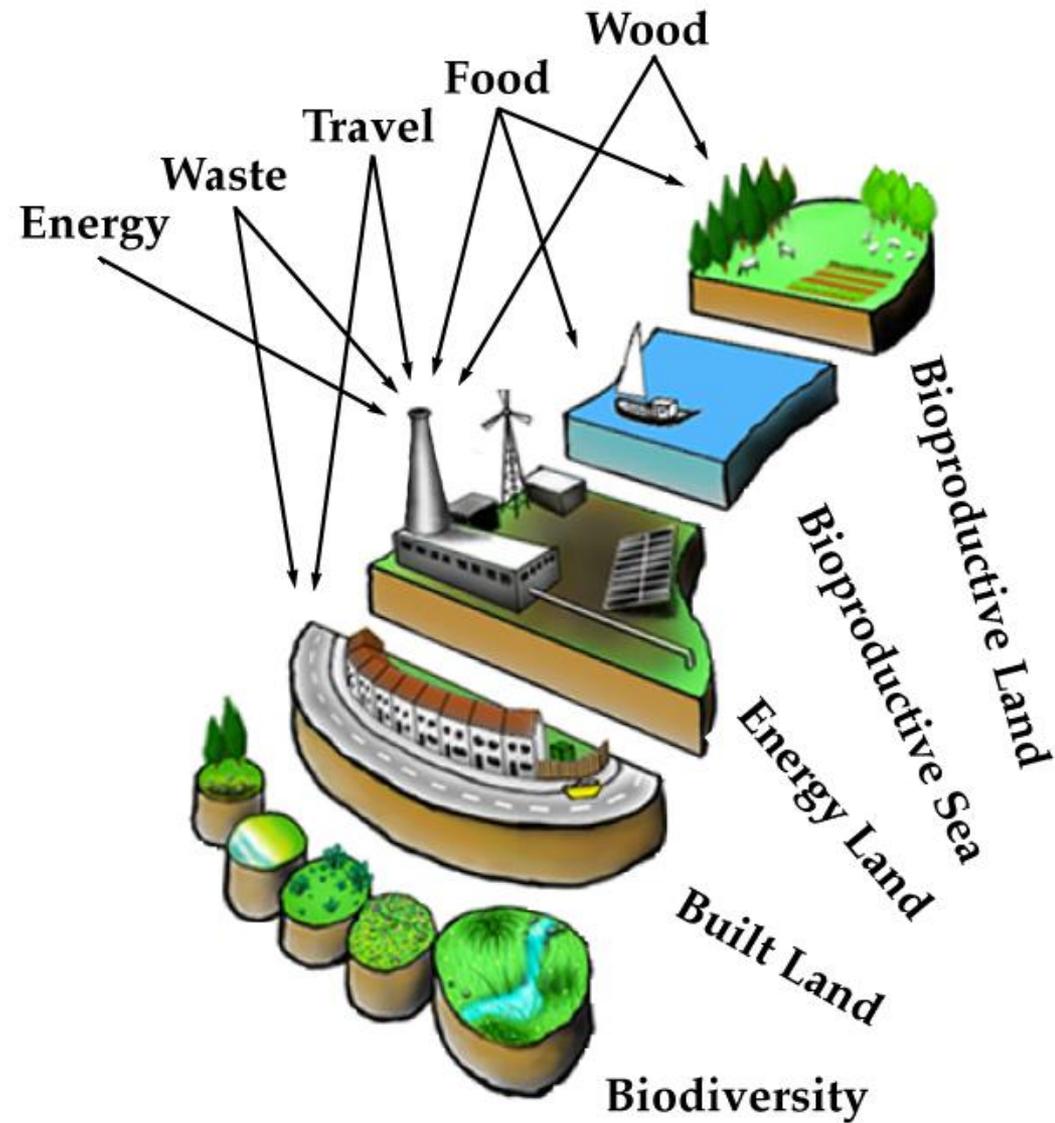
- The HDI consists of three equally weighted components:
  - (1) “A long and healthy life” (Health)
  - (2) “Knowledge” (Education)
  - (3) “A decent standard of living” (Wealth)





## Ecological Footprint(EF)

Ecological Footprint (EF) compares human consumption of natural resources with Earth's ecological capacity to regenerate them.





# The Ecological Footprint

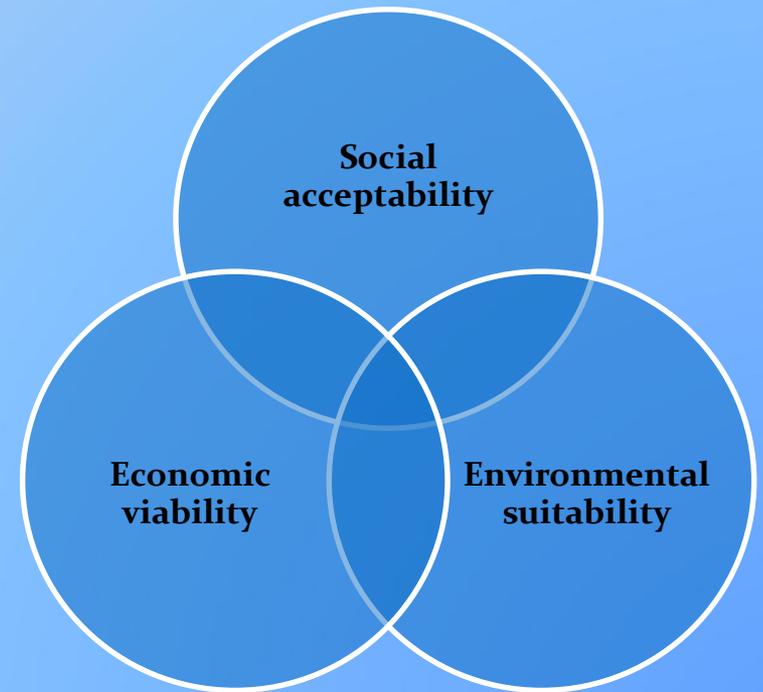
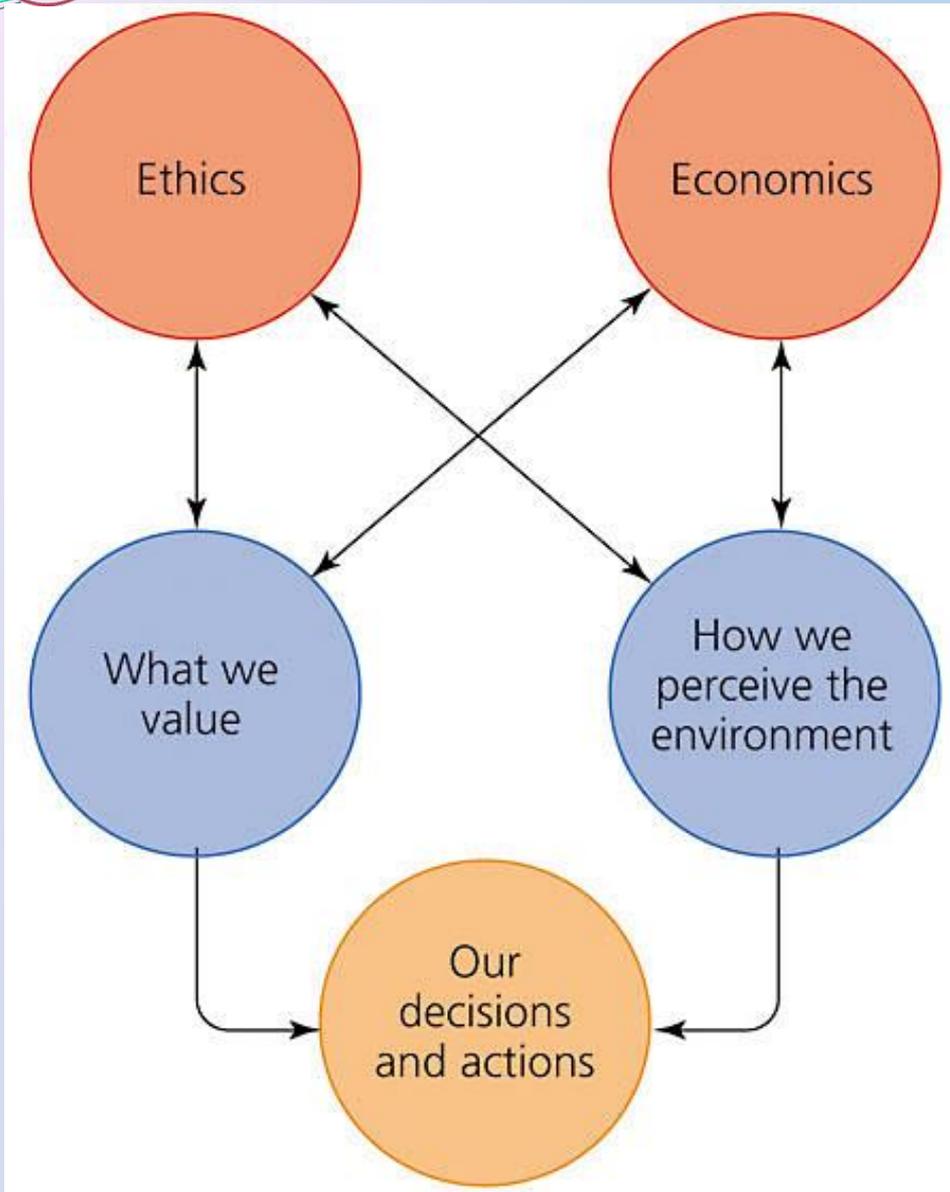


Visit

<http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/> to find out



# Conservation of Environment





# MODELS OF SUSTAINABLE DEVELOPMENT

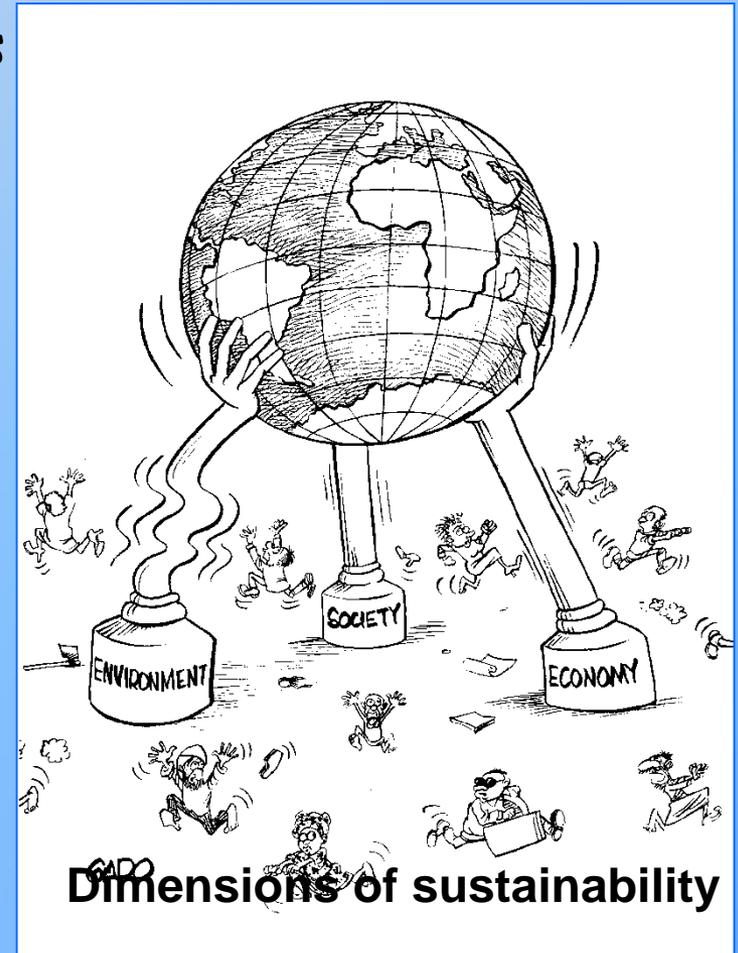


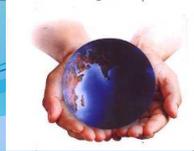
## Three Pillar Basic Model

This is one of the most well-known models created using the three dimensions - Economy, Environment and Society.

Sustainable Development is modelled on these three pillars.

It is based considering the society, but does not explicitly take into account 'human quality of life'.





## The **SDGs** are ...

- ▶ A set of 17 goals for the world's future, through 2030
- ▶ Backed up by a set of 169 detailed Targets
- ▶ Negotiated over a two-year period at the United Nations
- ▶ Agreed to by nearly all the world's nations, on 27 Sept 2015

**17**  
**GOALS**



# Environmental Issues

- Legal
- Technical
- Economic
- Social
- Political and
- Ethical





# HOW ENVIRONMENT IS MANAGED



- Awareness
- Technology
- Regulation
- Pricing



# Environmental Education





## TOOLS FOR ENVIRONMENTAL MANAGEMENT

- Concept of 4 R's
- Waste Minimization & Management
- **Environmental Impact Assessment**
- Environmental Risk Assessment
- Natural Resource Valuation & Accounting
- Environmental Management Systems (ISO 14000)  
etc



and Social

**Strategic Environmental Assessment**



and Social

**Environmental Impact Assessment**



and Social

**Environmental Management Plan**



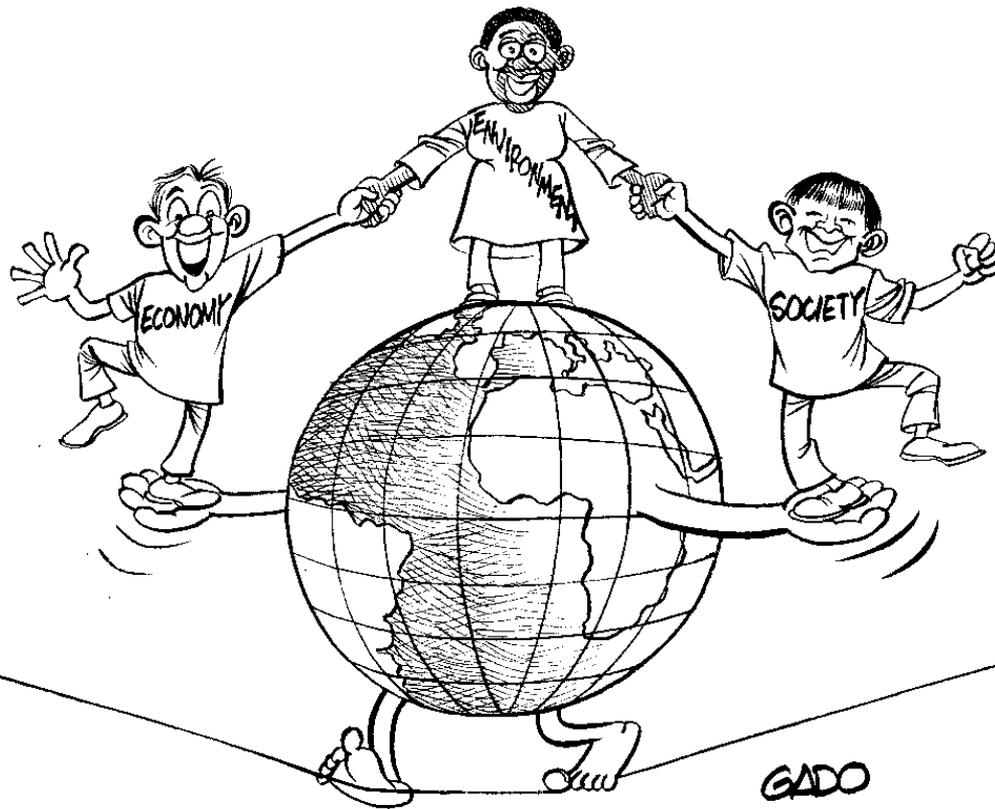
and Social

**Environmental Management Framework**





# *Environmental Impact Assessment*





# Project Evaluation



The Project Cycle, Project Planning Techniques, Project Quality Factors and Basic Needs, The Measurement of Project Performance

## **Investment Appraisal:-**

Investment and Operational Costs, Choice of Projects, Mutually Exclusive Projects and other Issues, Public Sector Appraisal Techniques

## **Social Cost Benefit, Cost Effectiveness and other Appraisal Techniques:-**

Social Cost-Benefit Analysis, Cost-Effectiveness Analysis, The Discount Rate, Risk and Uncertainty

## **Impact Assessment**

Economic Impact Analysis, Social Impact Analysis, Other Impact Analysis, Multi-Criteria Analysis, An Integrated Approach to Project Impact Assessment

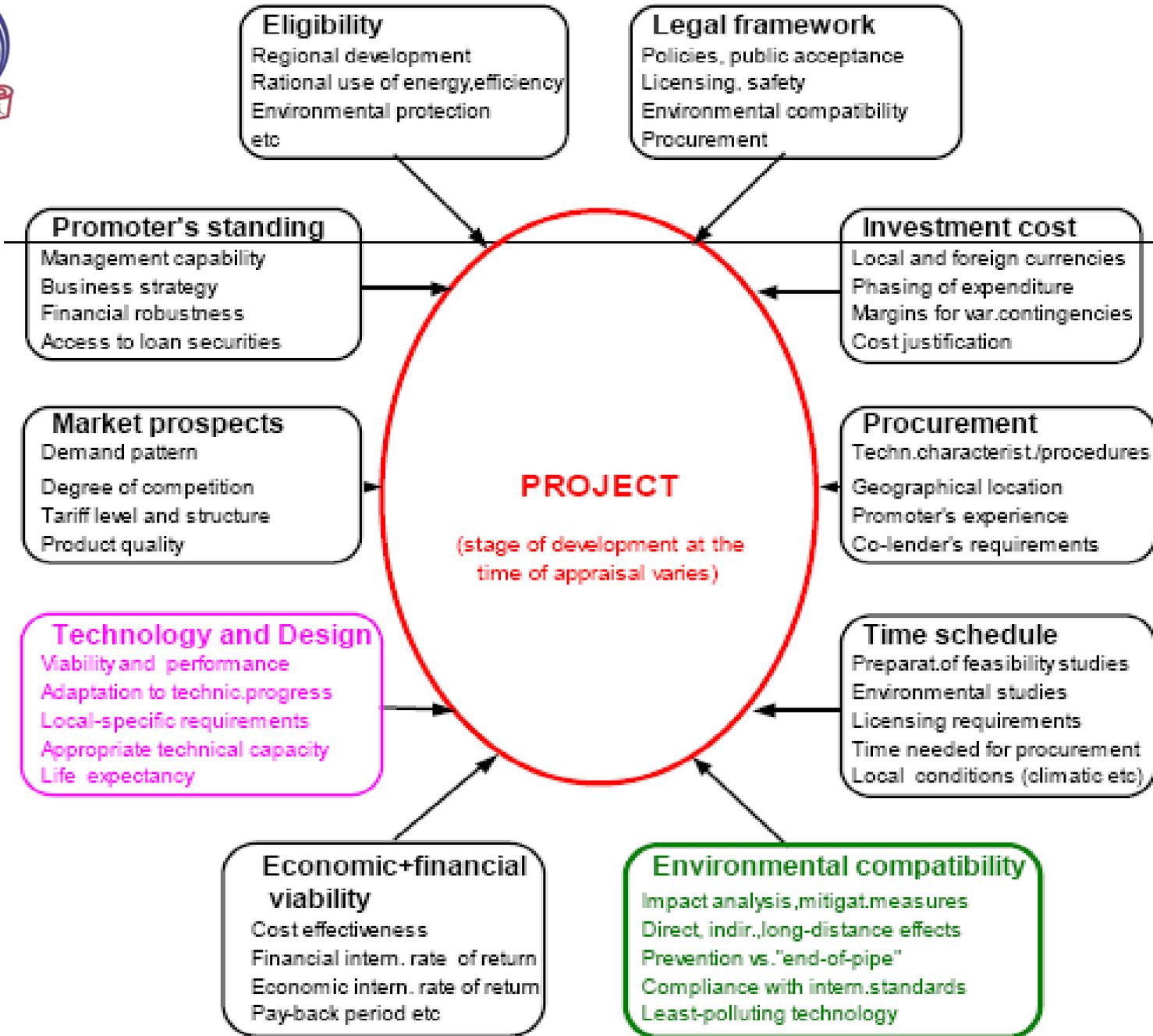
## **Environmental Impact Assessment →**

## **Political Economy, Welfare and Poverty**

Political Economy Aspects of Programmes and Projects, Welfare Aspects of Projects, Poverty Reduction and Alleviation – Do Projects and Programmes Reduce Poverty?

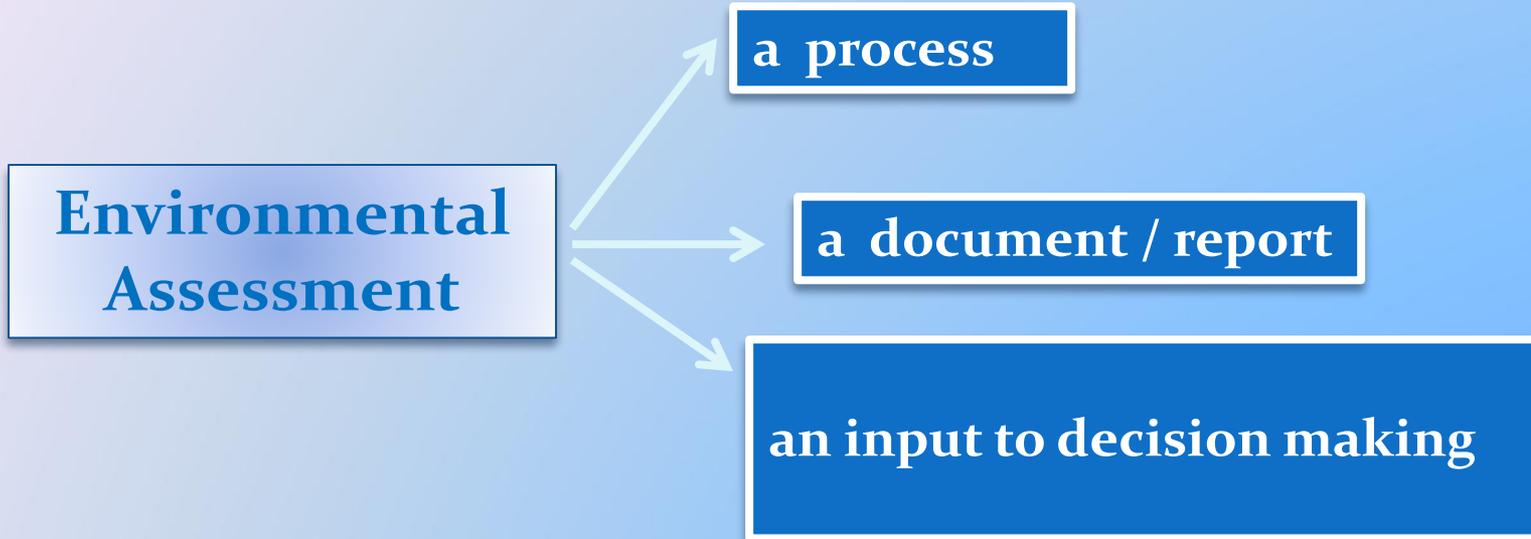
## **Risk Analysis in Project Evaluation and Appraisal**

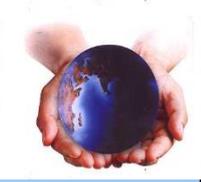
Taxonomy of Risks, Techniques for Risk Analysis, Risk and Large Projects, Uncertainty





# Environmental Impact Assessment





# What is the EIA mechanism?

There is a common misconception that an EIA is a report. In fact, an EIA is NOT simply a Report but is a Process

But EIA is a **Process** and a **Proactive planning** tool providing a major meeting point between development decisions and environmental management



# Environmental Impact Assessment

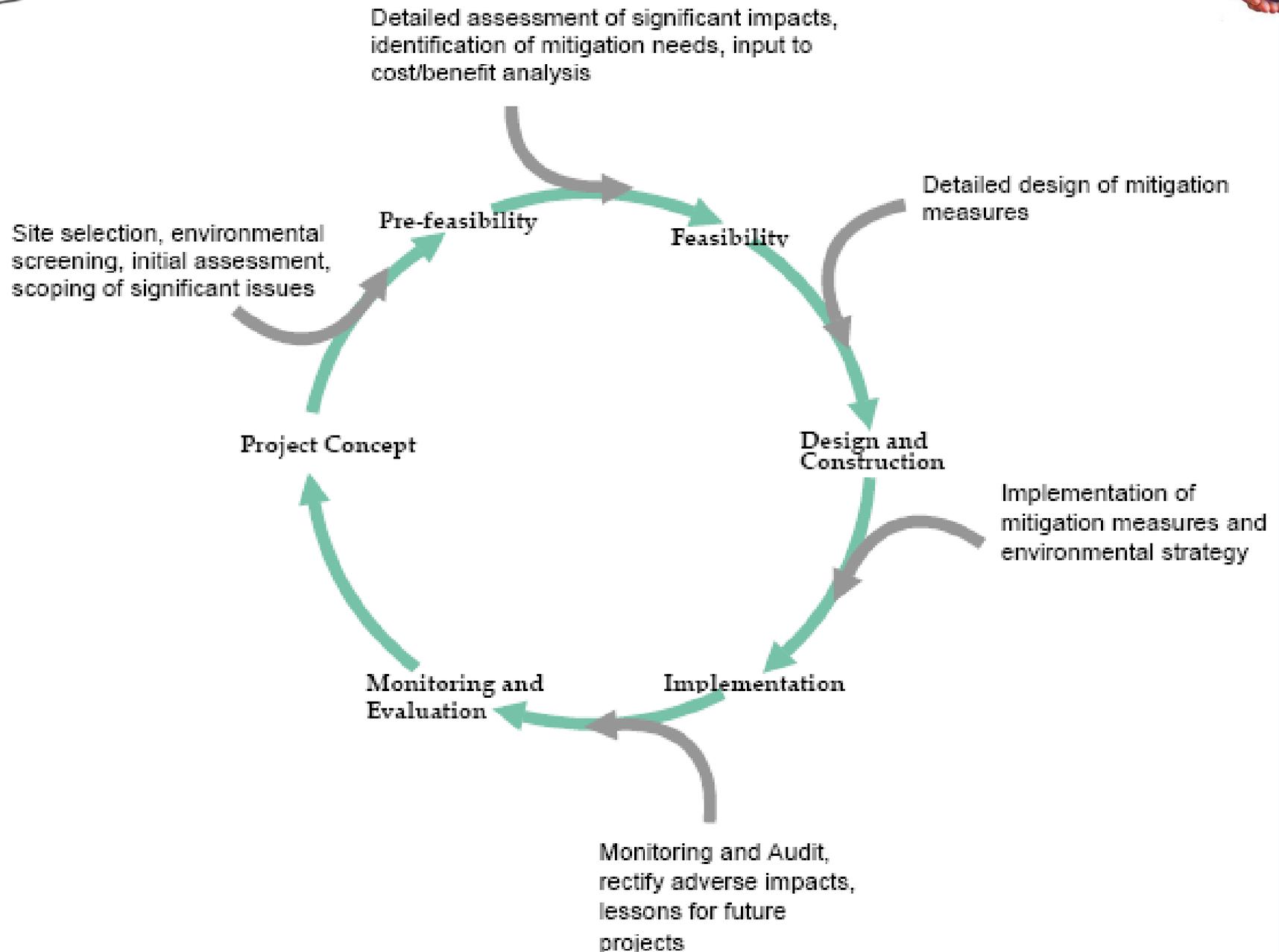


## Objectives of EIA:

- To ensure that the environmental considerations are explicitly addressed and incorporated into the development and decision-making process;
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use as well as management opportunities.

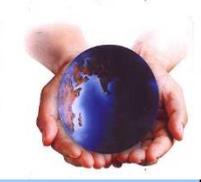


# Integration of Project Life Cycle with the EIA mechanism





## Key for legal compliance of the project



***Check whether the EIA report covers.....***

Applicable acts

Applicable rules

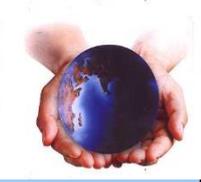
Applicable notifications

Applicable protocols

Applicable environmental norms

Applicable local restrictions

.....for the project activity / site specific  
are stated with clarity or stated in a generic version

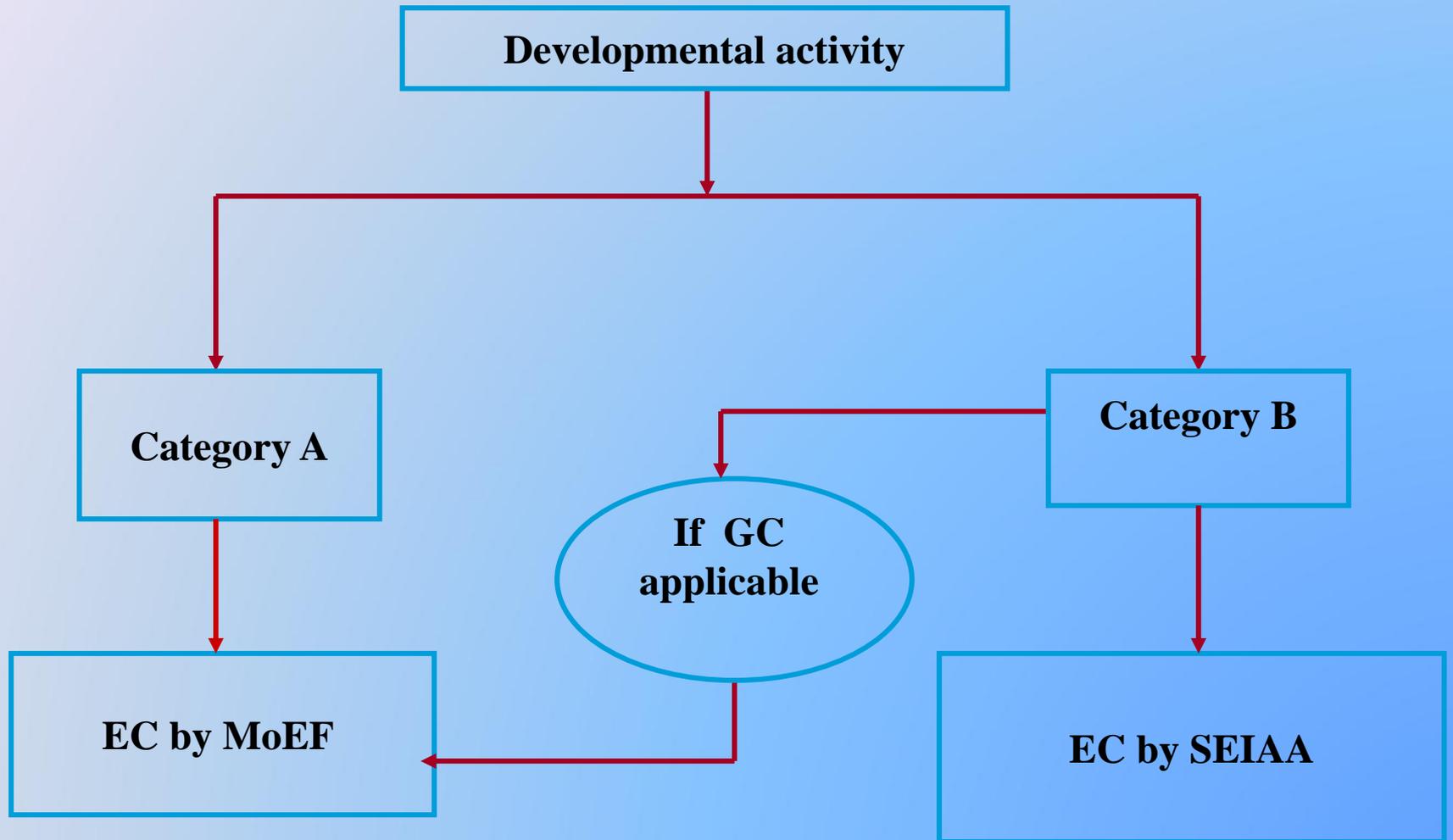


## **STAGES IN PRIOR ENVIRONMENTAL CLEARANCE**

- **Stage-I : Screening (only for Category 'B' projects)**
- **Stage-II : Scoping**
- **Stage-III : Public Consultation**
- **Stage-IV : Appraisal**



# CATEGORIZATION OF PROJECTS





# Categorization of 'A' and 'B'



(1)	(2)	(3)	(4)	(5)
"1(a)	(i) Mining of minerals	≥50 ha of mining lease area in respect of non-coal mine lease  >150 ha of mining lease area in respect of coal mine lease  Asbestos mining	<50 ha of mining lease area in respect of non-coal mine lease  ≤150 ha of mining lease area in respect of coal mine lease	General Conditions shall apply except:  (i) for project or activity of mining of minor minerals of Category 'B2' (up to 25 ha of mining lease area);  (ii) River bed mining projects on account of inter-state boundary.
		irrespective of mining area		<b>Note:</b>  (1) Mineral prospecting is exempted. ”;  (2) The prescribed procedure for environmental clearance for mining of minor minerals including cluster situation is given in Appendix XI.”;  (3) The mining leases which have obtained environmental clearance under Environment Impact Assessment Notification, 1994 and Environment Impact Assessment Notification, 2006 shall not require fresh environmental clearance during renewal provided the project has valid and subsisting environmental clearance.

# Categorization of 'A' and 'B'

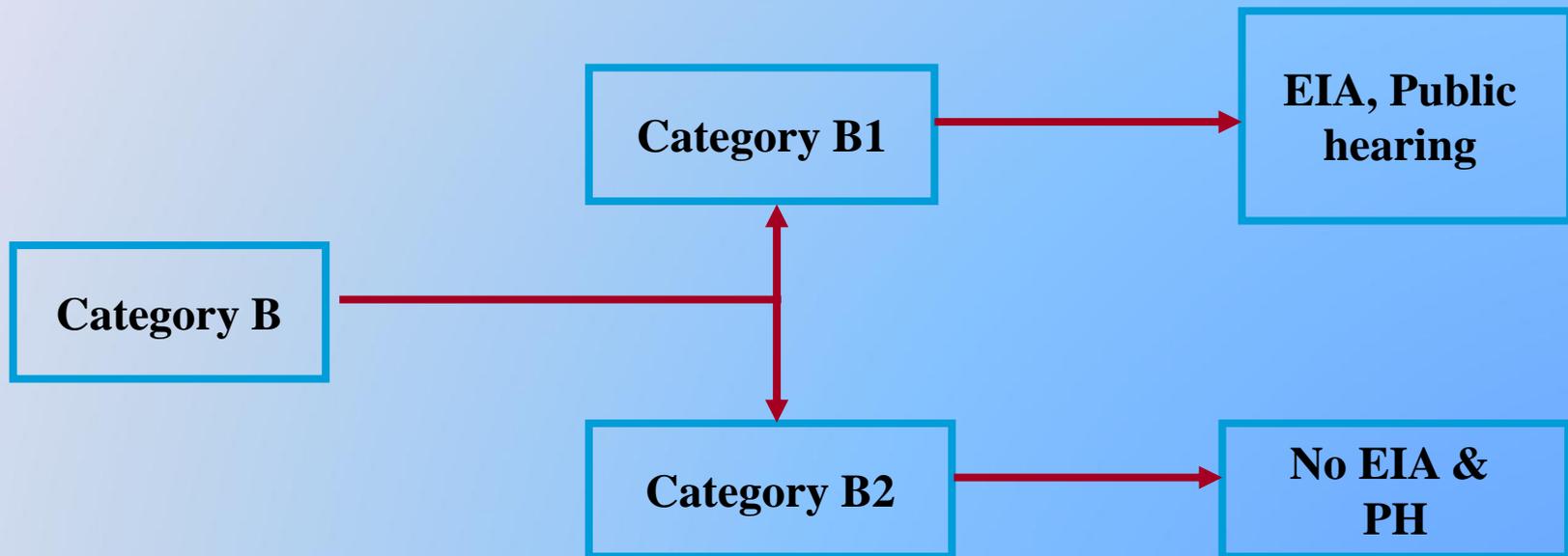
Project or Activity	Category with threshold limit		Conditions if any
	A	B	
<b>2</b>	<b>Primary Processing</b>		
<b>2(a)</b>	Coal washeries ≥ 1 million ton/annum throughput of coal	<1million ton/annum throughput of coal	General Condition shall apply  (If located within mining area the proposal shall be appraised together with the mining proposal)
<b>2 (b)</b>	Mineral beneficiation ≥ 0.1million ton/annum mineral throughput	< 0.1million ton/annum mineral throughput	General Condition shall apply  (Mining proposal with Mineral beneficiation shall be appraised together for grant of clearance)



## STAGE-I

## SCREENING

- No screening required for Category A projects
- Category B projects will be further screened by SEAC for categorization into either B1 or B2.





## ...SCOPING

**Application in Form-1,  
Pre-feasibility Report & Draft TOR by PP**

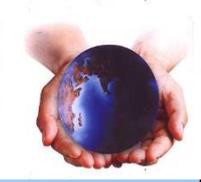


**EAC/SEAC to determine  
TOR for EIA Preparation**



**Intimation of Final TOR to project  
proponent and display in Website**

**To complete in 60 days (both Screening & Scoping)**

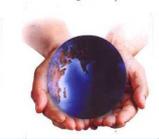


The TOR will typically cover:

- Details of PP and EIA consultant
- Project core area description with surrounding details .....
- Environmental sensitivity areas within 15 kms – **Form I**
- Project activity description with capacities / key facilities
- **Applicability of EIA Notification – Category A or B**
- **Applicability of GC conditions**
- **Applicability of CRZ Notification**
- **Applicability of Forest(Conservation) Act 1980**
- **Applicability of Wildlife (Protection) Act 1972**



## What Project Proponents should give in a TOR



- 1) **Year-wise production**
- 2) **Rightful lessee of the mine**
- 3) **Approved mine plan**
- 4) **Mine lease area**, superimposed on a High Resolution Imagery
- 5) Survey of India **Toposheet in 1:50,000**
- 6) State land diversion for mining should have **approval from State land use board or the concerned authority.**
- 7) **Mine Safety**
- 8) The **study area** will comprise of 10 km zone around the mine lease from lease periphery
- 09) **Land use of the study area** delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated.
- 10) Details of the land for any **Over Burden Dumps outside the mine lease**



## 11) R&R Plan/compensation details for the Project Affected People

- 12) A Certificate from the Competent Authority in the **State Forest Department** should be provided, confirming the involvement of forest land, if any
- 13) Deposition of **net present value (NPV) and compensatory afforestation (CA)**
- 14) **Recognition of forest rights** under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
- 15) Impact of the project on the **wildlife**
- 16) **Progressive Greenbelt Development Plan**
- 17) **Conceptual post mining land use** and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.
- 18) **Occupational Health impacts**
- 19) **Public health implications of the Project**
- 20) **Socio economic significance**



## Generic structure of environmental impact assessment document



**In terms of the EIA notification of the MoEF dated 14th September 2006, the generic structure of the EIA document should be as under:**

- **Introduction**
- **Project Description**
- **Analysis of Alternatives (Technology and site)**
- **Description of the Environment**
- **Anticipated Environmental Impacts & Mitigation Measures**
- **Environmental Monitoring Programme**
- **Additional Studies**
- **Project Benefits**
- **Environmental Cost Benefit Analysis**
- **Environmental Management Plan**
- **Summary & Conclusion**
- **Disclosure of Consultants engaged**



# Full EIA Report: Contents



## Section

## What it should tell us

## Keep in mind...

Policy, Legal and Administrative framework

Where national framework is sufficient to provide desired results

Categorization

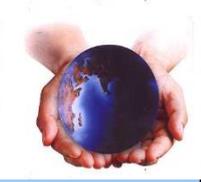
Whether it attracts EIA

Whether project as proposed will comply with national laws/regulations;

Include assessment of institutional structure and capacity for implementation & enforcement

Institutional framework for implementation





## Chapter on Introduction

- Profile of the PP
- Site Description
- Broader details of the basic activities
- Any notified restrictions / limitations from environmental angle
- Applicability of EIA Notification, 2006 / Forest (Conservation) Act, 1980 / Wildlife (Protection) Act, 1972 / CRZ Notification, 2011
- Status of litigations / court orders
- Applicability of GC conditions as per EIA Notification, 2006



# Full EIA Report: Contents



## Section

## What it should tell us

## Keep in mind...

### Project Description

Key elements of proposed project (objectives, location, design, implementation arrangements), with strong emphasis on aspects relevant to its potential environmental and social impacts.

Include all elements important to the project, including “ancillary” and “offsite” investments and facilities which might already exist or might be financed by others, but which are necessary for the project’s operation.

Provide detailed description of project elements with potential significance for environmental and social impacts (e.g. scale, technology, access arrangements, etc.).





## EIA OF MINING OF MINERALS INFLUENCE BY

- Deposit size, host rock lithology and wall rock alteration
- Nature of Ore and Trace Element Geochemistry
- Ore and gangue mineralogy
- Topography, Physiography, Climate and Hydrology
- Mining & Milling Methods employed



# MAJOR MINING OPERATIONS



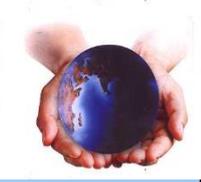
- Land use for Mining & Infrastructure development
- Displacement of persons
- Top soil removal
- Drilling and blasting
- Overburden dumping
- Mineral beneficiation
- Mine water pumping
- Toxic/contaminated waste water discharge mineral transportation
- Supporting activities





# Open Cast Mine

- Stripping Ratio
- Working Deptt. (BGL & MSL)
- Mining Plan (High & Width of the bench in over burden, ore body, slopes)
- Surface plan should 3<sup>rd</sup> yr, 8<sup>th</sup> yr, 13<sup>th</sup> yr, 18<sup>th</sup> yr, 23<sup>rd</sup> yr, 28<sup>th</sup> yr, closure.
- Type of blasting, drilling & Explosive
- Detail of Machinerics



# Underground Mine

- Season / Ore Body (Min., Max. Average & Thickness)
- Mode of entry to mine (Shaft, Adit & Incline)
- Details of Machineries
- Method of Stopping
- Extraction Method
- Mine water drainage



# Full E(S)IA Report: Contents

## Section

## What it should tell us

## Keep in mind...

### Analysis of Alternatives

Identify feasible alternatives (hopefully but not necessarily considered in Feasibility Study or prior planning activities)

Evaluate all above options with respect to environmental and social impacts

Indicate any options that are unacceptable or not recommended from env/social perspective and why.

Indicate any option(s) that are clearly preferred from env and/or social perspective and why.

Include “no project” option but not only this (except where no other feasible options exist).

Describe any previous alternatives analysis done previously (e.g. in context of spatial planning).

Avoid comparison to minor technical variations of same basic option.

Analyze/compare options – do not just list/describe them.

To extent possible, use objective methodology, e.g. multi-criteria analysis, scenario modelling, etc.





# Full EIA Report: Contents

**Section**

**What it should tell us**

**Keep in mind...**

Baseline Data  
(physical,  
biological,  
social

- Current status, trends for elements that are important for human wellbeing and/or environmental health and could be affected by the project;
- discuss Limits of Acceptable Change where possible

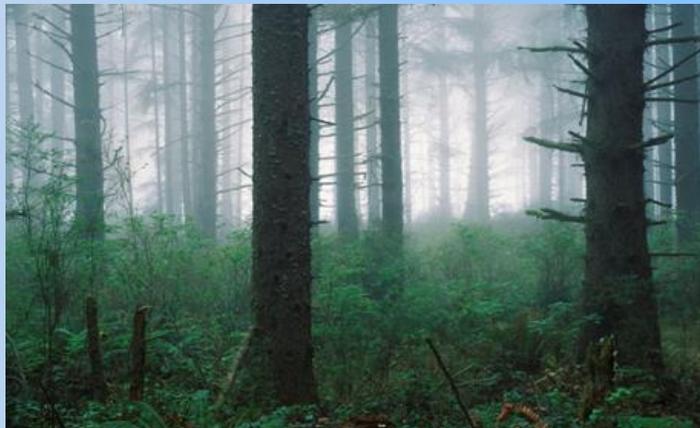
Focus on aspects that could influence or be affected by the project, indicating how they relate to the project.

Avoid general “data dump” of detailed information with no relevance to the project or its impacts.

Indicate methodology/sources used for data collection

For bio data may need to cover more than one season.

Use time frame/resolution that is relevant to the project timeframe





# Description of Environment

## Study area for secondary data

Study area for secondary data as specifically mentioned at column 9(III) of Form 1 of EIA Notification.....15 kms from the project boundary



## Study Area for Primary Data EIA guidance manuals

<b>Sector</b>	<b>Study Area</b>
<b>Mining project</b>	<b>Project area and 10 kms (mine lease area more than 50 ha) &amp; 5kms mine lease area of 5-50ha</b>
<b>Mineral beneficiation</b>	<b>Project area and 5 kms</b>
<b>Coal washeries</b>	<b>Project area and 5 kms</b>
<b>Building &amp; construction project</b>	<b>Project area and 0.5 kms</b>
<b>Township</b>	<b>Project area and 2 kms</b>



# COMPONENTS OF DATA QUALITY

## MICROLEVEL COMPONENTS

POSITIONAL  
ACCURACY

ATTRIBUTE  
ACCURACY

LOGICAL  
CONSISTENCY

RESOLUTION

## MACRO LEVEL COMPONENTS

COMPLETENESS

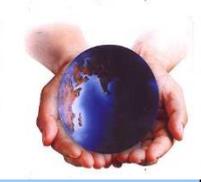
TIME

LINEAGE

## USAGE COMPONENTS

ACCESSIBILITY

DIRECT AND  
INDIRECT COSTS



# ENVIRONMENTAL COMPONENTS

- Land (Topography, Geology, Soil)
- Air (Climate Meteorology, Air Quality)
- Water
- Noise
- Biological (Flora & Fauna)
- Socio-Economic



# Data



- **Primary Data**
- **Secondary Data**

## SCOPE OF TYPICAL BASELINE STUDIES:

### *PHYSICAL ENVIRONMENT*

- **terrestrial**
  - land use
  - topography [terrain] and soils,
  - geology/seismology.
- **aquatic**
  - water quality
    - § surface water
    - § groundwater
  - morphology
  - hydrology
- **atmospheric**
  - air quality and Climate
  - meteorology
  - noise



# Ecological Resources

- § fisheries
- § aquatic biology
- § wildlife
- § forests
- § rare or endangered species
- § protected areas
- § coastal resources



# ***SOCIO-ECONOMIC ENVIRONMENT***



- history
- economic base
- labour supply/employment
- demography and population
- housing supply
- community/social services
- municipal finance/planning
- social and cultural patterns
- transportation
- tourism

## ***HERITAGE***

- heritage
- archaeological



## Information / Data Components of EIA



- (i) baseline information about the environmental, social, and economic conditions in the project area;
  - (ii) information on potential impacts of the project and the characteristic of the impacts, magnitude, distribution, who will be the affected group, and their duration;
  - (iii) information on potential mitigation measures to minimize the impact including mitigation costs;
  - (iv) to assess the best alternative project at most benefits and least costs in terms of financial, social, and environment.
- In addition to alternative location of the project, project design or project management may also be considered; and
- (v) basic information for formulating environmental management plan.



# STUDY AREA



Settlements

Highway  
Development

Water Quality  
Study Area

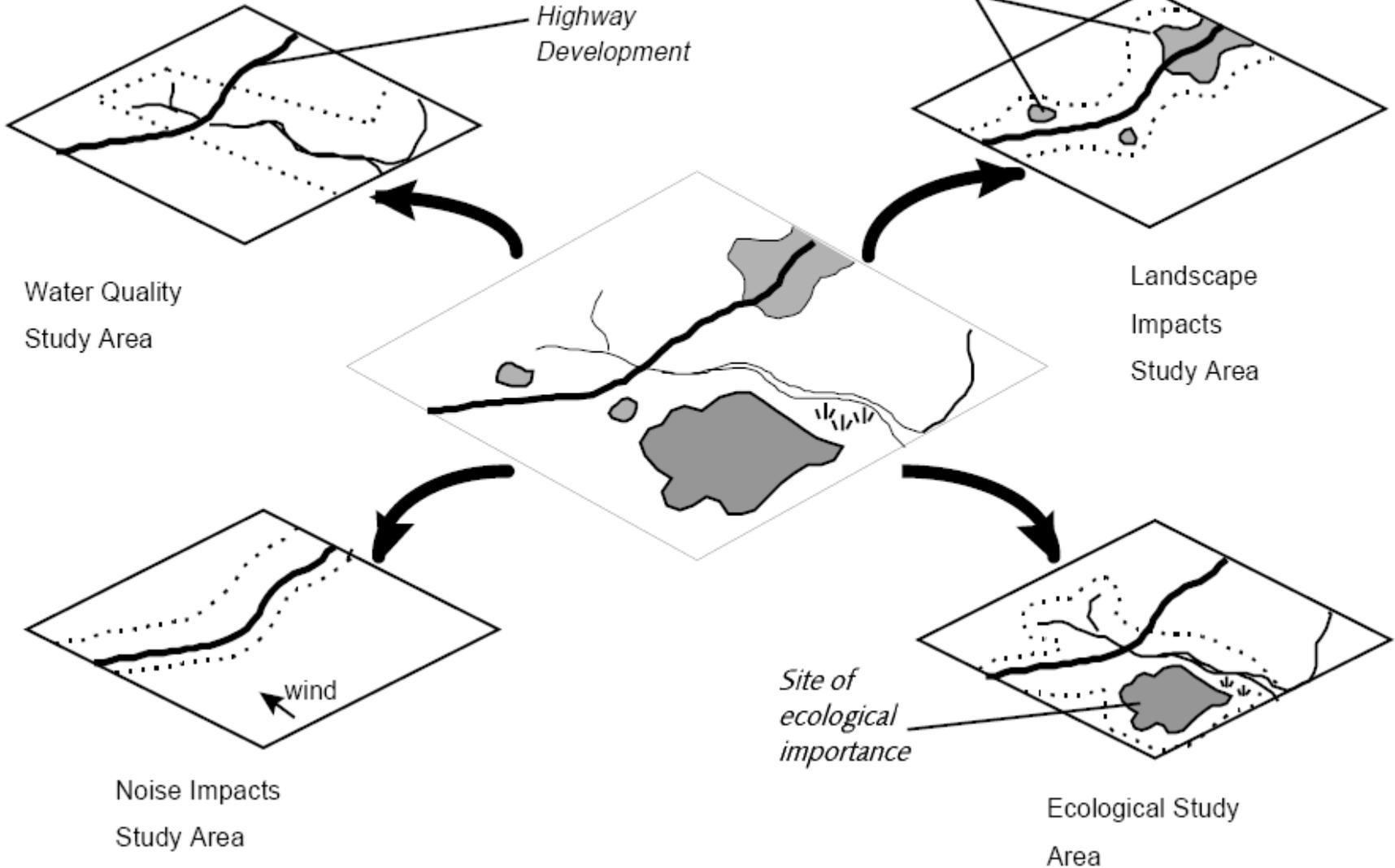
Landscape  
Impacts  
Study Area

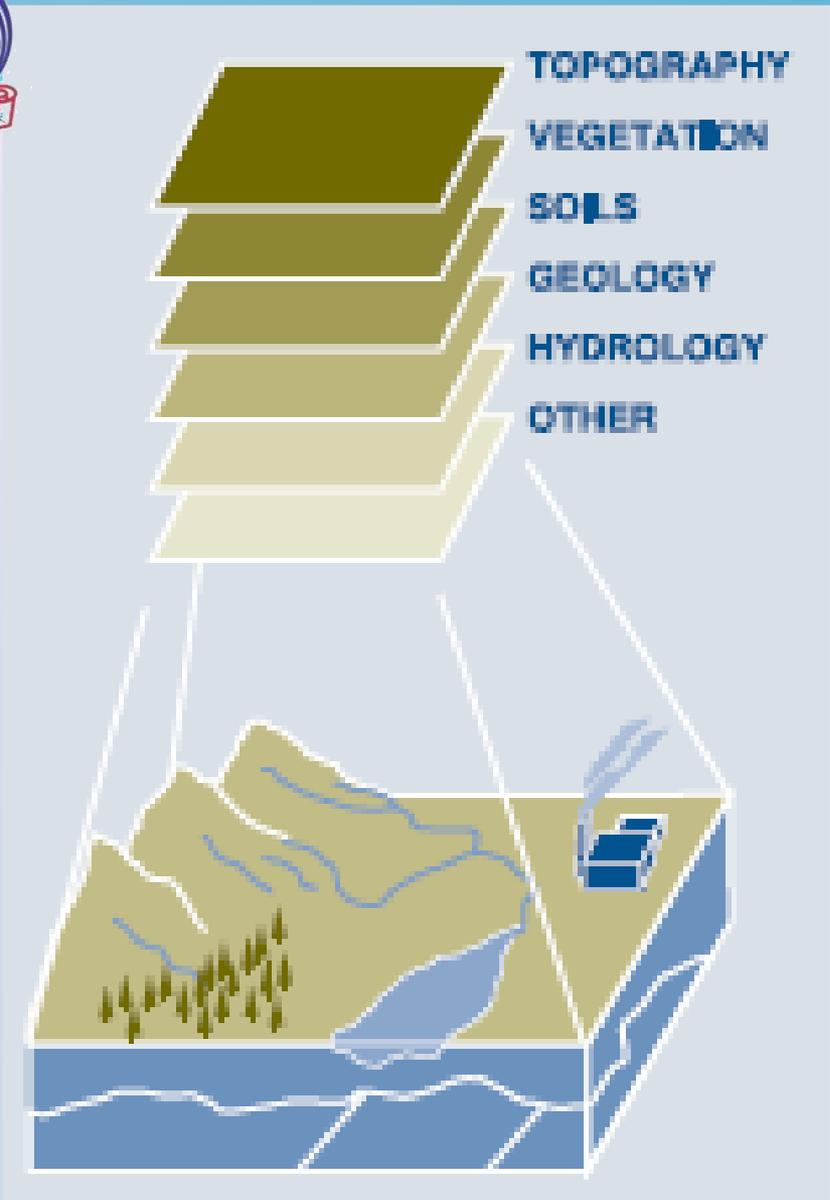
wind

Noise Impacts  
Study Area

Site of  
ecological  
importance

Ecological Study  
Area





GIS methods

*Tools and Methods  
Of  
Representation*

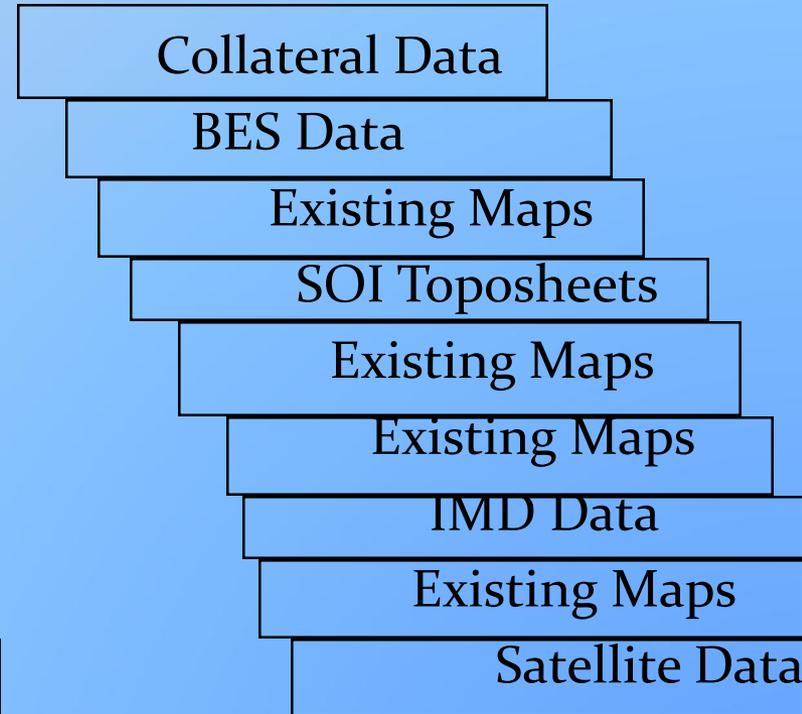
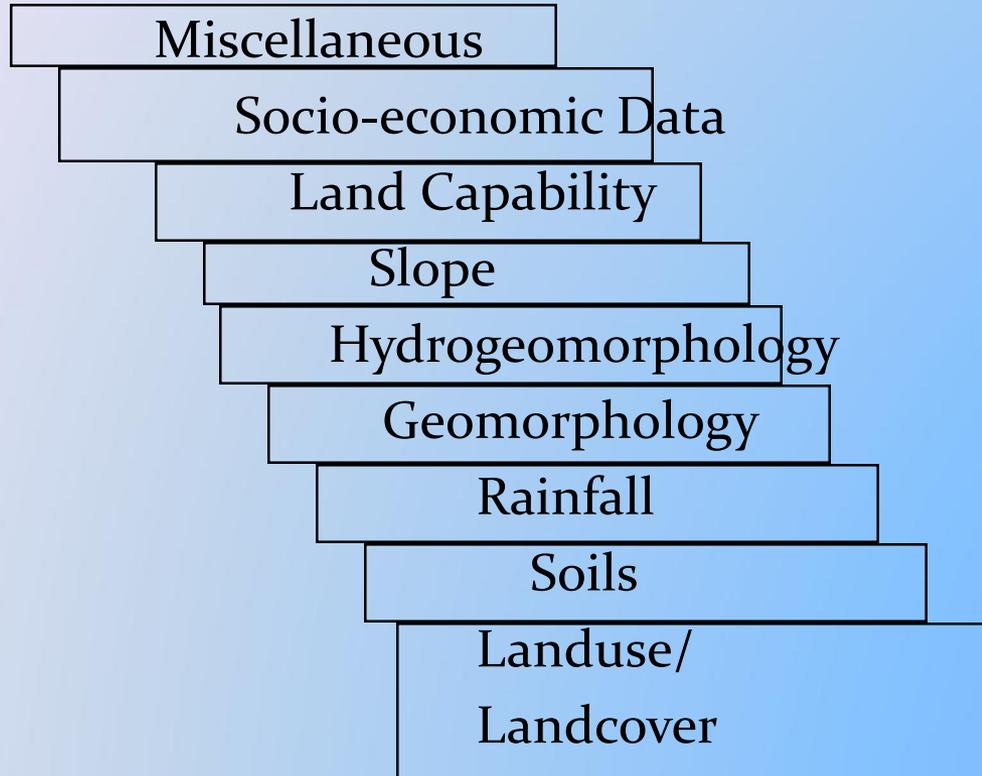


# DIFFERENT LAYERS AND THE DATASOURCE

## FOR GIS DATABASE

### THEMATIC LAYERS

### DATA SOURCES





# Full E(S)IA Report: Contents

Section

What it should tell us

Keep in mind...

Environmental  
and Social Impacts

Foreseeable changes in baseline conditions likely to be caused by the project. Include:

- direct and indirect impacts
- Positive and negative
- likelihood of impacts
- Potential significance of impacts, in relation to ecosystem stability, species survival, Limits of Acceptable Change..
- Potential cumulative impacts
- All project stages
- Residual impacts (expected to remain after all feasible mitigation measures are done)

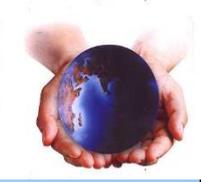
Set study boundaries based on project Area of Influence. Focus on features that could influence or be affected by the project (indicating how they are relevant to the project).

Indicate methodology/sources used for data collection

For biological data may need to cover more than one season.

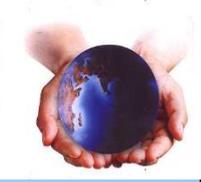
Use time frame/resolution that is relevant to the project timeframe.





# Key Impacts - Direct and Cumulative

- Positive impacts
  - Focus on developing Environmental Management Plans
- Cumulative Impacts
  - Air quality
  - Noise
  - Water
  - Land disturbance and degradation
  - Mine rehabilitation
  - Mine subsidence
  - Methane gas emissions



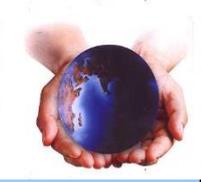
## Basic principle in mitigation planning

An EIA mechanism can apply to projects, in the following order of priority :

**Avoid** adverse environmental impacts

**Minimize** and control adverse environmental impacts

**Mitigate** adverse environmental impacts



## Checklist ....Five “W”s

- **What** mitigation measures will be implemented?
- **Who** will implement the measures?
- **When** will the measures be implemented?
- **Where** (i.e at What location) will the measures be implemented ?
- To **What** standards or requirements should these measures be implemented?



# Full E(S)IA Report: Contents

Section

What it should tell us

Keep in mind...

Environmental Management Plan (Mitigation and Monitoring)

What measures are needed to stay within acceptable limits of change.

What other measures are recommended to further reduce negative impacts and/or enhance positive impacts/sustainability

Monitoring indicators both for implementation of mitigation measures and for

Include capacity building as needed to ensure mitigation and monitoring measures can be implemented

Do “reality check” on mitigation measures (Feasible? Practical? Affordable? Likely to be successful?)

Include monitoring indicators for verifying implementation of mitigation measures (e.g. erosion barriers are installed), and for outcomes (e.g. water quality measures)

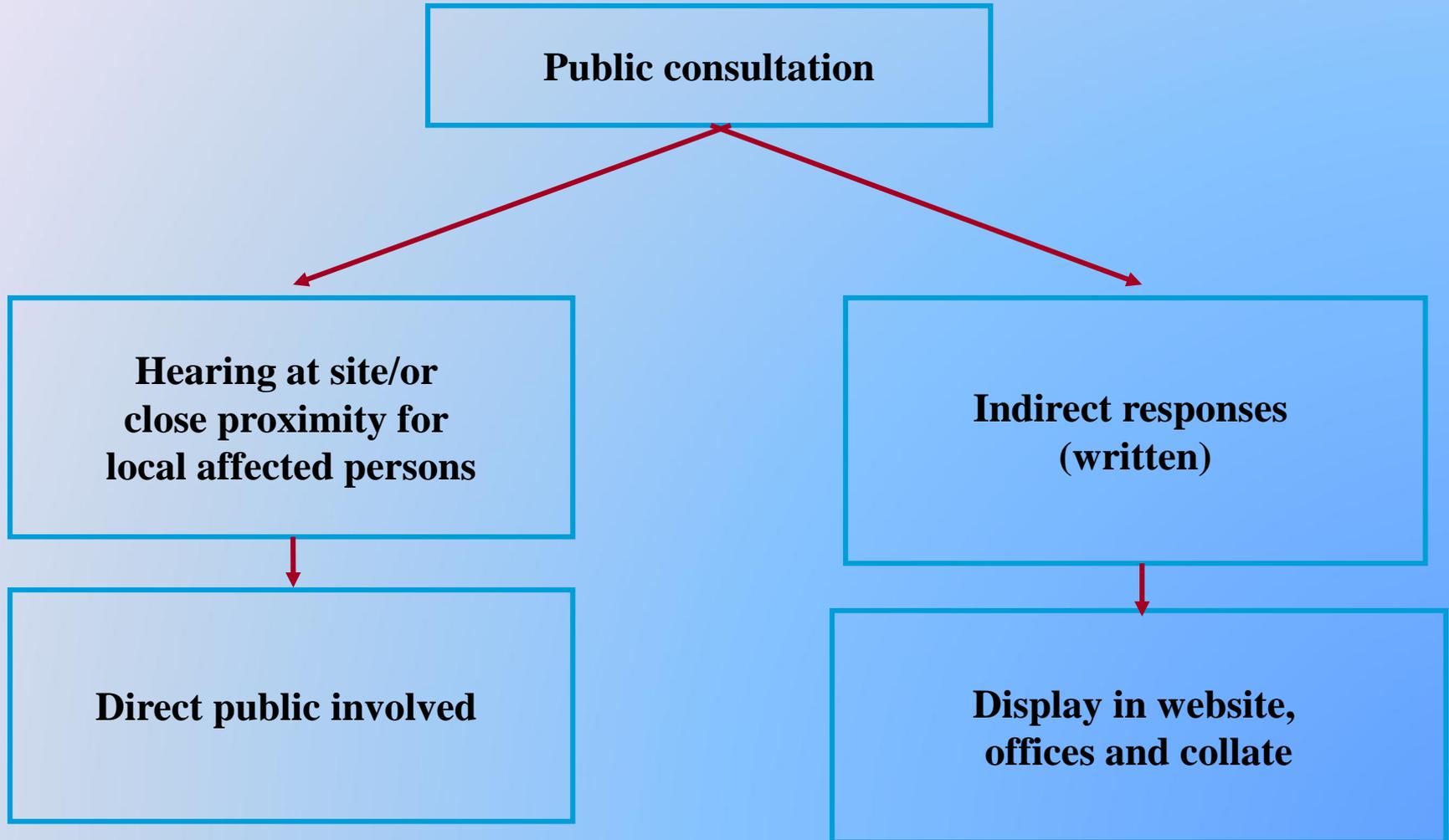


## STAGE-III

## PUBLIC CONSULTATION



To ascertain the concerns of local affected persons and others who have a plausible stake in environmental impacts of the project.

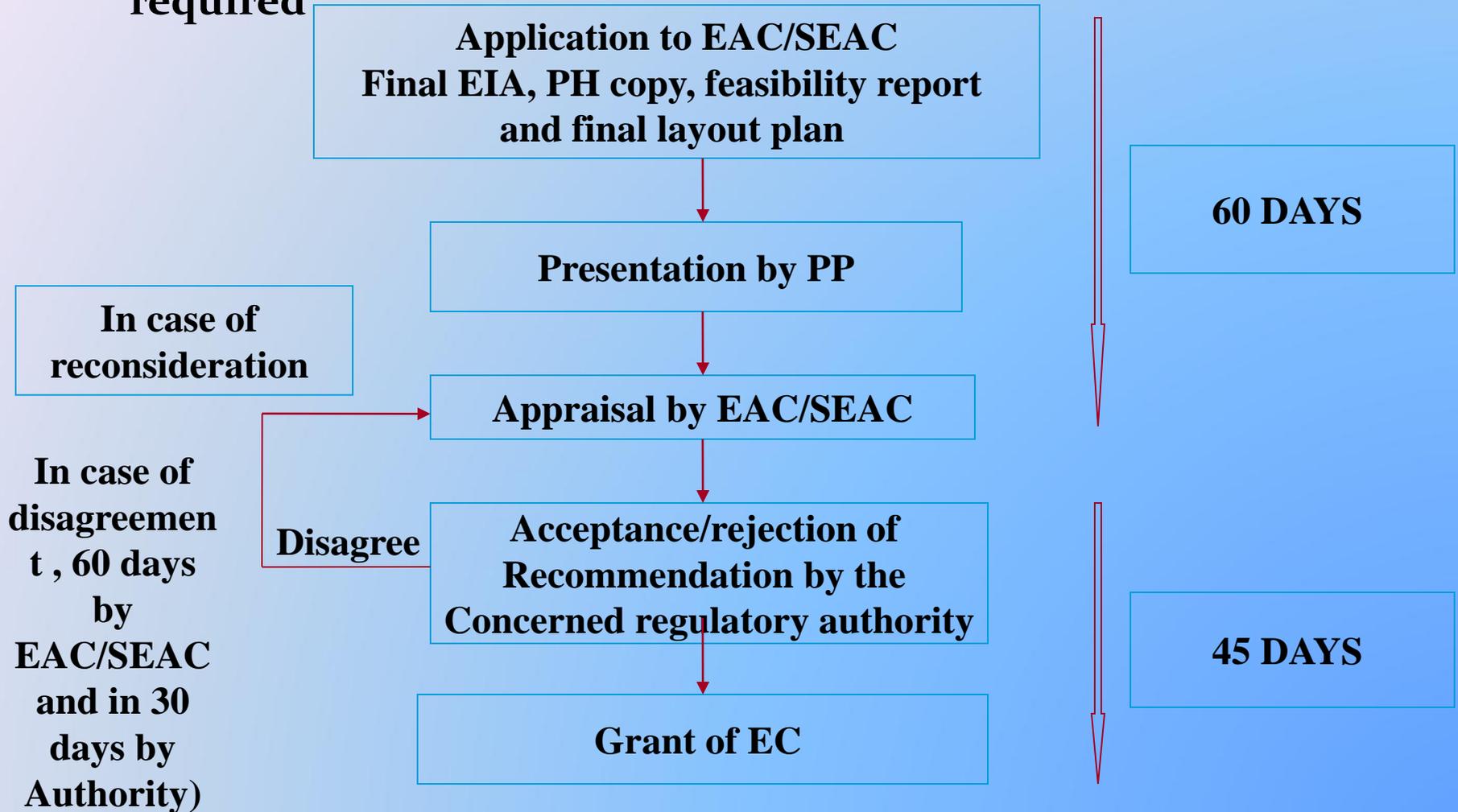




## STAGE-IV

## APPRAISAL

- Appraisal means detailed scrutiny of application in Form-1/Form-1A, final EIA report as per TORs and after PH, if required





## What Are Post Environmental Clearance Monitoring Requirements



Category A projects - The complete EC order prominently advertised in **at least two local newspapers** of the district. Shall also display in the PP's website permanently

Category B projects – The PP shall prominently advertise in the **newspapers** indicating that the project has been accorded environmental clearance and the details of MoEF website where it is displayed

The PP shall submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions on 1<sup>st</sup> June and 1<sup>st</sup> December of each calendar year.

All such reports shall be public documents. The latest such compliance report shall also be displayed on the website of the concerned regulatory

*Source : S.O 3067 (E) dated 1<sup>st</sup> December 2009 of MoEF*



# Sustainable Development



- A complex, multi-dimensional, time-determined and highly contextual state or condition adhering to the basic principle *“that the natural resource base must be utilized in a manner that its ability to provide current and future goods and services useful to human society is not impaired.”*
- *“It is a type of development which is economically viable, environmentally appropriate and socially acceptable.”*



**Thank You**