

# UNIT 1

## Waste and Resource and Sustainable Development

### Hazardous waste and Non-Hazardous waste

#### Hazardous Waste

- Hazardous waste is any waste material that is dangerous or harmful to human health or the environment.
- It exists in solid, liquid, or gas.

#### → Causes and Historical Impact:

- These are increased significantly with industrial and technological advancement.
- In industrial revolution (1700–1800), increased significantly due to increase of factories & industrial processes.

#### Basel Convention (Regulation of Hazardous Waste)

- It was signed by 199 countries to control the movement and disposal of hazardous waste.
- It was enforced in 1992.
- In 2019, plastic waste was officially added to it.

This includes one or a combination of the features in the EPA's **Resource Conservation and Recovery Act (RCRA)** which includes the following characteristics:

- Corrosivity
- Ignitability
- Reactivity
- Toxicity

#### Non-Hazardous Waste

- Non-hazardous waste is any waste that causes no harm to human or environmental health.
- Non-hazardous industrial waste can often be recycled and used as a raw material.
- They can typically be managed and disposed of through a variety of methods, such as:
  - **Landfills** – which involves burying the waste in designated area.
  - **Incineration** – burning the waste to reduce the volume and disinfect it from pathogens.

## Waste Management Hierarchy

### Waste Analysis

- Determines the exact composition of waste.
- Helps track food loss and waste (FLW) and categorize discarded food.
- Essential for proper waste handling and management.
- Generates reports that help track waste from source to disposal.

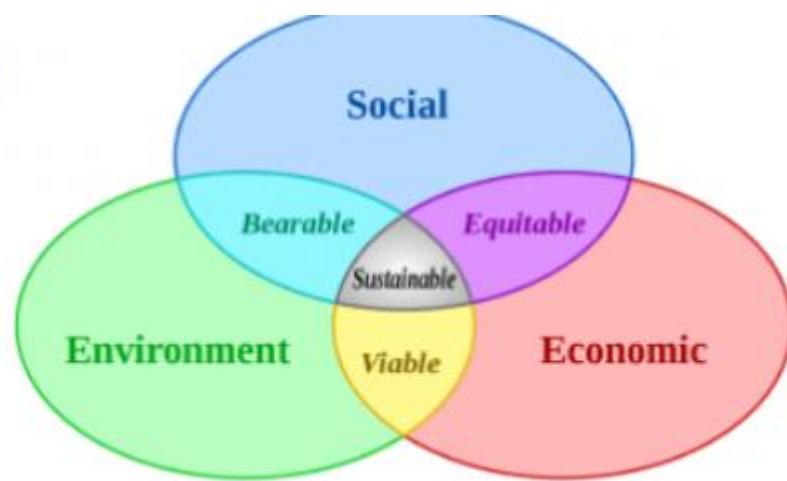
### Waste Analysis Plan

- A structured approach to managing waste.
- Identifies, quantifies, eliminates, and prevents waste.
- Ensures proper treatment and disposal of hazardous materials.
- Helps manage corrosive and hazardous waste.
- Also known as a “waste mitigation plan.”



## Sustainable Development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.





### Indian challenges in sustainable development

1. Tracking progress issues
  - India struggles to measure its progress on SDGs properly.
  - It lacks reliable indicators to track outcomes.
2. Safe drinking water confusion
  - Hand pumps and tube wells are considered "safe," but this is unclear.
  - Official data says 86% of Indians have safe drinking water.
3. Health problems from water
  - Many people still suffer from waterborne diseases.
  - Diarrhea-related deaths are a serious issue.

# Globalization

## Definition

- It is the process of expanding business and operations worldwide.
- It is driven by technological advancements and global communications.
- Socioeconomic, political, and environmental developments also contribute to globalization.

## Goal of Globalization

- Helps businesses reduce costs and increase competitiveness.
- Allows companies to sell more products and services to a larger global market.
- Encourages investment by opening new markets and accessing new resources.

## Economic Globalization

Economic globalization refers to how economies around the world are becoming more connected and dependent on each other. Key aspects like:

- Trade
- International capital flow
- Technology spread

## Benefits of Globalization

- **Economic growth:** Boost economies worldwide
- **Cultural exchange:** Encourages global sharing of traditions, ideas, and values
- **Financial integration:** Enables businesses to trade and invest internationally
- **Work transformation:** Changes job opportunities and work structure
- **Global citizenship:** People connect beyond borders
- **Easy access to goods & services:** Reduces importance of product origin & geographic distance

## Economic Growth

- It refers to an increase in the size of a country's economy over a period of time.
- It is typically measured by the total production of goods and services in the economy, which is called GDP – Gross Domestic Product.

## What is Economic Growth in Sustainability?

Sustainable economic growth is economic development that attempts to satisfy the needs of humans but in a manner that sustains natural resources and the environment for future generations.

## **Sustainability Indicators**

These are used to assess the environmental, social, and economic aspects of a system or organization to determine its overall sustainability.

### **Key Points:**

#### **1. Definition:**

It is a measure that helps evaluate sustainability in terms of resource use, emissions, biodiversity and circularity.

#### **2. Types:**

These can be quantitative or qualitative.

#### **3. Purpose:**

- Track progress toward sustainability goals.
- Identify areas that need improvement.
- Help in making informed, sustainable decisions.
- Communicate and disclose sustainability-related information.

### **Why are sustainability indicators important?**

#### **1. Monitoring & Assessment:**

Track environmental, economic and social changes over time.

#### **2. Decision Making:**

Helps policymakers make evidence-based choices.

#### **3. Benchmarking & Comparison:**

Compare sustainability across regions, sectors, and time periods.

#### **4. Public Awareness:**

Simplify complex data for public understanding.

#### **5. Accountability:**

Hold stakeholders responsible for meeting sustainability goals.

### **Examples of Sustainability Indicators**

#### **Environmental Indicators:**

- **Carbon Emissions:** Measures greenhouse gases in the atmosphere.
- **Air & Water Quality:** Tracks pollution levels for a healthy environment.
- **Biodiversity Index:** Measures species variety to assess ecosystem health.

#### **Economic Indicators:**

- **Energy Efficiency:** Measures how efficiently energy is used.
- **Green Jobs:** Counts jobs in renewable energy and conservation sectors.
- **Sustainable Resource Use:** Tracks renewable/non-renewable resource energy usage.

#### **Social Indicators:**

- **Access to Clean Water:** Percentage of people with safe drinking water.
- **Education Levels:** Literacy rates, access to education.
- **Health & Well-being:** Measures life expectancy, healthcare access, happiness levels.

## **Smart City**

A city that has developed technological infrastructure to support sustainable operations aiming to address urban challenges, improve quality of life, and build climate resilience.

### **Benefits of Smart Cities**

#### **Environmental Benefits:**

- Save energy and water
- Cuts costs and reduces waste
- Lowers carbon emissions and traffic congestion
- Improves air quality

#### **Social Benefits:**

- Engages residents and govt
- Enhances safety with crime monitoring
- Supports health & well-being with eco-friendly infrastructure
- Ensures digital access for all

#### **Economic benefits**

- creates jobs and boost business innovation
- Attracts investors and increase productivity
- save costs through automation
- Increase tourism and tax revenue.

#### **Challenges of smart cities**

- privacy concerns
- cyber security risks
- lacks of digital skills
- connectivity issues
- high initial costs

# UNIT 2

## Introduction to Policies

**Define Environmental Policy.**

**Answer:**

Environmental Policy refers to the commitment of a government or organization to regulate human activities to prevent environmental degradation.

### **Objectives**

1. Prevent pollution at source
2. Encourage, develop and apply the best available technical solutions
3. Ensure that the polluter pays for the pollution and control arrangement
4. Focus protection on heavily polluted areas and river stretches
5. Involve the public in decision making

**Differentiate between Acts, Rules, Laws, and Regulations with examples.**

**Answer:**

- **Act:** A formal law passed by a legislative body that sets out broad principles.  
Ex: Environmental Protection Act, 1986
- **Rules:** Detailed instructions created under an Act to guide implementation.  
Ex: Plastic Waste Management Rules, 2016
- **Laws:** The entire body of rules, including Acts, case law, and regulations.  
Ex: Hazardous Waste Law
- **Regulations:** Specific binding requirements established by an authority to enforce an Act.  
Ex: E-Waste Management Regulations, 2016

**Define Public Policy and Environmental Policy.**

**Answer:**

- Public Policy: A policy formulated by the government to regulate laws, incentives, and actions for public welfare.
- Environmental Policy: Environmental Policy refers to the commitment of a government or organization to regulate human activities to prevent environmental degradation.

**Explain the concept of 'Free Riders' and its impact on environmental policies.**

**Answer:**

- A Free Rider is an individual or entity that benefits from environmental resources or policies without contributing to their maintenance.  
Example: A factory releasing pollutants into a river without bearing the cleanup cost.

- Impact:
  - Reduces effectiveness of environmental policies.
  - Leads to overexploitation of shared resources.
  - Requires strict enforcement of laws like Polluter Pays Principle.

### **What is the role of the Central Pollution Control Board (CPCB)?**

#### **Answer:**

The Central Pollution Control Board (CPCB) is responsible for implementing environmental laws and regulations, monitoring pollution levels, and advising the government on pollution control measures.

### **What are Environmental Standards?**

#### **Answer:**

Environmental Standards are regulations set by the government to control pollution levels and ensure industries follow environmentally safe practices. These standards help in protecting human health and conserving natural resources.

### **What is the EcoMark label in India? Name two product categories covered under this scheme.?**

#### **Answer:**

EcoMark is a certification by the Bureau of Indian Standards (BIS) for environmentally friendly products.

#### **categories:**

- Wood substitutes
- Food additives
- Lubricating oils
- Electrical and electronic goods
- Batteries
- Soaps and detergents
- Food items
- Paints

## **Tragedy of the Commons**

### **1. Definition:**

- The "Tragedy of the Commons" refers to the overuse or depletion of a shared resource (like forests, oceans, or air) because individuals act in their own self-interest without considering the long-term consequences.
- Garret Hardin founded the term "Tragedy of the commons" in 1968,

### **2. Key Idea:**

- When a resource is shared and not owned by anyone, individuals tend to exploit it for personal gain, leading to its degradation or collapse.

### **3. Example: Overfishing in the Ocean:**

- Situation: Many fishing vessels operate independently in the open ocean.
- Action: Each vessel tries to catch as many fish as possible to maximize profit.
- Result: Fish stocks are depleted beyond sustainable levels.
- Impact: Fishermen lose their livelihood, and the marine ecosystem is disrupted.

### **4. Solution:**

- Regulation: Governments or communities can set rules to limit resource use (e.g., fishing quotas).
- Collective Action: People must work together to manage shared resources sustainably.
- Awareness: Educating individuals about the consequences of overexploitation.

### **5. Conclusion:**

- The "Tragedy of the Commons" shows the importance of regulating shared resources to prevent their collapse and ensure long-term sustainability.

## **Explain the importance and objectives of the Biological Diversity Act, 2002.**

### **Answer:**

The Biological Diversity Act, 2002 was enacted to conserve biodiversity and ensure its sustainable use.

### **Objectives:**

1. Conservation of Biological Diversity – Protect and maintain biodiversity.
2. Sustainable Use of Components – Utilize biodiversity without harming ecosystems.
3. Fair and Equitable Benefit Sharing – Ensure local communities benefit from biodiversity resources.

### **Importance:**

1. Economic Importance – Supports agriculture, medicine, and industry.
2. Food Security – Ensures genetic diversity for crop improvement.
3. National Biological Heritage – Protects unique flora and fauna.
4. Scientific & Educational Value – Promotes research and awareness.
5. Environmental Stability – Maintains ecosystem balance.
6. Sustainable Utilization – Ensures long-term resource availability.

**Describe the key features of the Hazardous Waste (Management & Handling) Rules, 1989.**

**Answer:**

The Hazardous Waste (Management & Handling) Rules, 1989 were formulated under the Environment (Protection) Act, 1986 to regulate the generation, storage, transportation, and disposal of hazardous waste.

**Key Features:**

1. **Definition of Hazardous Waste** – Identifies wastes that pose a risk to health and the environment.
2. **Authorization Requirement** – Industries must obtain permission for hazardous waste handling.
3. **Storage & Disposal Regulations** – Specifies safe storage and proper disposal methods.
4. **Import and Export Control** – Restricts international hazardous waste trade.
5. **Monitoring and Reporting** – Mandates periodic reporting to regulatory authorities.
6. **Penalty for Non-Compliance** – Violators face legal action under Environmental Protection Act, 1986.

**Explain the ‘Polluter Pays Principle’ with real-world applications.**

**Answer:**

- The Polluter Pays Principle (PPP) ensures that those responsible for environmental pollution must bear the cost of its prevention, control, and cleanup.

**Applications:**

1. Industries paying for wastewater treatment before discharging into rivers.
2. Carbon tax on companies emitting greenhouse gases.
3. Plastic manufacturers responsible for waste collection under Extended Producer Responsibility (EPR).
4. Oil spill penalties (e.g., BP Oil Spill fine in 2010).
5. Municipal fines for illegal waste dumping.

**Discuss key features of the Municipal Solid Waste (MSW) Management Rules, 2016.**

**Answer:**

- The Municipal Solid Waste (Management & Handling) Rules, 2016 were introduced to improve waste segregation, collection, processing, and disposal.

**Key Features:**

1. **Segregation at Source** – Households must separate wet, dry, and hazardous waste.
2. **Role of SPCBs** – State Pollution Control Boards must monitor and enforce waste regulations.
3. **Extended Producer Responsibility (EPR)** – Businesses must manage their own waste disposal.
4. **Waste Processing Methods** – Encourages composting, bio-methanation, and recycling.
5. **Penalties for Non-Compliance** – Spot fines for improper waste disposal and non-segregation.

**Explain ISO 14000 and its importance in Environmental Management.**

**Answer:**

ISO 14000 is a family of international environmental standards developed by the **International Organization for Standardization (ISO)**. It provides guidelines and requirements to help organizations minimize their environmental impact and comply with legal regulations.

**Key Components of ISO 14000 Family:**

1. **ISO 14001** – Environmental Management System (EMS): Specifies the requirements for an EMS, helping organizations identify, manage, and improve environmental performance.
2. **ISO 14004** – Guidelines for EMS Implementation: Provides practical guidance on establishing and improving an EMS.
3. **ISO 14031** – Environmental Performance Evaluation (EPE): Helps organizations measure how well their environmental management practices are working.
4. **ISO 14040-14043** – Life Cycle Assessment (LCA): Covers methods for evaluating environmental impacts from raw material extraction to disposal.
5. **ISO 14020-14024** – Environmental Labeling: Defines principles for certifying eco-friendly products under schemes like Eco Mark.

**Importance of ISO 14000:**

- Reduces environmental risks by ensuring industries follow best practices.
- Encourages sustainable business operations, reducing waste and pollution.
- Ensures compliance with environmental laws like the Environmental Protection Act.
- Improves corporate image, helping businesses gain global recognition.
- Encourages resource efficiency by reducing energy and water consumption.

# UNIT 3

## Environmental Economics and Market Mechanisms

### **Economics:**

#### **1. Definition of Economics:**

- Studies how individuals, firms, governments, and organizations interact in markets.
- Concerned with the creation, consumption, and transfer of wealth.

**Economics = Market Interactions + Wealth (Creation + Consumption + Transfer)**

#### **2. Branches of Economics:**

- **Microeconomics:** Studies individual units (consumers, producers, markets).  
Example: How a person spends money or a company sets prices.
- **Macroeconomics:** Studies the economy as a whole (national income, inflation, unemployment).  
Example: A country's GDP or reasons for rising inflation.

#### **3. Purpose of Economics:**

- Understand market interactions.
- Analyze the effects of policies and events on the economy and society.
- Example: How a tax policy affects prices.

**Purpose = Market Understanding + Policy Analysis.**

### **Environmental Economics:**

- A subfield of economics that studies on how economic activities affect the environment and how policies can address environmental issues.
- Originated in the 1960s due to awareness of environmental degradation from rapid economic growth.
- Focuses on the efficient allocation of environmental and natural resources.
- Deals with issues like air pollution, water quality, toxic substances, solid waste, and global warming.

**Environmental Economics = Economic Activities + Environmental Impact + Sustainability.**

### **Key Concepts in Environmental Economics:**

- **Sustainable Development:** Economic growth that meets present needs without compromising future generations.

- **Externalities:** Costs or benefits of economic activities that affect third parties (e.g., pollution).
- **Market Failure:** When markets fail to allocate resources efficiently due to externalities.
- **Cost-Benefit Analysis:** Weighing economic benefits against environmental costs.
- **Policy Instruments:** Carbon pricing, pollution taxes, cap-and-trade systems.

**“S-E-M-C-P” (Sustainability, Externalities, Market Failure, Cost-Benefit, Policy).**

### Types of Environmental Policies:

Prescriptive Regulations	Market-Based Regulations
In a prescriptive approach, the government dictates specific measures to reduce environmental harm.	Market-based policies use economic incentives to encourage desired behaviors.
For example, they may prohibit highly-polluting industries or require certain emissions-controlling technologies.	For example, cap-and-trade regulations do not prohibit companies from pollution, but they place a financial burden on those who do. These incentives reward companies for reducing their emissions, without dictating the method they use to do so.

### Ecological Economics:

#### Definition:

- An interdisciplinary approach that integrates economics with ecology.
- It views the economy as a subsystem of the natural environment and emphasizes that natural resources and ecosystems set limits on economic activity, unlike traditional economics.

**Ecological Economics = Economy within Environment + Limits.**

#### Key Concepts in Ecological Economics:

- **Ecosystem Services:** Benefits humans derive from ecosystems (e.g., clean air, water, pollination).
- **Strong Sustainability:** Natural capital (e.g., forests, water bodies) should not be depleted, and human-made capital cannot replace it.

- **Steady-State Economy:** An economy that maintains stability within ecological limits, without continuous growth.
- **Intergenerational Equity:** Preserving natural resources and ecosystems for future generations.

**Tip: “E-S-S-I” (Ecosystem, Strong Sustainability, Steady-State, Intergenerational).**

### **External cost:**

Externalities are the indirect effects of production or consumption activities that impact third parties who are not directly involved in those activities. These effects can be either positive or negative, and they are not reflected in market prices.

#### **Meaning of Externalities**

- An external cost or external benefit is a side effect of an activity that affects other people, not the buyer or seller.
- These costs/benefits are not included in market transactions.
- Externalities cause market failure by making Pareto efficiency difficult to achieve.

#### **Types of Externalities**

##### **Positive Externalities (External Benefits):**

- Occur when the activity benefits others without compensation.
- 1. Vaccinations**
    - When one person is vaccinated, others around them are less likely to catch the disease.
    - Society benefits through lower disease spread, even though only one person paid for the vaccine.
  - 2. Education**
    - An educated person is more productive and contributes to economic growth.
    - The whole society benefits even though only the individual paid for the education.
  - 3. Green Spaces (like parks and gardens)**
    - Parks improve air quality and reduce stress for everyone around.
    - Even people who don't create or pay for parks still enjoy their benefits.

##### **Negative Externalities (External Costs):**

- Occur when the activity harms others **without paying for the damage.**

## **Negative Production Externalities**

### **1. Air Pollution**

- Factories release harmful gases like carbon monoxide and carbon dioxide into the air.
- These gases damage human health, crops, buildings, and contribute to global warming.

### **2. Water Pollution**

- Industries dump toxic waste into rivers and lakes, polluting the water.
- This harms aquatic life, makes water unsafe, and affects fishermen's income.

### **3. Farm Animal Production**

- Excess use of antibiotics in animals can create resistant bacteria.
- These bacteria spread to nearby areas, affecting human and animal health.

## **Negative Consumption Externalities**

### **1. Passive Smoking**

- Non-smokers inhale smoke released by active smokers (second-hand smoke).
- This increases the risk of diseases like cancer and asthma in the non-smoking population.

### **2. Traffic Congestion**

- When too many vehicles use roads, it leads to traffic jams and delays.
- It causes more fuel burning, creates smog, and increases accident risks.

### **3. Noise Pollution**

- Loud music or noise from parties or clubs disturbs nearby residents.
- It affects sleep, concentration, and mental health, especially in children and elderly.

## **Remedies for Negative Externalities**

### **1. Imposing Taxes:**

- a. Taxes equal to the external cost (**Pigovian tax**).
- b. Discourages harmful behavior like **smoking or pollution**.

### **2. Property Rights:**

- a. Clear laws make offenders liable.
- b. Reduces irresponsible actions due to fear of **legal consequences**.

### 3. Government Policies:

- a. Subsidies for **positive externalities**.
- b. Regulations or penalties for **negative ones**.

## Economic Efficiency:

### Definition:

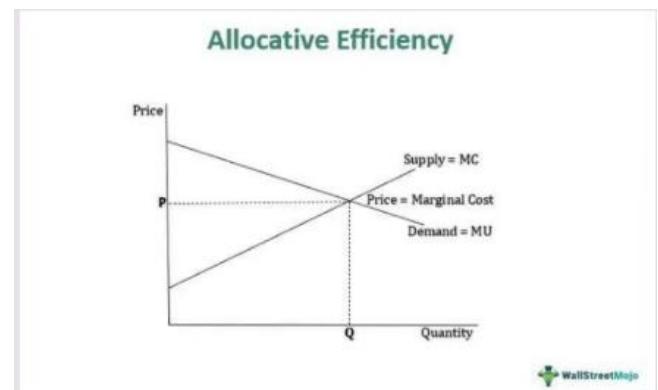
- Economic efficiency refers to the optimal allocation of resources to minimize waste and maximize welfare.
- **Importance:** It ensures that resources are used effectively to produce goods and services, leading to higher productivity and better living standards.

**Economic Efficiency = Resource Allocation + Waste Reduction + Welfare.**

### Types of Economic Efficiency

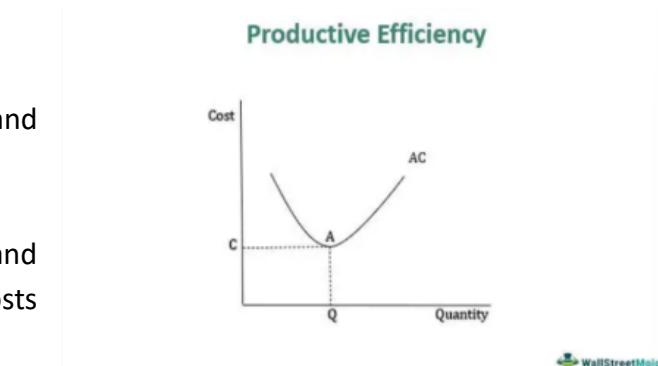
#### Allocative Efficiency:

- **Definition:** Resources are distributed in a way that maximizes consumer satisfaction (Price = Marginal Cost).
- **Example:**
  1. Public transport optimization:  
where bus routes are adjusted to serve high-demand areas, reducing unnecessary costs.
  2. Healthcare Resource Allocation:  
A hospital prioritizes emergency care and essential medicines based on patient demand rather than spending excessively on low-priority services.



#### Productive Efficiency:

- **Definition:** Firms produce goods at the lowest possible cost (minimum average cost).
- **Example:**
  1. Factory automation:  
where robotic arms reduce labour costs and increase production speed.
  2. Energy-Efficient Manufacturing  
A textile company switches to solar power and energy-efficient machinery lowering electricity costs while maintaining high output.



## Dynamic Efficiency:

- **Definition:** Adapting to technological changes to improve productivity and reduce costs over time.

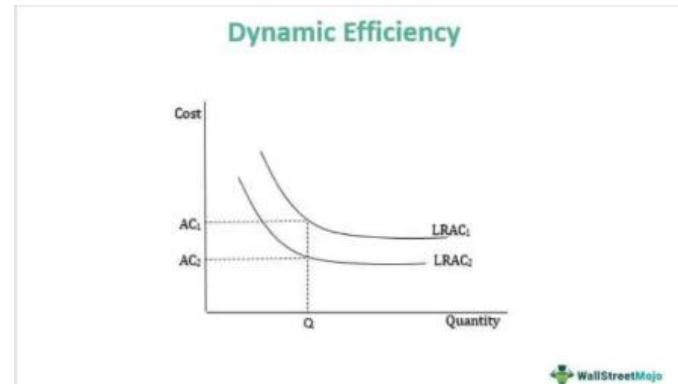
- **Example:**

1. Electric vehicle innovation:

Battery research lowers car prices, increasing adoption.

2. E-commerce Logistics Advancements

Online retailers adopt drone delivery systems, reducing transportation costs and speeding up delivery times.



## Pareto Efficiency:

- **Definition:** A state where no one can be made better off without making someone else worse off.

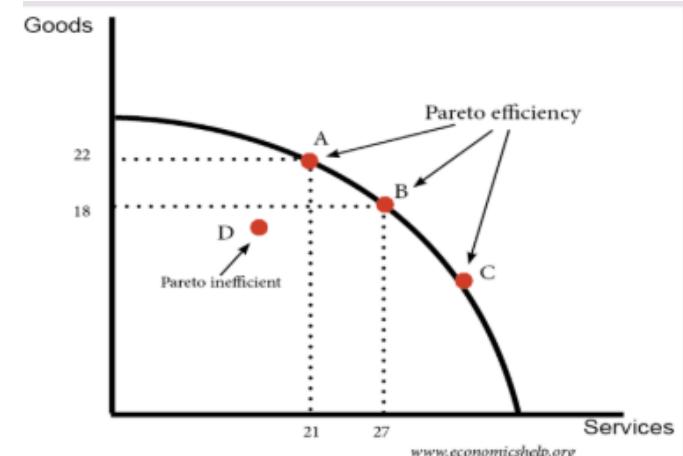
- **Example:**

1. Salary Distribution in a Company:

- A company pays employees based on their skill and performance.
- if salaries are already distributed fairly based on contribution, increasing one employee's salary would require reducing another's salary, making them

2. Healthcare Resource Allocation

- A hospital has five ventilators available during a health crisis.
- If all five ventilators are assigned to the most critical patients and no ventilator is left unused, this is Pareto efficient.
- If the hospital reallocates a ventilator to a less critical patient, it harms the original patient who needed it more.



## Market Failure and Lost Efficiency

- **Definition:** Market failure occurs when the market fails to allocate resources efficiently, leading to **allocative inefficiency**.
- **Causes:** Externalities, public goods, monopolies.
- **Example:** Pollution from factories imposes costs on society, but these costs are not reflected in the market price, leading to overproduction and inefficiency.

## **Trade/markets for the environment**

### **1. Trade and the Environment:**

- Global trade and integration of global value chains has both positive and negative effects on the environment.
- Trade can lead to economic growth, but it can also increase pollution and degrade natural resources.

### **2. Positive Effects of Trade on the Environment:**

- Economic Growth: Supports development and social welfare, enabling better environmental management.
- Access to Technology: Open markets improve access to new technologies that reduce energy, water, and harmful inputs in production processes.

### **3. Negative Effects of Trade on the Environment:**

- Pollution Haven Hypothesis: Countries with lax environmental regulations may specialize in pollution-intensive activities.
- Resource Degradation: Increased trade can lead to overexploitation of natural resources.

### **4. Climate Change and Trade:**

- Disruptions: Climate change can disrupt trade through extreme weather events, rising sea levels, and port closures.
- Productivity Loss: Climate change reduces the productivity of labour, capital, and land, leading to output losses and decreased global trade volume.

## **Emissions trading**

- A market-based approach to controlling pollution by providing economic incentives for reducing emissions.
- Also known as Emissions Trading Scheme (ETS).
- Used for carbon dioxide (CO<sub>2</sub>) and other greenhouse gases.
- **Cap and Trade (Emissions Trading):**

### **1. How Cap and Trade Works:**

- **Cap:** The government sets a limit (cap) on total emissions.
- **Trade:** Companies buy/sell emission permits to stay within the cap.
- **Permits:** Companies must hold permits equal to their emissions. Excess permits can be sold.

### **3. Challenges of Cap and Trade:**

- **Setting the Correct Cap:** Too high or too low caps can lead to inefficiencies.

- **Lack of Reliable Data:** Accurate emissions data is costly and time-consuming to obtain.
- **International Consensus:** Difficult to achieve due to differing national priorities.
- **High Costs:** Transaction and administrative costs can be high.

Pros	Cons
Income source for companies	Allowed emissions levels are set too high
Promotes cleaner technologies	Credits and penalties are cheaper than converting to cleaner technologies
Leads to faster cuts in pollution	Some credits are given away
Source of revenue for the government	Companies can cheat the system
Supplements taxpayers resources	It increases the prices for goods and services
Gives consumers the power to decide	There is no global consistency in the system

## Law of Supply and Demand:

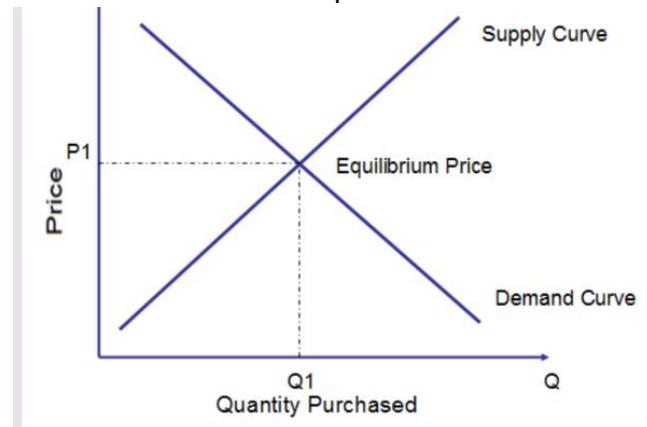
- Combines two fundamental economic principles: supply and demand.
- Explains how changes in the price of a product affect its supply and demand.
- Equilibrium: The point where supply and demand curves intersect, determining the market-clearing price.

### 1. Law of Demand:

- Definition: Demand for a product changes inversely to its price (higher price = lower demand, lower price = higher demand).
- Demand Curve: Slopes downward from left to right.
- Income Effect: Changes in demand due to changes in buyers' income or resources.

### 2. Factors Affecting Demand:

- Availability of Substitutes: More substitutes reduce demand for a product.
- Consumer Income: Higher income increases demand for normal goods.
- Degree of Necessity: Essential goods have inelastic demand.
- Proportion of Income Spent: Higher proportion spent on a product reduces demand elasticity.



### 3. Law of Supply:

- Definition: Quantity supplied changes directly with price (higher price = higher supply, lower price = lower supply).
- Supply Curve: Slopes upward from left to right.
- Price Elasticity of Supply: How responsive supply is to price changes.

### 4. Factors Affecting Supply:

- Availability of Resources: Limited resources can constrain supply.
- Technology Innovation: Improves production efficiency, increasing supply.
- Competitors: More competitors can increase supply.
- Flexibility: Ability to adjust production levels quickly.

## **Total Economic Value (TEV)**

Total Economic Value (TEV) is a concept in environmental economics that represents the sum of all values derived from a natural resource, including use, option, and non-use values, expressed in monetary terms.

- TEV aims to capture the full economic worth of an ecosystem or resource, going beyond just its direct use value (e.g., timber from a forest) to include indirect benefits and values people derive from simply knowing the resource exists or having the option to use it in the future.

## **Cost-Benefit Analysis (CBA)**

### **Definition:**

A tool to evaluate projects by comparing **costs** (expenses) and **benefits** (gains) to determine feasibility.

### **Purpose:**

- Decide if a project is **economically/socially/environmentally viable** (e.g., building a dam).
- Compare multiple projects (e.g., solar vs. coal power plants).

### **The Cost –Benefit Analysis (CBA) Process**

The following is a list of steps that comprise a generic cost-benefit analysis.

- Define the goals and objectives of the activities
- List alternative projects/programs
- List stakeholders
- Select measurement and measure all cost/benefit elements
- Predict outcome of cost and benefits over relevant time period
- Convert all costs and benefits into a common currency
- Apply discount rate
- Calculate net present value of project options
- Perform sensitivity analysis
- Adopt recommended choice

### **Limitations:**

- Ignores **inflation, long-term uncertainties** (e.g., climate change impacts).
- Hard to value **non-market goods** (e.g., biodiversity).

### **Example:**

- *Wetland Development:* Costs = ₹50M (construction); Benefits = ₹80M (flood prevention + tourism). **CBA Ratio = 1.6 (Acceptable).**

## **Sustainable Development Economics**

Sustainable development refers to meeting current economic needs without compromising the ability of future generations to meet theirs. It integrates three key dimensions:

- Economic growth (jobs, income, industrial production)
- Social inclusion (equitable resource distribution)
- Environmental protection (conserving biodiversity, reducing pollution)

### **Pillars of Sustainable Economy**

#### **(A) Society's Role**

- People produce goods using natural resources, labor, and capital.
- Must invest in eco-friendly technologies (e.g., solar energy).

#### **(B) Business & Government**

##### **Hartwick-Solow Rule**

- Idea: If a country uses up non-renewable resources (oil, forests), it must invest the profits in other assets (schools, machines) for future generations.
- Goal: Ensures long-term wealth despite resource depletion.

Pros:

- Prevents short-term waste of resources.
- Protects future economies.

Cons:

- Needs strong governance (or money gets misused).
- Doesn't replace lost ecosystems.

##### **Green Taxes**

Taxes on harmful activities to **discourage pollution** and fund sustainability.

**Types:**

1. **Carbon Tax:** Charge per ton of CO<sub>2</sub> emitted (e.g., tax on coal/oil).
2. **Fuel Tax:** Extra tax on petrol/diesel to reduce fossil fuel use.
3. **Pigovian Tax:** Penalty for pollution (e.g., tax on plastic waste).
4. **Land Value Tax:** Tax on land (not buildings) to prevent land hoarding.

**Pros:**

- Simple to implement.
- Raises money for green projects.

**Cons:**

- Can increase costs for poor households.

- Businesses may resist higher taxes.

### **Green Subsidies**

Financial help for **eco-friendly practices** (e.g., solar panels, electric cars).

#### **Types:**

1. **Cash Grants:** Direct money for renewable energy projects.
2. **Tax Breaks:** Lower taxes for green businesses.
3. **Feed-in Tariffs:** Guaranteed high prices for renewable energy sold to the grid.

#### **Pros:**

- Makes clean tech cheaper.
- Boosts green jobs.

#### **Cons:**

- Expensive for governments.
- Risk of funding inefficient projects.

### **Polluter Pays Principle**

The Polluter Pays Principle (PPP) ensures that those responsible for environmental pollution must bear the cost of its prevention, control, and cleanup.

### **Carbon Trading**

#### **Definition:**

Carbon trading is a market-based system designed to reduce greenhouse gas emissions by:

- Setting a maximum allowable limit (cap) on emissions
- Creating a marketplace where emission permits can be bought and sold

#### **How Carbon Trading Works**

##### **A. Cap-and-Trade System**

1. **Setting the Cap:** Governments establish emission limits (measured in Assigned Amount Units or AAUs)
2. **Allocating Permits:** Companies receive or purchase emission allowances (1 permit = 1 ton of CO<sub>2</sub>)
3. **Trading Mechanism:**
  - a. Companies emitting below their limit can sell unused permits
  - b. Companies exceeding limits must buy additional permits

#### **Carbon Offsetting**

- Additional system where companies can invest in environmental projects to compensate for emissions

- A landowner plants trees which absorb CO<sub>2</sub>  
The carbon reduction is calculated and converted into Offset Credits  
These credits can be sold to companies needing to offset their emissions Buying company counts these toward their emission reduction targets

### **Benefits of Carbon Trading**

#### **Reduction in Greenhouse Gas Emissions**

- The cap system ensures total emissions decrease over time
- Creates financial incentive to reduce emissions

#### **Economic Benefits for Developing Nations**

- Developing countries can earn revenue by:
  - Selling unused emission allowances
  - Creating and selling offset credits from green projects

#### **Market-Based Solution**

- Allows flexibility in how emissions are reduced
- Encourages innovation in clean technologies

#### **Disadvantages of Carbon Trading**

##### **Right to Pollute Concerns**

- Some argue it allows wealthy companies to simply buy permission to pollute
- May reduce incentive for actual emission reductions

##### **Implementation Challenges**

- Process can be slow as companies may prefer buying credits over changing practices
- Requires complex monitoring and verification systems

##### **Lack of Global Standards**

- No unified international system
- Potential for emissions to simply shift locations rather than decrease overall

##### **Effectiveness Questions**

- Offsets may not always represent real, permanent emission reductions
- Some projects have questionable environmental benefits

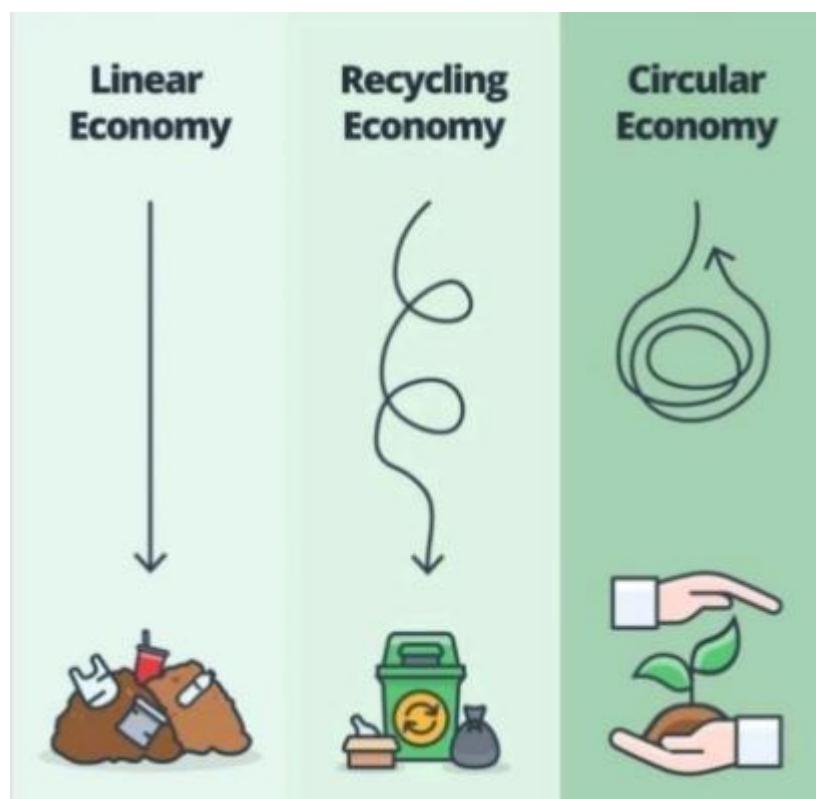
## **Environmental Impact Assessment (EIA)**

An Environmental Impact Assessment (EIA) is an assessment of the possible positive and negative impact that a proposed project may have on the environment, considering natural, social and economic aspects.

### 5-Step Process:

1. **Screening:** Does the project need EIA? (e.g., small solar farm vs. coal plant).
2. **Scoping:** Identify key impacts (e.g., wildlife disruption).
3. **Prediction:** Forecast effects (e.g., air pollution levels).
4. **Mitigation:** Plan fixes (e.g., wildlife corridors).
5. **Monitoring:** Track long-term impacts (e.g., post-construction water tests).

**Real Case:** Three Gorges Dam (China) – EIA predicted displacement of 1.3M people.



# Unit 4

## Green Accounting and Reporting

### **Green Accounting:**

#### **Definition:**

- Green Accounting, also known as **Environmental Accounting**, records the **use of natural resources** and **environmental impact** of economic activities.
- It measures **resource depletion** and **environmental degradation** providing a **balance sheet for future generations**.

**Key Point:** Ensures sustainable development by accounting for environmental costs.

#### **Scope of Green Accounting**

It has a wide scope, especially from two main viewpoints:

1. Internal Point of View:  
It covers the investments made by a company to reduce environmental loss caused by its own activities.
2. External Point of View:  
It includes the indirect environmental damage caused by the company's actions to the surroundings and society.

**Internal = Company's costs, External = Society's losses**

#### **Types of Green Accounting**

1. Carbon Accounting – Measures carbon emissions.
2. Ecological Footprint Accounting – Measures how much nature is needed to support a company or country.
3. Sustainability Accounting – Focuses on long-term environmental performance.
4. Eco-efficiency Accounting – Combines economic and ecological performance.

#### **Importance:**

1. **Sustainable Resource Management:** Ensures **long-term resource availability**.
2. **Policy Making:** Provides **data** for environmental policies.
3. **National Income Calculation:** Adjusts **GDP** for resource changes.
4. **Intergenerational Equity:** Ensures **fair resource distribution**.

5. **Environmental Degradation:** Highlights **resource damage**.

**Key Point:** *Reveals hidden costs for sustainable growth.*

#### **Approaches:**

##### **1. Physical Approach:**

Best approach for environmental accounting that analyse the linkage between the environment and economy

Example: Norway's 1970s **resource planning**.

##### **2. Monetary Approach:**

The monetary accounts are derived from the physical accounts by applying monetary unit values

Supports **cost-benefit analysis**.

**Key Point:** *Physical tracks quantities, monetary assigns value.*

#### **Account Types:**

##### **1. Central Account:** Tracks **resource status** (e.g., oil reserves).

##### **2. Peripheral Account:** Shows **resource-human relationships**.

##### **3. Agent Account:** Measures **sustainability efforts** (e.g., forest maintenance).

**Key Point:** *Ensures consistent data for decisions.*

#### **Environmental Cost Categories**

##### **1. Direct Cost:**

- a. Capital expenditure,
- b. Depreciation,
- c. Operating and maintenance costs

##### **2. Hidden Cost:**

- a. Waste treatment,
- b. Training and support,
- c. Compliance management

##### **3. Potential Future Cost:**

- a. Remediation cost (cleaning pollution)
- b. Contingent liability cost (possible penalties).

#### **Techniques to identify environmental costs :**

##### **1. EMS (Environmental management system) is used.**

##### **2. LCA (Lifecycle assessment) is used.**

3. Environmental economic valuation techniques can be used.

#### **Environmental valuation:**

- It refers to the assignment of money values to non-marketed assets goods and services where money values have a particular and precise meaning.
- Environmental values are measured in many terms through WTA/WTP.
  - **Willingness to pay (WTP):**

The maximum amount of money that the person would be willing to pay in return for receiving the benefit

- **Willingness to accept (WTA):**

The minimum amount of money that a person would be willing to accept as compensation for incurring the cost

#### **Need / Benefits of Green Accounting**

- Shows if a business is **environmentally responsible**
- Helps **investors and stakeholders** see what steps are taken to reduce pollution
- Maintains **systematic records** of environmental data
- Useful in getting **government environmental licenses**
- Ensures business activities do not cause **environmental damage**
- Improves **public image** of the company
- Leads to **better efficiency** in using resources
- Contributes to **sustainable GDP growth**
- Encourages use of **green technologies**
- Helps manage **waste and pollution**, generating **financial value**

Remember as “R-I-R-L-I-E-S-G-T-W” (**R**esponsible, **I**nvestors, **R**ecords, **L**icenses, **E**fficiency, **S**ustainable, **G**reen Tech, **T**Waste).

#### **Limitations of Green Accounting**

- No **official accounting standards** by ICAI
- **Comparison** between companies becomes difficult
- Difficult to separate **environmental** and **business** expenses
- **Values** of environmental goods change frequently
- Ignores **social costs** to the society

- **High initial cost** of implementation
- Needs to be **integrated with financial accounting**, which is complex

**Remember as “S-C-S-V-I-H-C” (Standards, Comparison, Separation, Values, Ignores, High cost, Complex).**

### **Important Laws Related to Green Accounting**

- **1974 – Water (Prevention and Control of Pollution) Act**
- **1980 – Forest Conservation Act**
- **1981 – Air (Prevention and Control of Pollution) Act**
- **1986 – Environment (Protection) Act**
- **1986 – Hazardous Waste (Management and Handling) Rules**

Memorize years: **74, 80, 81, 86, 86** (Water, Forest, Air, Environment, Hazardous).

## **Environmental Reporting**

### **Definition:**

- **Environmental Reporting (ER)** means the inclusion of **environmental issues** in the **corporate annual reports** of business entities.
- It refers to both **voluntary** and **involuntary disclosures** by companies about how their activities impact the **environment**.

**Environmental Reporting = Environmental Info + Company Reports.**

### **Purpose:**

Environmental reporting involves preparing and giving information to both **internal stakeholders** (like management) and **external stakeholders** (like investors, public) about the company's **environmental status and performance**.

**Purpose = Providing info (to internal + external stakeholders).**

### **Types of Environmental Reporting:**

Environmental reporting is usually not regulated, but companies follow three main types:

## 1. Descriptive and Performance Reporting

- ◆ Common in UK
- ◆ Includes **description of environmental policies**
- ◆ Shows data on **performance like emission control, energy savings, etc.**

## 2. Quantitative Environmental Accounting

- ◆ Describes company's **environmental policy**
- ◆ Shows share of **eco-friendly products** in the market
- ◆ Uses **quantitative input-output analysis** (what resources go in vs. what comes out)

## 3. Financial Environmental Reporting

- ◆ Aims to create a **comprehensive document**
- ◆ Includes **standard financial information** related to environmental costs
- ◆ Satisfies needs of both **stakeholders** and the **company**

Remember types as “D-Q-F” (**Descriptive, Quantitative, Financial**).

## Benefits of Environmental Reporting

1. Shows the company's **commitment** to improve environmental performance
2. Increases **accountability** and **transparency** to the public and authorities
3. Provides clear information on **progress** made by the company
4. Helps in **identifying environmental problems** early
5. Improves the company's **public image and reputation**

Remember benefits as “C-A-P-I-I” (**Commitment, Accountability, Progress, Identify, Image**).

## Conclusion

- By using **environmental reporting**, companies show they are **responsible and eco-conscious**.

- It helps in building **public trust**, gaining **stakeholder confidence**, and achieving **sustainable business growth**.
- Such companies are seen as **enlightened and progressive** in today's environmentally aware world.

## UNIT 5

# Entrepreneurship in Waste Management

### Entrepreneurship

- **Definition:** Entrepreneurship in waste management involves creating businesses that address waste problems through recycling, upcycling, and sustainable disposal.
- **Innovation:** Entrepreneurs develop new methods to reduce waste, such as converting trash into useful products.
- **Environmental Focus:** These businesses aim to minimize pollution and landfill use while promoting a circular economy.
- **Economic Value:** By turning waste into resources, entrepreneurs create profitable ventures that also benefit society.

### Significance and Contribution to the Economy

- **Job Creation:** Waste management businesses employ workers in collection, sorting, recycling, and technology development.
- **Cost Savings:** Recycling and reusing materials reduce expenses for industries that rely on raw resources.
- **Green Technology Growth:** Startups in this field drive advancements in eco-friendly tech, boosting the green economy.
- **Resource Recovery:** Entrepreneurs extract valuable materials (e.g., metals from e-waste) that can be reused, reducing waste.

**Contribution = “J-C-G-R” (Jobs, Cost Savings, Green Tech, Resource Recovery)**

### **Innovation in Ideas and Design**

- **Smart Waste Solutions:** IoT-enabled bins and AI-powered sorting systems improve efficiency.
- **Waste-to-Energy:** Technologies convert non-recyclable waste into electricity or fuel.
- **Eco-Friendly Products:** Entrepreneurs design items like biodegradable packaging or upcycled fashion.
- **Circular Economy Models:** Businesses focus on reusing materials endlessly, reducing waste generation.

**Innovations = “S-W-E-C” (Smart Solutions, Waste-to-Energy, Eco-Products, Circular).**

### **Revenue Models**

- **Recycling Services:** Charging fees for collecting and processing recyclable materials.
- **Product Sales:** Selling upcycled goods (e.g., furniture from plastic waste).
- **Waste-to-Energy:** Earning revenue by converting waste into power and selling it.
- **Subscription Models:** Offering regular waste pickup or composting services for households/businesses.

**Revenue = “R-P-W-S” (Recycling, Product, Waste-to-Energy, Subscription).**

### **Developing Networks**

- **Government Partnerships:** Collaborating with municipalities for waste collection contracts.
- **Corporate Tie-Ups:** Working with companies to manage their waste sustainably.
- **NGO Alliances:** Partnering with environmental groups for funding and awareness campaigns.
- **Community Engagement:** Educating locals on waste reduction to ensure participation.

**Networks = “G-C-N-C” (Government, Corporate, NGO, Community).**

### **Challenges in Entrepreneurship**

- **High Startup Costs:** Setting up recycling plants or tech systems requires significant investment.
- **Regulatory Hurdles:** Complying with waste disposal laws can be complex and costly.
- **Public Awareness:** Many people don't separate waste properly, making recycling harder.
- **Market Competition:** Competing with established waste management firms can be tough for startups.

**Challenges = “C-R-P-C” (Costs, Regulations, Public, Competition)**