DO RIGHT THINGS RIGHT
(TAKE RESPONSIBILITY FOR SUSTAINABILITY)

By

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Objectives of the Presentation

The objectives of this presentation are to:

➢ Explain the concept and principles of Sustainability (Sustainable Development);

➢ Explain the importance of Sustainable Development;

➢ Explain the concept and levels of Responsibility;

➢ Understand the concept of "Sustainability through Responsibility";

➢ Understand the relationships between the elements of Sustainable Development and how the true sustainability can be met;

➢ Explain what is "Engineering Education for Sustainable Development" and "Sustainable Engineering Education";

➢ Explain the Role of Engineers in Sustainable Development.

What is "Do Right Things Right"?
"Plan your Work, Work your Plan"

"People never plan to fail they only fail to plan. If you fail to plan, you plan to fail. Make sure you plan and manage to do right things right with a right person using the least amount of resources available"

Do Right Things or Plan Your Work: tends to do things *" effectively "*.

Do Things Right or Work Your Plan: tends to do things *" efficiently"*.

Least amount of resources available: tends to use things *"in the most economic manner"*.

Effectiveness

❖ Consists of ***doing right things*** *or* ***planning your work*** at the right time with a right person.

❖ It is never a function of how late you stay in the office.

❖ It's what you do while you are there that counts. Effectiveness focuses on:

- ▪ Objectives what to do;
- ▪ Revenue and profit outcomes;
- ▪ Future results and decisions.

Efficiency

❑ Consists of *doing things right* or *working your plan*.

❑ It has no objective(s).

❑ It has a built-in tendency to take us rapidly to where we will not want to be when we get there.

❑ The manager who concentrates on "efficiency" rather than "effectiveness" could be dangerous and it tends to:

- Do *"things right"* rather than *"right things"*
- Solve problems rather than produce creative alternatives
- Safe guard resources rather than optimize resource utilization
- Obtain the unreliable results and thus leading to the wrong decision.
- Focus on costs only.
- Lower costs rather than increase profit.

Least Amount of Resources Available

➢ Tends to do things *'in the most economic manner'*.

➢ Considers optimal resource use principles: Reducing, Reusing, and Recycling (3Rs)

➢ Resources must be extracted on the increased productivity basis rather than the increased production inputs basis.

What are Sustainability and Sustainable Development?

❖ The terms 'Sustainability', and 'Sustainable Development (SD)' are frequently used interchangeably.

❖ There is a close relationship between the two, but they are different in concepts and thus not interchangeable.

❖ Sustainability: often thought of as a long term goal.

❖ Sustainable Development: refers to the many processes and pathways to achieve it.

What is Sustainability?

❖ **Sustainability** is the ability to make development as sustainable by ensuring the needs of the present demands without compromising any power or ability of future generations to meet their own needs.

❖ It refers to issues such as sustainable resource use, sustainable consumption, and developing a sustainable society and an economy.

❖ It is a production model which aims at better economic results for both humans and the natural environment, not only in the present but in the indefinite future as well.

❖ It is considered as the goal of Sustainable Development (SD) process.

❖ It means thinking not just about yourself but about the world and everything in it, on it, and around it --- taking care of these things for the present and the future. Everything is connected.

Definition of Sustainability

ISO Definition:

State of the global system, which includes environmental, social, and economic subsystems, in which the needs of the present are met without compromising the ability of future generations to meet their own needs.

Achieving a balance between these subsystems is considered essential for achieving sustainability. Thus, "Natural resources are preserved, the environment is protected, the economy is not harmed, and the quality of life for our people is improved or maintained".

Some Principles about Sustainability

- *Sustainability is about balancing or harmonizing social, environmental, and economic interests. (Elkington,1997)*
- *Sustainability is about both short-term and long-term orientation (Meadows et al. 1972; World Commission on Environment and Development,1987)*
- *Sustainability is about both local and global orientation (Hurrell and Kingsbury,1992)*
- *Sustainability is about values and ethics (ISO,2010; Gareis, et al, 2013)*
- *Sustainability is about transparency and accountability (ISO, 2010)*
- *Sustainability is about stakeholder participation (Freeman,1984)*
- *Sustainability is about risk reduction (Godfrey et al., 2009)*
- *Sustainability is about eliminating waste (Braungart and Donough, 2002)*
- *Sustainability is about consuming income, not capital. (Dyllick and Hockerts, 2002)*

What is Sustainable Development (SD)?

- Sustainable Development is the harmonious integration of a sound and viable economy, a responsible governance, social cohesion, and ecological integrity to ensure that development is a life-sustaining process.
- Sustainable Development also interlinks the development and carrying capacity of environment and ecosystems.
- Thus, Sustainable Development =

  Economic Development (Globalization)

  + Carrying Capacity of Environment and Ecosystems (Global Change)

  + Social Reform (Human Development)

  + People's Empowerment (Human Development)
- Its implementation is intended to lead to sustainability.

Definition of Sustainable Development (SD)

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs". (World Commission of Environment and Development (1987): Our Common Future).

"Sustainable Development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and hence both current and future potential to meet human needs and aspirations" (World Commission of Environment and Development (1987): Our Common Future).

In short, the term 'Sustainable Development' can also be defined as the "Environmental, Economic, and Social well-being for today and tomorrow"

Why We Need Sustainable Development

- Both economic development and stable environment are required for the continual improvement of lifestyle and living standards.
- The development was human-oriented and was achieved by damaging the environment and over exploitation of natural resources.
- This caused instability of environment and crossed the threshold limit of environmental damage.
- we humans are still totally dependent for our survival upon the continued functioning of natural systems.
- In order to safeguard the existence of life and future of humanity, we have to change our approach from unsustainable to sustainable development.
- A judicious balance between developmental activities and environmental protection should be assured.
- This is possible only through the process of sustainable development.

What is Responsibility?

❖ Responsibility is closely linked to sustainability.

❖ When we use the earth's natural resources we are borrowing from the earth and from future generation and have a moral responsibility to pay the debt by leaving the earth in at least a good condition as we now enjoy. This is our main Responsibility.

ISO Definition of Responsibility

It is the willingness of an organization to incorporate broader social and environmental considerations for the impacts of its decisions and activities on society and the environment through transparent and ethical behavior that:

- *Contributes to SD, including the health and the welfare of society*
- *Takes into account the expectations of stakeholders*
- *Is in compliance with applicable law and consistent with international norms of behavior, and*
- *Is integrated throughout the organization and practiced in its relationships*

Categorizing Responsibilities

1) *Economic Responsibilities*: To deliver an acceptable return for shareholders while contributing to local and global economies through their core business.

2) *Legal Responsibilities*: This requires that organizations operate within the law at all locations in which they do business.

3) *Social, Culture and Ethical Responsibilities*: To consider social and environmental impacts of their operations and, as far as possible, to do no harm while pursuing business interests.

Sustainability Through Responsibility

❖ **Responsible Organization** has to be framed by a vision of **Sustainable Organization.**

❖ **Sustainable Organization** in turn, will only be achieved with **Responsible Organization** at its core.

❖ Like **Vision and Mission** of an organization.

"Vision without Mission (Action) is merely a dream.

Mission (Action) without Vision just passes the time.

Vision with Mission (Action) can change the world".

Principal Impacts of Human Activities

On the Environmental Aspect

- Earth's climate change
- Destruction of ozone layer
- Degradation of topsoil and increases in desertification
- Loss of biodiversity
- Damage of nutrient cycles
- Widespread pollution of airs, rivers, and oceans, and
- Depletion of artesian water storages

On the Socio-Economic Aspect

- The increasing gap between the rich and the poor
- The human rights violations
- The growth of human population and inadequate human resources and food
- Gender equity
- Inequalities
- Human health
- Peace, and social justice.

Requirements for Sustainable Development Frame Work (WCED 1987)

1. A political system that secures effective citizen participation;
2. An economic system that is able to generate surpluses and technical knowledge on a self-reliant basis;
3. A social system that provides for solutions for tensions arising from disharmonious development;
4. A production that respects the obligation to preserve the ecological base for development;
5. A technological system that can search continuously for new solutions;
6. An international system that fosters sustainable patterns of trade and finance; and
7. An administrative system that is flexible and has the capacity for self-correction.

Principles of Sustainable Development (IUCN/UNEP/WWF 1991)

1. Respect and care for the community of life;
2. Improve the quality of human life;
3. Conserve the Earth's vitality and diversity;
4. Minimize the depletion of non-renewable resources;
5. Keep within the Earth's carrying capacity;
6. Change personal attitudes and practices;
7. Enable communities to care for their own environments;
8. Provide a national framework for integration, development, and conservation;
9. Create a global alliance.

The Nature of Sustainable Development

❑ Sustainability is a dynamic concept.

❑ Societies and their environments change, technologies and culture change, values and aspirations change.

❑ Sustainable society must allow and sustain such change, i.e., it must allow continuous, viable and vigorous development.

❑ That is what we mean by sustainable development.

What is to be Sustained and What is to be Developed?

What is to be Sustained

1. **Nature (Environmental)**
   - Earth
   - Bio-diversity
   - Eco-systems

2. **Life Support**
   - Ecosystem Services
   - Resources

3. **Social Community**
   - Culture
   - Groups
   - Places

What is to be Sustained and What is to be Developed? (Cont'd)

What is to be Developed

People

- Child Survival
- Life Expectancy
- Education
- Health
- Food
- Security
- Equity

Economy

o Wealth
o Living Wage/ Standard
o Productive Sectors
o Consumptions

Society

- Institutional Capacity
- Social Capital
- Stabilized Population
- Housing
- States
- Regions

Major Elements of Sustainable Development

Generally, contains three major dimensions or pillars:

1) Environmental Dimension (Ecological Dimension)
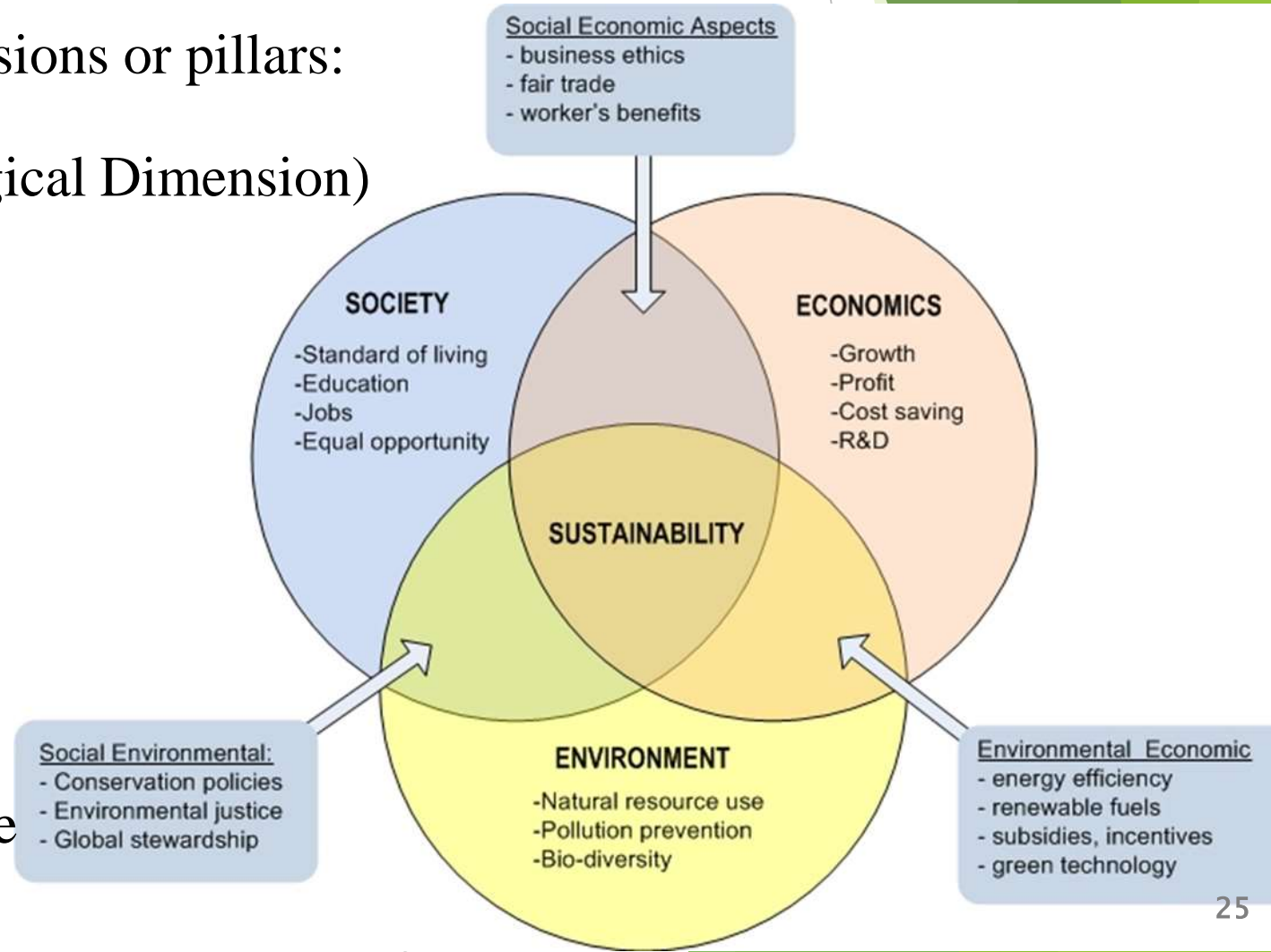
2) Social Dimension

3) Economic Dimension

Social Economic Aspects
- business ethics
- fair trade
- worker's benefits

SOCIETY
-Standard of living
-Education
-Jobs
-Equal opportunity

ECONOMICS
-Growth
-Profit
-Cost saving
-R&D

SUSTAINABILITY

Social Environmental:
- Conservation policies
- Environmental justice
- Global stewardship

ENVIRONMENT
-Natural resource use
-Pollution prevention
-Bio-diversity

Environmental Economic
- energy efficiency
- renewable fuels
- subsidies, incentives
- green technology

Figure **.** Interplay of the environmental, economic, and social aspects of sustainable development.

Elements of Sustainable Development (Contd.)

Alternatively, elements of Sustainable Development can be further expressed as follows:

- Economic

- Ecological

- Social-cultural

- Technological

- Institutional

- Political

Parameters of Elements of Sustainable Development

❑ **Economic:**
- Money and Capital
- Employment
- Investments
- Market Forces
- Productivity and profitability
- Population

❑ **Ecological:**
- Biodiversity
- Biophysical interactions
- Natural resources (materials and energy)
- Adopting environmental management weapons

Parameters of Elements of Sustainable Development (Contd.)

❑ **Social-cultural**
- Human diversity (Cultural, linguistic, and ethnic)
- Equity
- Quality of life
- Property rights
- Environmental awareness

❑ **Technological**
- Technological growth
- Proper management of resources use (includes wastes and natural resources)
- Environmental-friendly technologies

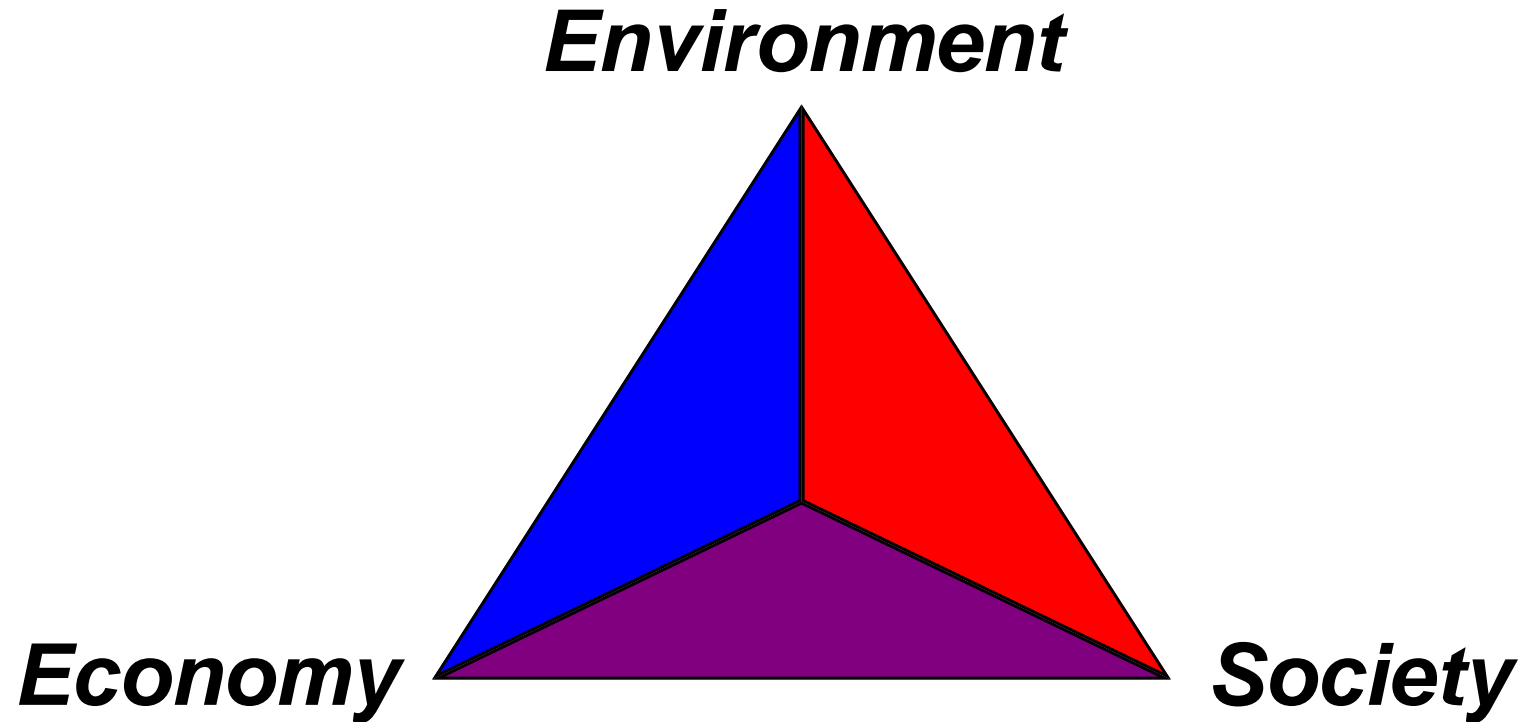# Parameters of Elements of Sustainable Development (Contd.)

❑ **Institutional**

  ▪ Capacity of institutional structures and organizations

❑ **Political**

  ▪ Capacity of political structures

  ▪ Empowering people

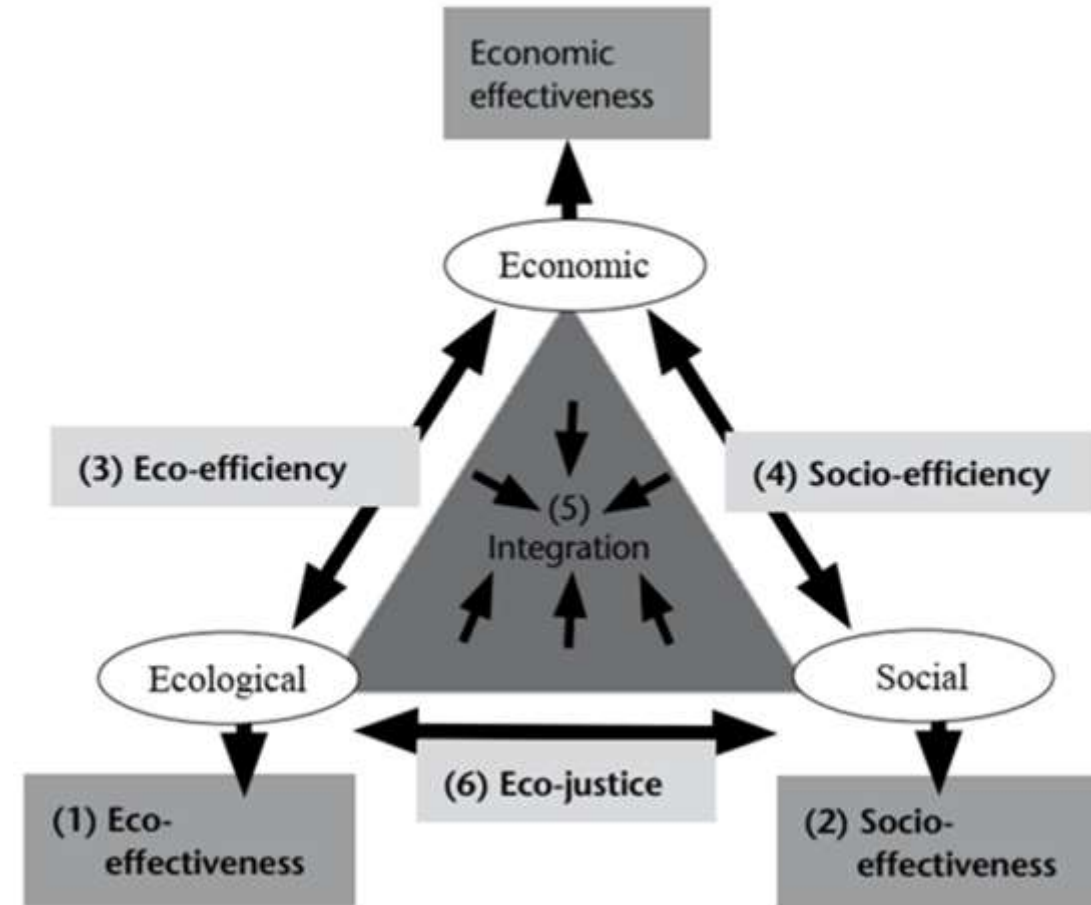 ▪ Peace and order.

Sustainability Triangle

Environment

Economy   **Society**

- ➢ Designed to help explain the three generally recognized elements of sustainability – the social, environment, and economic perspectives (represented by each corner).
- ➢ Its purpose is to explain each component individually, and the relationships between them.

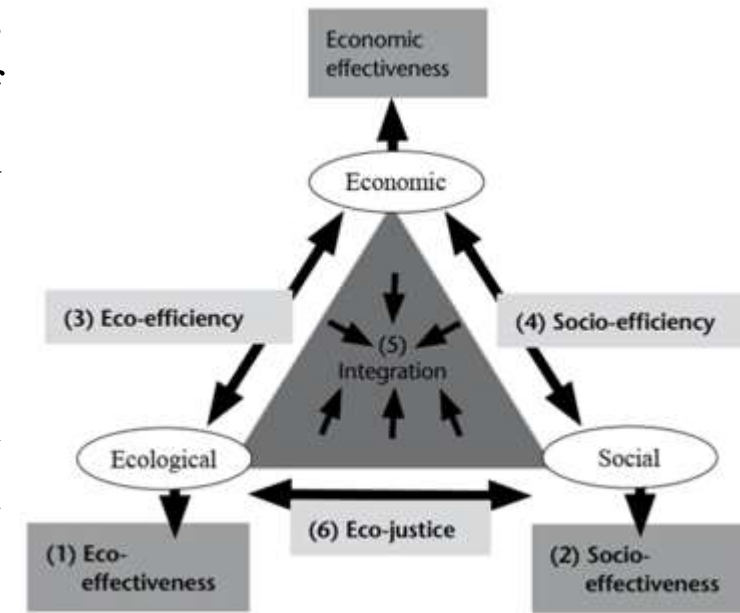# Relationships Between Elements of Sustainable Development

In the Sustainability Triangle:
- ❖ Each element (Social, Environment, and Economic dimensions) is represented by each corner, which in turn represents the company's effectiveness (i.e. socio-effectiveness, ecological effectiveness, and economic effectiveness);
- ❖ The interrelationships between them are shown by lines which connect the corners:
  - Eco-efficiency
  - Ecological-efficiency, and
  - Socio-efficiency.

# Relationships Between Elements of Sustainable Development (Contd.)

- **Sustainability (Vision)** tends to be about doing the **right things (effectively)** and includes issues such as the equitable distribution of benefits, the protection of rights and good governance. It is considered as the goal/objective of sustainable development (process): e.g. Economic Effectiveness or Eco-effectiveness, Ecological Effectiveness, and Socio-Effectiveness.

- ❖ *Economic-effectiveness: reflects how successful a company has been in maximizing its profits in terms of financial or economic returns through maximum environmental (ecological-efficiency) and social (socio-efficiency) performance as economically as possible.*

- ❖ *Ecological-effectiveness: reflects how successful a company has been in reducing its impacts on the natural environment.*

- ❖ *Socio-effectiveness: reflects how a company has taken account of the diversity of social and cultural demands to ensure its acceptance by the society within which it operates.*

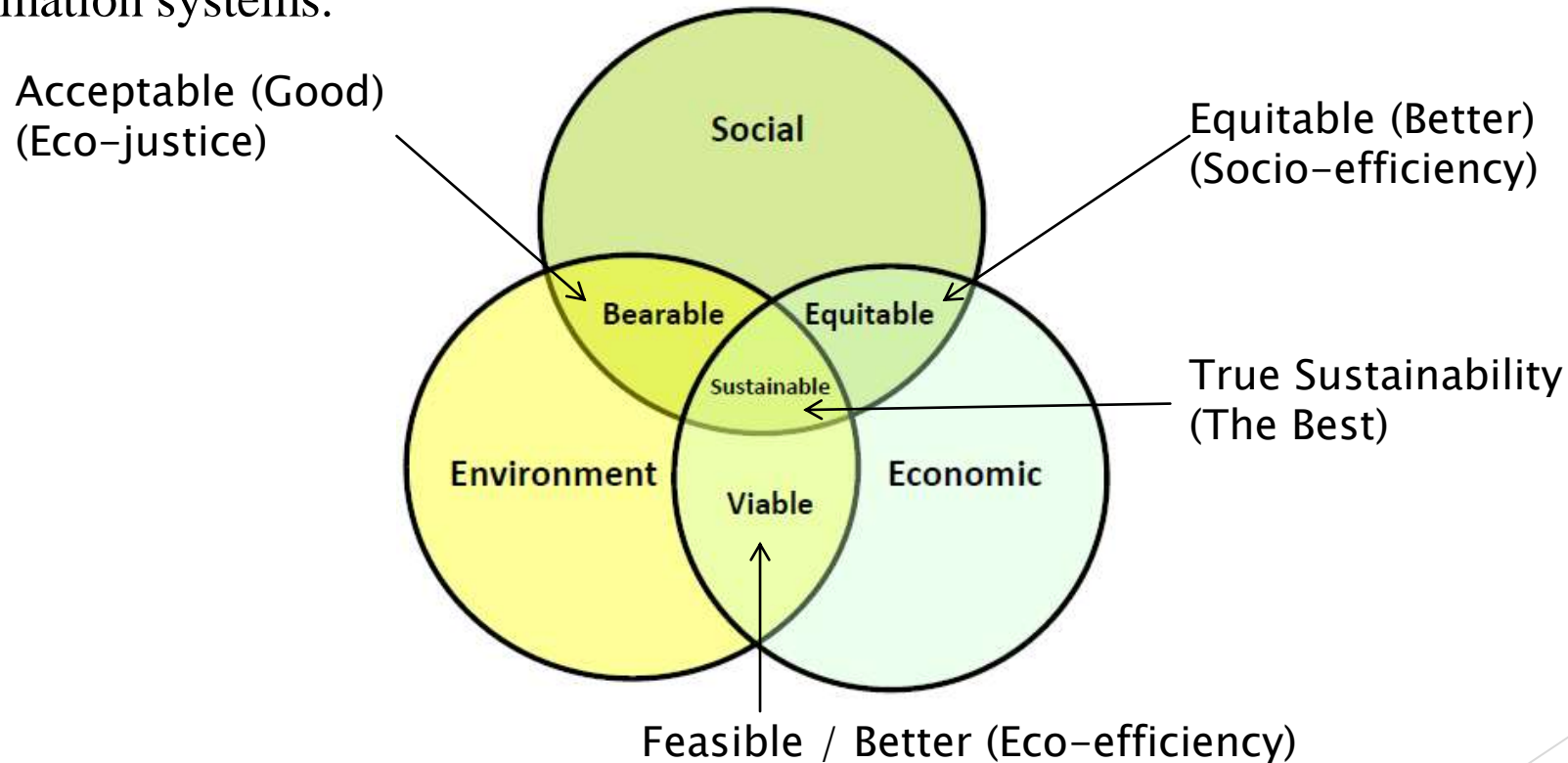# Relationships Between Elements of Sustainable Development (Contd.)

❖ **Responsibility (Mission)** is more focused on **doing things right (efficiently)** and concerns more on the application of appropriate environmental and social performance standard. It is considered as the guidelines/actions for implementing sustainable development (process): e.g. Economic Efficiency or Eco-efficiency, Ecological Efficiency, and Socio-efficiency.

❑ *Economic Efficiency or Eco-efficiency: relative proportions of an economic measure and environmental measure.*

❑ *Ecological-efficiency: relative proportions of physical (environmental) measures and social objectives.*

❑ *Socio-efficiency: relative proportions of an economic measure and social impact.*
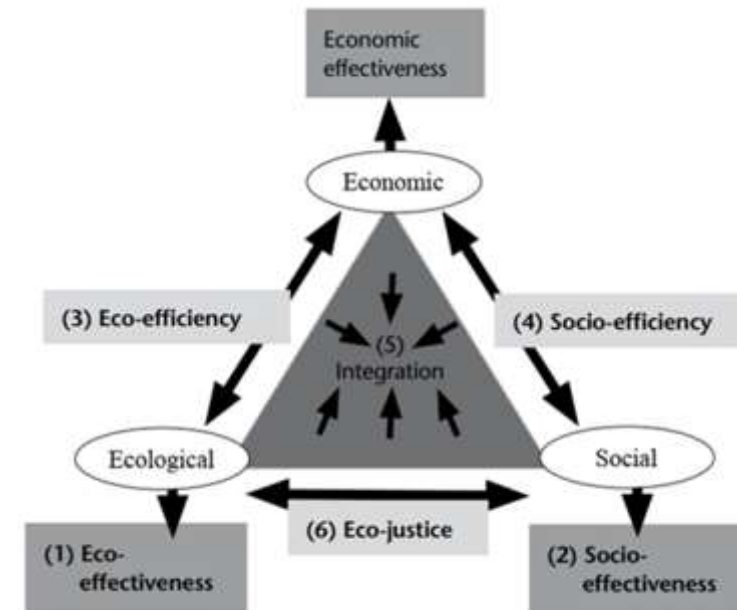
True Sustainability

- The main challenge for any company to achieve the true sustainability is to integrate all these different aspects
- This requires both the simultaneous pursuit of all aspects, and the integration of accounting for sustainability-related information with conventional accounting and information systems.

Acceptable (Good)
(Eco-justice)

Equitable (Better)
(Socio-efficiency)

True Sustainability
(The Best)

Social

Bearable   Equitable

Sustainable

Environment   Viable   Economic

Feasible / Better (Eco-efficiency)

Only through balancing in equal harmony of three dimensions (pillars) can we achieve " True Sustainability"

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How can we meet True Sustainability?

As the environment, society and economy become more aligned the area of overlap increases, and so does human well-being. The following rules can be defined to meet True Sustainability:

- Reduce our dependency on heavy metals and fossil fuels coal, oil, and natural gas;
- Reduce our dependency on synthetic chemicals;
- Reduce our destruction of nature to keep minimize the impacts on the environment;
- Reduce the level of waste through recycling and improved technologies to optimize recoveries;
- Contribute to the environment by adopting land use practices that improve biodiversity, and protect fragile ecosystems and reduce water use;
- Utilize the capital obtained to provide the adequate health care, education, and other social services and human development activities;
- Generate wealth through jobs, taxes, royalties, and shares the benefits equitably;
- Conduct efficient project closure, rehabilitation plans.
- Maintain a balance between environmental and economic sustainability.

Measures for Sustainable Development

a) Using Appropriate Technology (Design with Nature):
  - Locally adaptable,
  - Ecofriendly efficient and culturally suitable,
  - Less labour and less resources,
  - Maximum production with minimum wastes.

b) 3 – R's Approach:
  - Reduce, Reuse, and Recycle approach;
  - Reduce the usage and reduce the wastage of resource;
  - Produce things that last longer and easier to recycle, reuse, and repair;

c) Promoting Environmental Education Awareness
  - Will help changing the thinking and attitude of people towards environment.

d) Population Stabilization
  - Can achieve sustainable development by controlling population.

e) Conservation of Non-renewable Resources
  - Conserved by recycling and reusing.

f) Usage of Renewable Resources
  - Usage of renewable resources should not be faster than their regeneration capacity.

Planning for Sustainability

Planning for sustainability involves outlining where you hope to be and how you intend to get there:

- How is your organization structured and governed?
    o Where are we now?
    o Where are we headed?
    o Where should we be going? (Vision)?
- Does your effort have sufficient staffing?
- Is your budget sufficient to cover expected costs, now and the future?
- What are some obstacles you may encounter?
- How do you get around them?

Steps for the Sustainability Plan

- Identify what needs to be sustained. (Vision Statement)
- Identify what resources are required.
- How do we make the vision more concrete? – Targets and Indicators (Mission Statements)
  - Creating case statements
  - Present current activities
  - Present how new plan will benefit people and society
  - Present how you measure your progress
- Determining funding strategies
- Identify your action plan
- Implementation
- Monitoring and Evaluation

Benefits of Sustainable Development for Organizations

■ **Economic Sphere**

- Maximizes human well-beings
- Ensures efficient use of all resources
- Seeks to identify and internalize environmental and social costs
- Maintains and enhances the conditions for viable enterprise
- Generates direct and indirect employment
- Provides substantial government revenue and foreign exchange
- Provides a broad range of cost savings
- Improves human resource management.

Benefits of Sustainable Development for Organizations (Contd.)

■ **Social Sphere**
- Ensures a fair distribution of the costs and benefits of development
- Respects and reinforces the fundamental rights of human beings
- Seeks to sustain improvements overtime, ensures that depletion of natural resources will not deprive future generations
- Provides human capital and social infrastructure to the general public
- Contributes to community development in the project area.

Benefits of Sustainable Development for Organizations (Contd.)

■ **Environmental Sphere**
- Promotes responsible stewardship of natural resources and environment
- Minimizes waste and environmental damage along the whole supply chain
- Exercises prudence where impacts are unknown or uncertain
- Operates within ecological limits and protect critical natural capital.

Benefits of Sustainable Development for Organizations (Contd.)

■ **Governance Sphere**
- Supports representative democracy, including participatory decision-making
- Encourages free enterprise within a system of clear and fair rules and incentives
- Avoids excessive concentration of power
- Ensures transparency
- Ensures accountability for decisions and actions
- Encourages cooperation in order to build trust and shared goals
- Ensures that decisions are made at the appropriate level.

Think Globally and Act Locally

- Sustainable Development is a program needing both local and global action.
- Any environmental problem either local or regional can become a gigantic global issue if not addressed in time.
- As individual committees become successfully sustainable, the global community also progresses toward sustainability.
- Thus our motto should be: ***Think Globally and Act Locally***.

Levels of Responsibility

Levels of Responsibility

Global to Local (Top down)

Earth
Continent
Country
Province
Region
Municipality
Neighborhood
Household
Individual

Macro to Micro (Top down)

United Nations

Governments

NGOs/Community groups

Individuals

Levels of Responsibility (Contd.)

Generally, Environmental problems must be approached at all three levels:

- *Community level / local level:* Problems like air, water and noise pollution, land use and clearance, loss of bio-diversity, and waste management; most of them can be addressed through mechanisms such as IEE, and EIAs.

- *National or regional level*: problems like acid rain, floods, air pollution and deforestation; and

- *Global level:* issues like climate change (global warming), resource use/depletion, depletion of ozone layer and the associated problems.

Take Responsibility for Sustainability

- Each one of us can play our role, as a responsible member of the society to conserve the resources and protect or save the environment.
- Adoption of energy and resource saving methods; conserve fossil fuels, water, energy, and etc.
- New technology for minimization of wastes and toxins; waste management, pollution management.
- Biodegradable, renewable and recyclable products; natural resources management.
- Education and awareness about environment in people; eco-friendly and environmental-friendly life style.

General Guidelines Towards Sustainability

Herman Daly's three conditions of a sustainable society

1. Rates of use of renewable resources do not exceed their rates of regeneration.
2. Rates of use of non-renewable resources do not exceed the rate at which sustainable renewable substitutes are developed.
3. Rates of pollution emission do not exceed the assimilative capacity of the environment.

Donnella Meadows's guidelines for Restructuring World Systems Towards Sustainability

1. Minimize the use of non-renewable resources.
2. Prevent erosion of renewable resources.
3. Use all resources with maximum efficiency.
4. Slow and eventually stop the exponential growth of population and physical capital.
5. Monitor the condition of resources, the natural environment, and the welfare of humans.
6. Improve response time for environmental stress.

Characteristics of Profit-Oriented Organizations to be Sustainable

Sustainable Development is only for profit-oriented organizations. Such a profit-oriented organization should have the following characteristics:
- Financially Profitable
- Economically Viable
- Technically Efficient/Appropriate
- Environmentally Sound
- Socially Responsible
- Sound Governance
- Long lasting Benefits for the Community
- Efficient Use of Natural Resources

Education for Sustainable Development (ESD)

❖ **What is Education for Sustainable Development (ESD)?**
  ▪ Education for Sustainable Development (ESD) is about learning to (UNESCO):
    ➤ *Respect, value and preserve the achievements of the past;*
    ➤ *Respect and care for the community of life and diversity, ecological integrity; and economic justice.*
    ➤ *Appreciate the wonders and the peoples of the Earth;*
    ➤ *Live in a world where all people have sufficient for a healthy and productive life;*
    ➤ *Assess, care for and restore the state of our planet;*
    ➤ *Create and enjoy a better, safer, culture of peace and democracy, more just world;*
    ➤ *Be caring citizens who exercise their rights and responsibilities locally, nationally, and globally.*

Education for Sustainable Development (ESD)(Cont'd)

- The United Nations Decade of Education for Sustainable Development (DESD) signaled a new purpose for education:

"Education should be of a quality that provides the values, knowledge, skills, issues, perspectives, and competencies for the environmental, social, and economic spheres of sustainability and participation in society decent work."

Definitions of ESD

Defining Education for Sustainability

Education for Sustainability is defined as a combination of content, learning methods, and outcomes that helps students develop a knowledge base about the environment, the economy, and society, in addition to helping them learn skills, perspectives, and values that guide and motivate them to seek sustainable livelihoods, participate in a democratic society, and live in a sustainable manner.

McMillan and Higgs(2003). In National Education for Sustainability K-12 Student Learning Standards , www.uspartnership.org.

Definitions of ESD (Contd.)

"Education for sustainable development (ESD) is education, which promotes the balancing of economic growth, environmental conservation, cultural diversity, and social well-being in a way that inclusive of marginalized populations and attends to gender issues" (UNESCO 2009).

"Education for Sustainable Development is a lifelong learning process that leads to an informed and involved citizenry having a creative problem-solving skills, scientific and social literacy and commitment to engage in responsible individual and cooperative actions. These actions will help ensure an environmentally sound and economically prosperous future" (President Council on Sustainable Development --- Education for Sustainable Development).

Ways of Thinking to ESD Approach

❖ Ways of thinking are vital to ESD approach:

Includes: systems-thinking, intergenerational responsibility, protection and enhancement of shared natural resources, awareness of driving forces, and taking on strategic responsibility (McKeown and Hopkins 2009; Gallagher and Hogan 2000).

❖ Calls for a multiple-perspective approach: a tool designed to help students of today to understand and work on large projects, complex problems, multi-disciplinary nature, intractable situations, gender specializations, various communities and nations, and multi-perspective teams.

❖ The most unique perspectives: Scientific, Historical, Geographic, Human Rights, Gender Equality, Values, Cultural Diversity, and Sustainability.

Sustainable Development and Engineering

- Engineers and designers must turn their attention to design for needs, not wants.
- Engineering should serve the community in a socially responsible and sustainable manner.
- The engineering profession must progress from the role of technical service provider, to a profession that leads change through understanding of the human, environmental, societal and cultural, and economical challenges.
- Perdan and Azapagic (2003) stated that engineering continues to provide and develop technologies that have a meaningful impact on the livelihood of communities: *this is through Sustainable Development Technologies.*
- This requires engineers to better understand the criteria to be examined in moving towards sustainable development technologies.

Engineering Education for Sustainable Development (EESD)

❖ At some stage in their career, engineers do come into direct or indirect conflict with the economic, environment, human, societal and cultural activities, and hence there is a need for the sustainable development in engineering education to be taught as part of the curricula (Abdul-Wahab et al. 2003).

❖ **What is Engineering Education for Sustainable Development (EESD)?**

Definitions

"*Means education that encourages engineers to play an important role in planning and building projects that preserve natural resources, are cost-efficient and support human and natural environments*"

(World Federation of Engineering Organizations (WFEO, 2002)

Accreditation Requirements Related to EESD:

- Materials on sustainability should be introduced in the curriculum, so students can consider the impacts of design upon society, nations and the environment.
- The curriculum should cover the following aspects:
- *Appropriate coverage of sustainable technologies and sustainable development methodologies (Principles of Sustainable Design/ Sustainability/Sustainable Development);*
- *Integrated consideration of the social and environmental effects of students' future engineering activities (Environmental Studies, Environmental and social issues, Environmental Engineering, Environmental and Social Impact Studies)*
- *Financial and Economic Context of Engineering Processes, Projects, Design Alternatives, and Problems (Concepts of Engineering Economy)*

Accreditation Requirements Related to EESD: (Contd.)

- *Project Management;*
- *Process Design;*
- *Resources Use Management: Renewable and Non-renewable Resources Use;*
- *Complexity/Complex Systems, and related problems*
- *Professional and Ethical Responsibilities*
- *Multi-disciplinary issues;*
- *Technical and Safety Measures; and*
- *Sound Governance Consideration.*

Some Recommendations for EESD

❖ It is recommended that, with respect to sustainability/sustainable development, the graduates should:

"*Understand the impact of engineering solutions in a societal context and demonstrate knowledge of, and need for, sustainable development*" (International Engineering Alliance, IEA, 2007).

❖ It is essential that our undergraduate engineering programs must be reformed" (David Wood 2009, keynote speaker to the World Congress of Chemical Engineering held in Montreal, 2009).

Sustainability Declaration (An Example)

Portland State University (PSU) (2005)

Infuse sustainability into all colleges, schools and programs (both undergraduates and graduates) in 2005.

PSU Motto
"Let Knowledge Serve the City"

PSU Sustainability Vision and Mission

Vision
To be an internationally recognized university known for excellence in student learning, innovative research, and community engagement that simultaneously advance economic vitality, environmental health, and quality of social life.

Mission
Serving as a leading academic laboratory for developing sustainable processes and practices using multi-disciplinary approaches in partnership with business, government, and other organizations.

Sustainable Engineering Education

❖ **What is Sustainable Engineering?**
  ▪ The incorporating sustainable development in engineering academic teaching reinforces engineering students with sound awareness of environmental issues and promotes innovative ideas that contribute to green engineering solutions (Parden et al. 2000).
  ▪ Engineering students with well-grounded in sustainable development awareness will be able to design innovated engineering solutions that the expanding global population demands, while at the same time take environmental management and protection into account (Abdul-Wahab et al. 2003).

❖ **Definition of Sustainable Engineering Education**

"Practices that promote environmental, social, and economic sustainability through greater resource efficiency, reduced pollution and consideration of the wider social impacts of new technologies, processes and practices" (Dowling et al.,2010).

Engineering Principles for Sustainable Development

Some principles of engineering for SD are:

- Adopting cradle to grave (life cycle) approach;
- Think globally and act locally.
- Be cautious to the cost reductions;
- Being creative and innovational;
- Be sure about the knowledge of needs and wants;
- Commitment of risk assessment experts to safety assessments or ethical risks;
- Commitment of engineering education programs for future engineers about social, environmental, and moral responsibilities;
- Engineering knowledge in designing and developing sustainable technologies;

Engineering Principles for Sustainable Development (Contd.)

- Principles of Sustainable Development followed, together with consideration of technical and engineering designs and their impacts on nature and environment, social, and economic spheres;
- Guaranteeing the safety and well-being to the public;
- Looking for a balanced solution;
- Looking for the engagement from all stakeholders;
- Adopting democratic procedures for technology decision making and policy management;
- Communicating advices from experts to non-experts;
- Demonstrate social activities by engineers in public interest;
- Conducting public participation regarding the proposed project.

The Role of Engineers in Sustainable Development

- Professional engineers can play an important role in sustainable development by planning and building projects that preserve natural resources, are cost efficient and support human and natural environment.
- Professional engineers need to better understand the criteria to be examined in moving towards sustainable development technologies:
- *The use of sustainable engineering technology design processes;*
- *Enhancement of the efficiency of engineering processes and resource use;*
- *Appropriate selection of resources bearing in mind the sustainability criteria; and*
- *An adoption of environmental stewardship in engineering activities.*

The Role of Engineers in Sustainable Development (Contd.)

❖ Professional engineers are required to take responsibility for engineering projects and programs, technologies and products they design and manufacture and the risks to the sustainability of the environment, society and economic outcomes over the life time of the project. Responsibilities include:

- *Social responsibilities including ethics, health and safety and other legislation;*
- *Cultural responsibilities;*
- *Environmental responsibilities including the need for sustainable development and deign and legislative responsibilities.*

The Role of Engineers in Sustainable Development (Contd.)

❖ Engineers can contribute to sustainable development along the entire life of modern production processes, and projects through the following management tools:

- *Volume Cost Profit (VCP)and Profit Planning Analysis;*
- ***Engineering Studies****: Conceptual or Preliminary Economic Assessment, Pre-feasibility Study, Final Feasibility Study, and Detail Engineering Studies;*
- ***Project Analysis****: Technical Analysis, Economic Analysis, Financial Analysis, Market Analysis, Environmental Analysis, Social Analysis; and Political Analysis.*
- ***Project Evaluation Techniques****: Cash-flows Analysis, Economic and Financial Tools for Investment Decision Analysis, Sensitivity Analysis, Scenario Analysis, Break-even Analysis and Risk Analysis; and etc.*

❖ Engineers need to recognize this professional responsibility and start taking a leadership role in this field to enhance sustainability and sustainable design.

❖ Only when leaders in society begin to accept the responsibility for achieving sustainability will society be on the path to that goal.

What kind of Engineers do we need?

It is clear that engineering has responded to the needs of society and without a doubt, today's society requires a new kind of engineers:

"A new kind of engineer is needed, an engineer who is fully aware of what is going on in society and who has the skills to deal with societal aspects of technologies" (De Graaff et al., 2001)

"It is undeniable that the world and its cultures need a different kind of engineer, one who has a long-term, systematic approach to decision-making, one who is guided by ethics, justice, equality and solidarity, and has a holistic understanding and skills that go beyond his or her own field of specialization" (Barcelona Declaration 2004)

Qualifications for Future/Next Engineer

The next or future engineers will need the following embedded social and ethical philosophy, that stems from the foundation of their engineering learning:

➢ *Understanding of the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development;*

➢ *Understanding of the principles of sustainable design, development, and methodologies so as to minimize adverse impacts of environment, social, and economic aspects;*

➢ *Understanding of the life cycle analysis for a product, process, project or system to be designed;*

➢ *Understanding of the pros and cons of alternative design options to assist in the selection of an optimized design based on the life cycle analysis; and*

➢ *Understanding of and commitment to professional and ethical responsibilities.*

Conclusion

❖ Endless growth is destroying our beautiful environment in the name of development.

❖ Market demand and a growing population drive endless extraction of resources what nature has created at an alarming speed until they no longer exist.

❖ On the other hand, it is not easy to meet society's needs without changing the landscape somewhere and affecting local communities.

❖ The challenges to provide society with its needs, protect future resources, and alter the landscape and affect local communities as little as possible are:

➢ to live within certain limits of the earths' carrying capacity;

➢ to understand the interconnections among economy, society, and environment;

➢ to maintain a fair distribution of resources and opportunity for this generation and the next.

Conclusion (Contd.)

❖ There is very little time left for talking and discussing the matter.

❖ What is not started today is never finished tomorrow (John Wolfgang von Goeth, 1749 – 1832)

❖ Our main responsibility for sustainability to save our planet would be to make sure we:

"Do Right Things or Plan the Work: Identify the main objective(s) for Sustainable Development Process (i.e. What is/are needed to be sustained? And what is/are needed to be developed?) (The Vision Statement)"

And

"Do Things Right or Work the Plan: Identify responsible activities (draw action plan or responsible guidelines) (The Mission Statement)"

Conclusion (Contd.)

My final words for you are:

"If everyone lived like the average American, we would need 5 planets to sustain, and if they lived like the average European (or Greek) we would need 3. In any case we have only ONE"

"There is enough in the world for everyone's need, but not enough for everyone's greed".

"Humans are greedy, selfish, competitive materialists".

"Nature provides a free lunch, but only if we control our appetites" (William Ruckelshaus, June 1990)

Conclusion (Contd.)

"Everyone is Responsible for Sustainability to save our Planet" (think globally first, and then act locally).

"It's about what each of us can do right now to help restore the lost harmony between humanity and nature".

"It's only one small thing you can do right now to make a big difference".

"Be sure you plan and manage to do right things right with a right person at the right time using the least amount of resources available".

Thank You Very Much for Your Kind Attention!

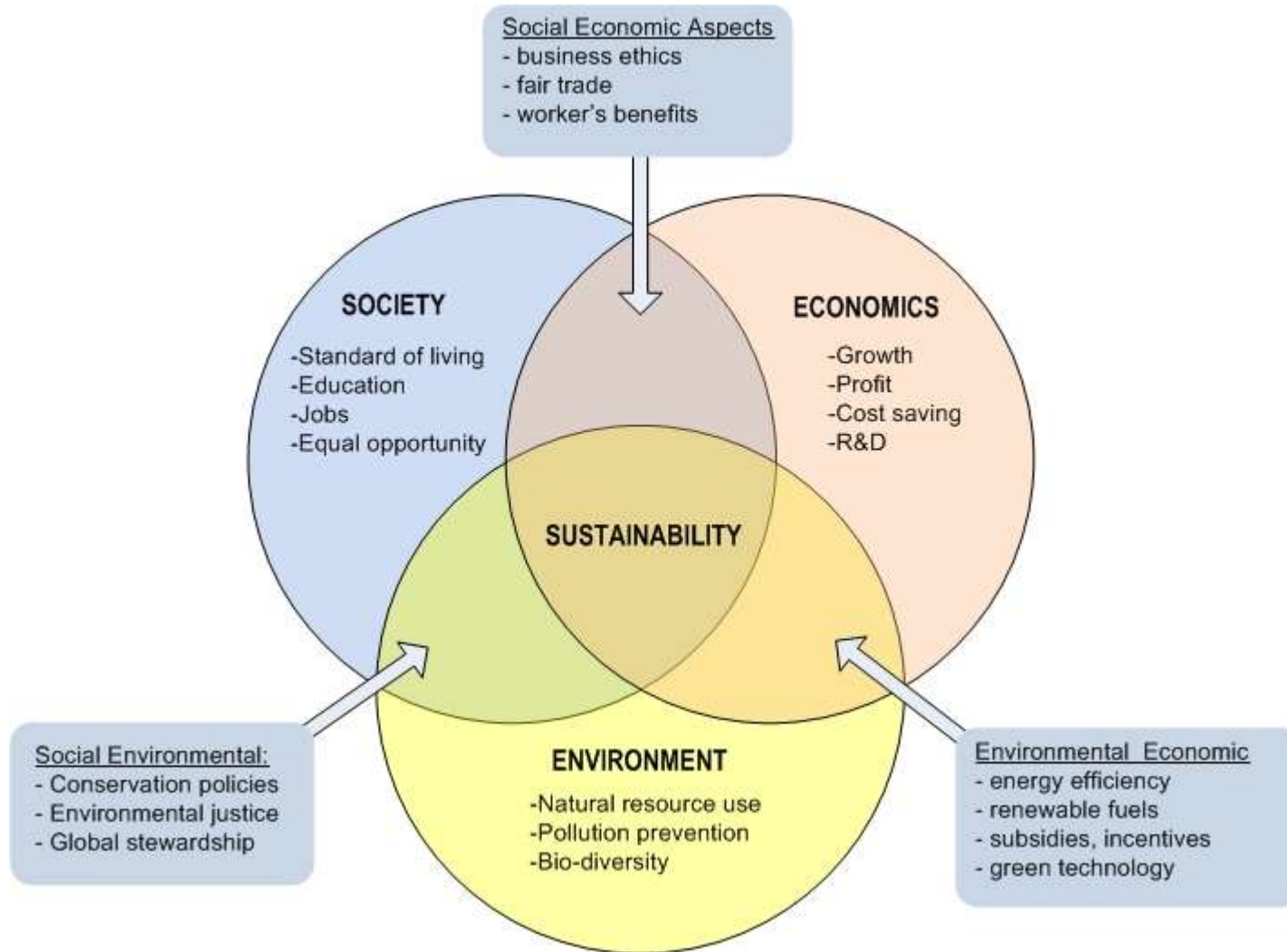**Thank You Very Much for Your Kind Attention!**

Figure 1.1. Interplay of the environmental, economic, and social aspects of sustainable development. Slide 22
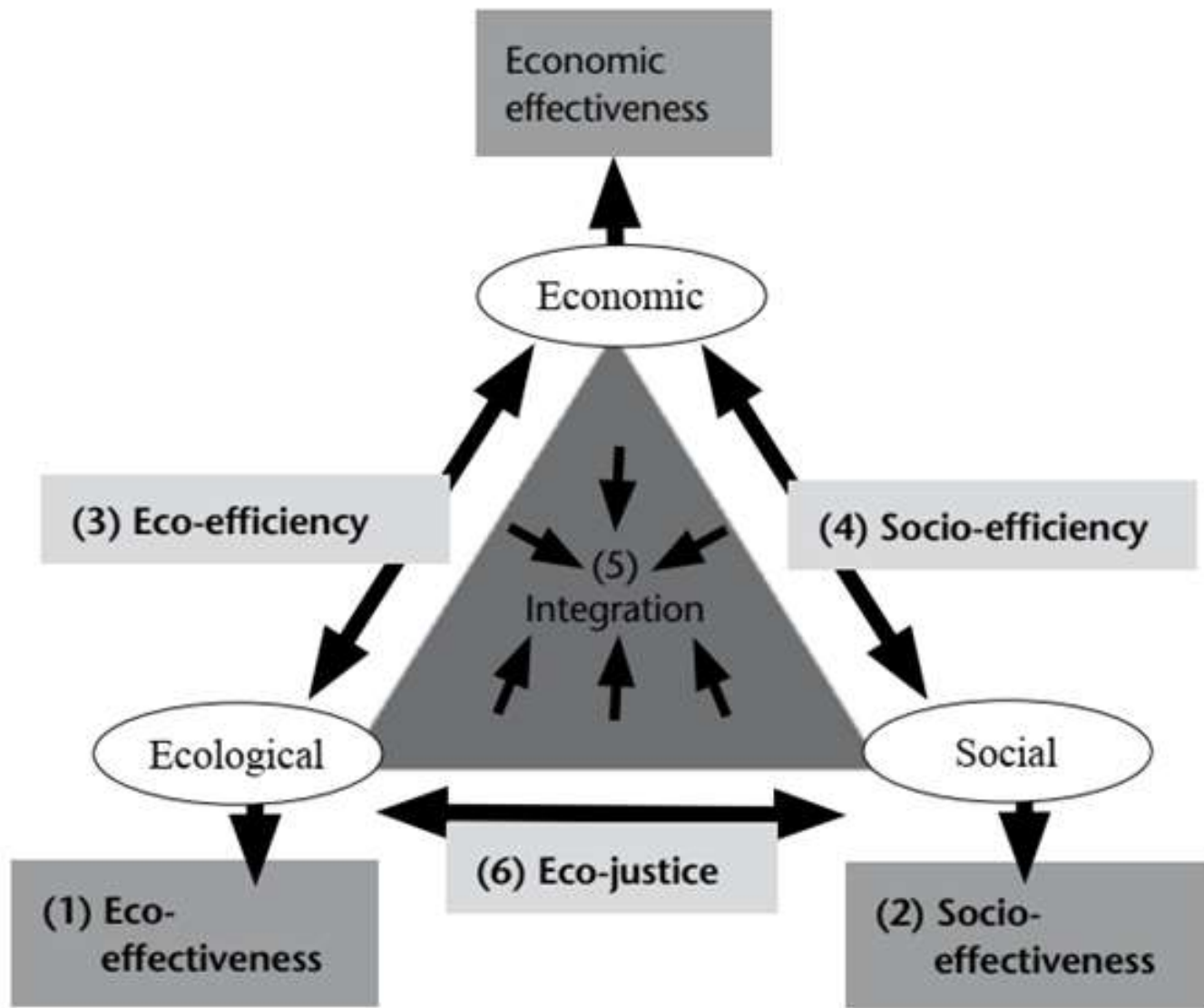
Figure: Structuring the information needs of corporate sustainability with the sustainability triangle slide27,28

Your Carbon Footprint

- Water
- Emissions
- Fuel
- Electricity
- Transport
- Personnel
- Gas
- Waste
- Offsets
- Recycling