

MCN-201 :

SUSTAINABLE ENGINEERING

MODULE 1

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MODULE 1

Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).

Sustainability

- Sustainability refers to achieving our goals without affecting the capacity of future generations to achieve their goals.
- Sustainability means that there is a chance that humans and other forms of life on our planet will continue to survive for as long as we are here.
- In addition to natural resources, we also need social and economic resources. Sustainability is not just environmentalism.
- Sustainability was built on the idea of managing the environment.

Why do we need sustainability?

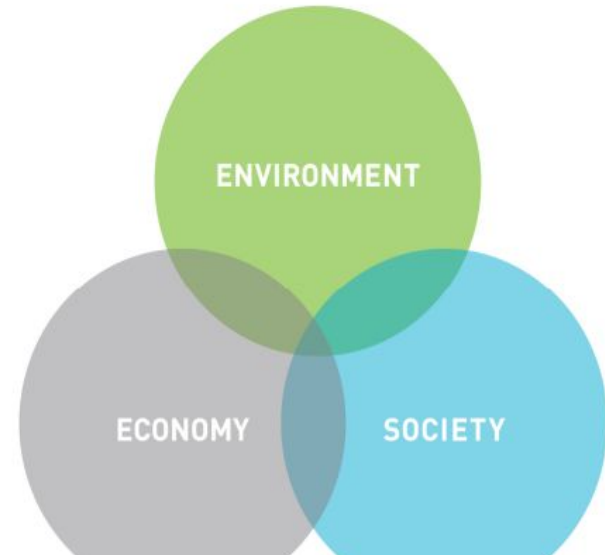
- The general goal of environmental sustainability is to even things out.
- As we've seen, environmental sustainability provides huge benefits for human health and that of all other species.
- Sustainability can increase life expectancy by providing healthier living conditions and better healthcare, which could also lessen the divide between the rich and poor.
- Sustainable development encourages more responsible manufacturing and production, covering the industrial side of waste and pollution.
- It also encourages companies, industries, and governments to make decisions based on long-term consequences, rather than taking the easiest, cheapest option.

Concept & evolution of Sustainability

Pillars of Sustainability

The three bottom lines, or pillars, are:

- Economic Sustainability
- Social Sustainability
- Environmental Sustainability



Economic Sustainability

Economic Sustainability takes into account the social and ecological consequences of economic activity. It incorporates new paradigms like circular economy, cradle to grave etc. Additionally, economic sustainability also means that human communities across the globe are able to maintain their independence and have access to the resources that they require, financial and other, to meet their needs.

Social Sustainability

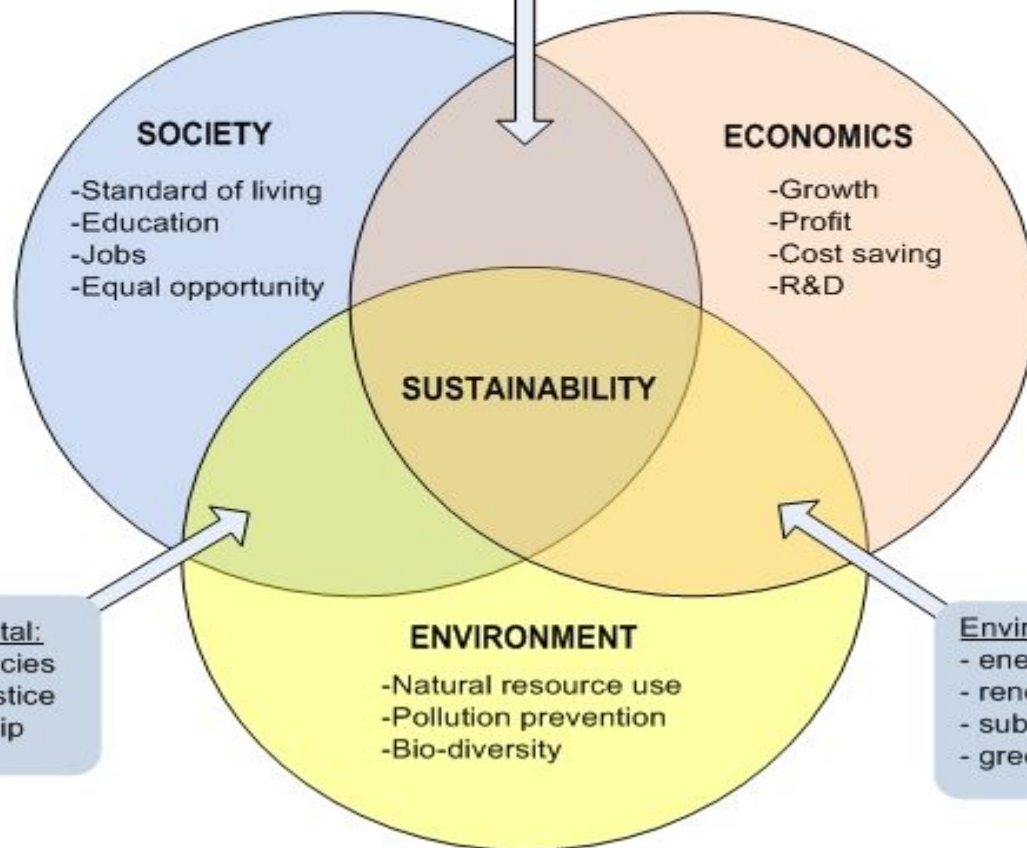
A socially sustainable society is one in which all members have equal rights, all share equitably in societal benefits, and all participate equally in the decision-making process. Universal human rights and basic necessities are attainable by all people, who have access to enough resources in order to keep their families and communities healthy and secure.

Environmental Sustainability

Ecological integrity is maintained, all of earth's environmental systems are kept in balance while natural resources within them are consumed by humans at a rate where they are able to replenish themselves.

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

ENVIRONMENT

- Natural resource use
- Pollution prevention
- Bio-diversity

Social Environmental:

- Conservation policies
- Environmental justice
- Global stewardship

Environmental Economic

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

Economic Sustainability

- Economic sustainability refers to practices that support the long-term economic development of a company or nation while also protecting environmental, social, and cultural elements.
- Today, economic sustainability is a goal that very few organizations achieve, despite a fairly universal understanding of what types of business practices (e.g., burning of fossil fuels, creating food waste, leveraging harmful manufacturing methods) contribute to climate change.

ECONOMIC SUSTAINABILITY EXAMPLES

- A variety of economic sustainability examples are taking hold around the world.
- In some cases, businesses and governmental agencies are improving their sustainability practices to reduce their carbon footprint.

AIR-TO-WATER INNOVATIONS

- One of the most exciting examples is emerging technology that can extract water from the air.
- Several companies have developed or are working on these types of innovations.
- For example, Zero Mass Water's system, which is powered by solar panels, captures air with a fan, filters out dust and pollutants, and separates out the water. It has been installed in more than 40 countries.

GROWTH OF RECYCLING

- Recycling is still one of the best ways to reduce your carbon footprint.
- Today, a variety of companies have made a business out of recycling or its counterparts: upcycling, downcycling, e-cycling, and precycling.
- These include local recycling centers, websites like Ebay, vintage and pre-owned clothing shops, and apps such as LetGo.

MICRO-FARMING

- Micro-farming, also known as urban farming, is farming on residential or commercial property of less than five acres.
- Micro-farming is a relatively easy way for a community to improve the food security of its residents and boost local economic growth while benefiting the environment.
- Each micro-farm offers benefits such as reduced carbon emissions, less use of pesticides and herbicides, and better public health.
- When a micro-farm replaces a grass yard, the farmer also ensures he or she is using less water and providing an attractive area for pollinating insects.

Social Sustainability

“Social sustainability, as an independent dimension of sustainable development, and equally important as the economic or environmental dimension still lacks broad recognition by scientists as well as by decision makers.”

The five dimensions of social Sustainability are:

- Quality of life
- Equality
- Diversity
- Social Cohesion
- Democracy & Governance

Quality of Life Social Sustainability

- Quality of life is a big topic and covers many aspects of things that affect our living qualities.
- For example, affordable housing, physical & mental medical support, education training opportunities, employment opportunities, access to support, and of course safety and security.

Equality dimension of Social Sustainability

- Equality is the act to reduce disadvantages to certain groups, or helping certain groups to remove barriers to have more control of their lives.
- It also includes identifying the causes and reasons of disadvantages and find ways to reduce them.

Diversity dimension of Social sustainability

- Diversity includes finding needs from different diverse groups of different diversity types and assess their needs, and educating everyone to have diverse viewpoints to leverage benefits of diversity.
- **Social Cohesion dimension of social sustainability**
- Social Cohesion means increasing participation by individual in a target group, as well as helping target groups to access public and civic institutions. One important factor is to build links between different target groups in a broader way by encouraging target groups to contribute to society as well.
- **Democracy & Governance**
- Governance is to make sure budget and resources are adequate to sustain sustainability programs and the ability to measure it.

● **Environmental Sustainability**

- Environmental sustainability aims to improve the quality of human life without putting unnecessary strain on the earth's supporting ecosystems. It's about creating an equilibrium between consumerist human culture and the living world. We can do this by living in a way that doesn't waste or unnecessarily deplete natural resources

● **examples of environmental sustainability**

- There are two primary ways in which environmental sustainability can be achieved: by individuals and by corporations and government bodies.
- As individuals, we can take small but effective steps towards a more sustainable lifestyle, like using less water, reducing our meat consumption and switching to reusable products to reduce our dependence on single-use plastics.
- From a corporation's perspective, environmental sustainability may involve switching to renewable energy in warehouses, factories and offices or cutting down on single-use plastics in manufacturing.

Nexus between Technology and Sustainable development

- ★ Technology is a big part of both sustainable development and how it is done.
- ★ Not everything that comes from modern technologies is good.
- ★ On the contrary, many problems, like those in the environmental field, are caused by how technology is used and implemented.
- ★ Technology development is a big part of meeting SDG goals because it makes new, more sustainable ways of developing more efficient and effective.
- ★ So, we need to make new technologies that help with research and encourage new ideas.

The benefits of environmental sustainability are:

- ★ We can protect ecosystems
- ★ We can continue to enjoy nature as it is
- ★ We can protect endangered species
- ★ Less pollution in the cities will result in better respiratory health for all
- ★ It could halt or reverse the effects of global warming
- ★ We won't be creating huge landfills all over the world that will take hundreds of years to break down

- ★ Robotics, digital twins, and smart building systems can help businesses become more efficient and reduce their carbon footprint.
- ★ Using the cloud, utilities can manage energy in a sustainable way across whole grids.
- ★ Technology makes it possible to make new products and services that use less energy, chemicals, and water and produce less waste.
- ★ This is good for the environment and for the efficiency of operations at the same time.

Examples of Sustainable Technology

- ★ Public and electric transport.
- ★ LED light technology.
- ★ Solar power.
- ★ Carbon capture and storage technologies.
- ★ Self-sufficient and LEED buildings and construction methods

Millennium Development Goals (MDGs)

- ★ At the September 2000 Millennium Summit, the greatest assembly of world leaders in history adopted the United Nations Millennium Declaration, pledging member nations to a new global partnership to reduce extreme poverty and establishing a number of goals with a 2015 deadline.
- ★ These are known as the Millennium Development Objectives (MDGs).
- ★ The MDG monitoring framework was amended in 2007 to include four new goals agreed to by member states at the 2005 World Summit: full and productive employment and decent work for all, access to reproductive health, access to treatment for HIV/AIDS, and protection of biodiversity.
- ★ Indicators for these new targets were operational in January 2008, and this framework is used to track progress toward reaching the Millennium Development Goals..

Millennium Development Goals (MDGs)

Keyfacts

- ★ Globally, the number of deaths of children under 5 years of age fell from 12.7 million in 1990 to 6.3 million in 2013.
- ★ In developing countries, the percentage of underweight children under 5 years old dropped from 28% in 1990 to 17% in 2013.
- ★ Globally, new HIV infections declined by 38% between 2001 and 2013.
- ★ Existing cases of tuberculosis are declining, along with deaths among HIV-negative tuberculosis cases.
- ★ In 2010, the world met the United Nations Millennium Development Goals target on access to safe drinking-water, as measured by the proxy indicator of access to improved drinking-water sources, but more needs to be done to achieve the sanitation target.

The following are the eight Millennium Development Goals:

1. to eliminate extreme poverty and hunger;
2. to achieve global primary education;
3. to empower women and promote gender equality;
4. to reduce child mortality;
5. to promote maternal health;
6. to fight malaria, HIV/AIDS, and other diseases;
7. to promote environmental sustainability; and
8. to develop a universal partnership for development.

MDG 1: Eradicate extreme poverty and hunger

Millennium Development Goal 1 has three targets:

1. To halve the proportion of people whose daily income is less than \$1.25
2. To achieve full and productive employment, as well as decent work for all, including young people and women
3. To halve the proportion of individuals suffering from hunger in the period between 1990 and 2015.

MDG 2: Achieve universal primary education

There is only one target for millennium development goal 2:

1. To ensure that children universally – including both boys and girls – will be able to complete a full course of primary education by 2015.

MDG 3: Promote gender equality and empower women

There was only one target under millennium development goal 3:

- To eliminate gender disparity in primary and secondary education by 2005, and in all levels of education by 2015.

MDG 4: Reduce child mortality

The **Millennium Development Goal 4** has only one target:

- **To reduce the under-five mortality rate by two-thirds in the period between 1990 and 2015**

MDG 5: Improve maternal health

In this regard, millennium development goal 5 has two targets:

1. **To reduce the maternal mortality ratio by 75 percent**
2. **To achieve universal access to reproductive health**

MDG 6: Combat HIV/AIDS, Malaria and other major diseases

In this regard, Millennium Development Goal 6 has three targets:

1. **To halt by 2015 and have started to reverse the spread of HIV/AIDS**
2. **To achieve global access to treatment for HIV/AIDS for those who need it by 2010**
3. **To have ceased and started reversal of the incidence of malaria and other major diseases by 2015**

MDG 7: Ensure environmental sustainability

As such, millennium development goal 7 has 4 targets:

1. To integrate the principles of sustainable development into every nation's policies and programmes, and also reverse the depletion of environmental resources
2. To reduce biodiversity loss and achieve a substantial reduction in the rate of loss by 2010
3. To halve the proportion of the universal population without sustainable access to clean and safe drinking water and basic sanitation by 2015.
4. To achieve substantial improvement in the lives of a minimum of 100 million slum dwellers by 2020.

MDG 8: Develop a Global Partnership for Development

Millennium development goal 8 has 6 targets that seek to develop global partnership for development, namely:

- To further develop an open, predictable, rule-based, non-discriminatory trading and economic system
- To address the special needs of the least developed countries
- To address the special needs of small island developing States and landlocked developing countries
- To deal exhaustively with the debt problems of developing nations
- To provide access to affordable essential drugs in the developing world – in collaboration with pharmaceutical companies
- To avail benefits of new technologies, especially information and communications, in collaboration with the private sector

Sustainable Development Goals (SDGs)

The goals focus on improving inequality regarding health, education, and the economy, with a large focus on helping to tackle climate change and preserve the oceans

- There are 17 sustainable development goals



SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



SUSTAINABLE DEVELOPMENT GOALS

1. No Poverty

- End extreme poverty reduce half the population living in poverty, implement protection systems, ensure equal rights to economic resources and basic services

2. Zero Hunger

- end hunger, end all forms of malnutrition, double agricultural productivity and the income of small-scale food producers.

3. Good Health and Well-Being

- Reduce maternal mortality, end preventable newborn and child death, end multiple disease epidemics, reduce premature mortality

4. Quality Education

Ensure free and quality primary and secondary education, give children access to early childhood development, ensure equal access for men and women to afford higher education choices.

5. Gender Equality

End discrimination against women, eliminate all forms of violence against women, ensure access to feminine health care, and ensure equal rights.

6. Clean Water and Sanitation

Provide equal universal access to safe drinking water, sanitation, and hygiene, reduce water pollution.

7. Affordable and Clean Energy

Increase renewable energy use, improve energy use efficiency, enhance international cooperation regarding clean energy access

8. Decent Work and Economic Growth

Sustain economic growth, increase economic productivity, promote tourism, and grant access to financial institution access for all.

9. Industry, Innovation, and Infrastructure

Reliable infrastructure for all, sustainable industrialization, increased access of small-scale industries and enterprises in developing countries, rendering industries sustainable, and improving technology in all industries.

10. Reduced Inequalities

better financial market and institution regulation, legitimate institutions that represent developing countries in global decisions, and safe migration.

11. Sustainable Cities and Communities

safe and affordable housing for all, safe and affordable transport for all, monitoring air quality and waste management to reduce negative city impact, and to provide green public space

12. Responsible Consumption and Production

implementing a 10-year framework program for sustainable development and consumption, achieving sustainable management, encourage company sustainable practices, sustainable public procurement practices.

13. Climate Action

being prepared for climate related disasters, integrating climate policies into national policies, and raising climate awareness

14. Life Below Water

preventing marine pollution, protecting marine and coastal ecosystems.

15. Life on Land

ensuring freshwater ecosystem health, sustainable management of forests, and integrating biodiversity values into national planning.

16. Peace, Justice, and Strong Institutions

Reduce violence and death rates, end all forms of violence against children, and ensuring public access to information and freedom rights

17. Partnership for the Goals

Enhance developing country international support, enhancing international cooperation, increase developing country exports, and enhance global economic stability

Finally, The SDGs are a global effort towards a socially just and environmentally sustainable future, where no one is left behind.

Clean Development Mechanism (CDM)

- Clean Development Mechanism was instituted in 2001 under Kyoto Protocol.
- Came into force on 16th February 2005 after Russia and European Community ratified it.
- Major non participants USA and Australia.

KYOTO PROTOCOL

To tackle the challenges posed by global warming and climate change, the United Nations Framework Convention on Climate Change (UNFCCC) initiated the framing of a protocol during the climate change meeting held at Kyoto, Japan in 1997.

Objectives:

The Clean Development Mechanism (CDM) is an instrument of cooperation between developed and developing country parties **Three main objectives:**

- ★ Assist developed countries fulfill their commitments to reduce emissions
 - ★ Assist developing country parties achieve sustainable development
 - ★ Contribute to achieving stabilization of concentrations of GHGs
- Criteria for participation

Typical Clean Development Mechanism Projects

- Energy—Renewable energy projects, such as hydropower, wind, solar, and biomass; energy efficiency measures, such as energy-savings lamps; and energy efficiency measures in industries
- Transport—Low-carbon transport, such as bus rapid transit and electric vehicles
- Urban—Methane recovery and utilization from wastewater and solid waste treatment
- Agriculture and natural resource management—Biogas and forestry

