

SUSTAINABLE DEVELOPMENT INDICATORS:

Sustainable development indicators are quantitative or qualitative measures used to assess progress towards achieving sustainable development goals. These indicators are used to monitor and evaluate the social, economic, and environmental aspects of development to ensure that it is sustainable. Sustainable development indicators provide valuable information for policymakers, stakeholders, and the public to make informed decisions and take appropriate actions to promote sustainable development.

Here are some examples of sustainable development indicators:

1. **Greenhouse gas emissions:** This indicator measures the amount of greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, emitted into the atmosphere by human activities. It helps assess progress towards mitigating climate change, a key aspect of sustainable development.
2. **Poverty rate:** This indicator measures the proportion of the population living below the poverty line, which is an important social aspect of sustainable development. It helps assess progress towards poverty eradication and improving social equity.
3. **Gender equality index:** This indicator measures the extent to which men and women have equal access to opportunities, resources, and services, such as education, healthcare, and

- employment. It helps assess progress towards achieving gender equality and empowering women, which is an important aspect of social sustainability.
4. **Biodiversity index:** This indicator measures the diversity and abundance of species, ecosystems, and genetic resources, which are important components of environmental sustainability. It helps assess progress towards conserving biodiversity and protecting ecosystems.
 5. **Renewable energy consumption:** This indicator measures the proportion of energy consumed that is generated from renewable sources, such as solar, wind, and hydropower. It helps assess progress towards promoting clean and sustainable energy sources and reducing reliance on fossil fuels.
 6. **Water quality index:** This indicator measures the quality of freshwater resources, such as rivers, lakes, and groundwater, which are important for human well-being and ecosystem health. It helps assess progress towards protecting water resources and ensuring their sustainable use.
 7. **Human development index:** This indicator measures the overall well-being and standard of living of a population, taking into account factors such as income, education, and life expectancy. It provides a holistic assessment of social and economic development, which is a key aspect of sustainable development.
 8. **Waste generation and recycling rate:** This indicator measures the amount of waste generated and the proportion of waste that is recycled, which is an important aspect of environmental sustainability. It helps assess progress towards reducing waste generation, promoting recycling, and managing waste effectively.
 9. **Sustainable consumption and production patterns:** This indicator measures the level of resource use, waste generation, and environmental impact associated with production and consumption patterns. It helps assess progress towards promoting sustainable production and consumption practices that minimize resource depletion and environmental degradation.
 10. **Access to basic services:** This indicator measures access to basic services, such as clean water, sanitation, healthcare, education, and housing, which are fundamental to human well-being and social development. It helps assess progress towards ensuring equitable access to basic services for all, which is a key aspect of sustainable development.

SUSTAINABLE INTERVENTION

INTERVENTION: the action of becoming intentionally involved in a difficult situation, in order to improve it or prevent it from getting worse

A sustainable intervention refers to a planned action or initiative that is designed to promote sustainable development, meaning it supports economic growth, social progress, and environmental protection in a balanced and integrated manner, here are some examples of sustainable interventions:

1. **Renewable energy projects:** Investing in renewable energy sources such as solar, wind, hydro, and geothermal power can reduce reliance on fossil fuels, mitigate climate change, and promote sustainable energy production and consumption.

2. Sustainable agriculture and food systems: Implementing sustainable agricultural practices such as organic farming, agroforestry, and regenerative agriculture can improve soil health, protect biodiversity, reduce chemical inputs, and promote sustainable food production and supply chains.
3. Conservation and restoration of ecosystems: Protecting and restoring natural ecosystems such as forests, wetlands, and coral reefs can enhance biodiversity, carbon sequestration, and ecosystem services, while supporting local livelihoods and maintaining cultural values.
4. Sustainable urban planning and transportation: Designing cities and transportation systems with a focus on public transportation, active transportation (e.g., walking and cycling), green spaces, and energy-efficient buildings can reduce greenhouse gas emissions, air pollution, and congestion, while promoting livability and accessibility for all.
5. Education and capacity building: Providing education and training programs that focus on sustainable development principles, such as environmental conservation, social equity, and economic resilience, can build local capacity, promote awareness, and empower communities to make informed decisions and take sustainable actions.
6. Water resources management: Implementing sustainable water management practices, such as rainwater harvesting, water use efficiency, and integrated water resources management, can ensure access to clean water, protect water quality, and enhance water security in a changing climate.
7. Disaster risk reduction and climate adaptation measures: Implementing measures to reduce vulnerability and enhance resilience to disasters and climate change, such as early warning systems, infrastructure upgrades, and community-based adaptation strategies, can protect lives, livelihoods, and assets in a sustainable manner.
8. Corporate sustainability practices: Adopting sustainable business practices, such as responsible resource management, ethical supply chain management, and stakeholder engagement, can promote sustainable economic growth, innovation, and corporate social responsibility.

These are just a few examples of sustainable interventions, and there are many other strategies, approaches, and actions that can contribute to sustainable development. The key is to consider the social, economic, and environmental dimensions of development in an integrated and balanced manner, and ensure that interventions are designed and implemented with a long-term perspective to meet the needs of the present and future generations.

CLIMATE CHANGE

The average weather in a particular place over many years is called Climate. Climate change is a shift in those average conditions. The rapid climate change we are now seeing is caused by humans using oil, gas and coal for their homes, factories and transport. When these fossil fuels burn, they release greenhouse gases - mostly carbon dioxide (CO₂). These gases trap the Sun's heat and cause the planet's temperature to rise. The world is now about 1.1⁰C warmer than it was in the 19th Century - and the amount of CO₂ in the atmosphere has risen by 50%

CAUSES / REASONS OF CLIMATE CHANGE:

Generating power: Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is still generated by burning coal, oil, or gas, which produces carbon dioxide and nitrous oxide – powerful greenhouse gases that blanket the Earth and trap the sun's heat.

Manufacturing goods: Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things like cement, iron, steel, electronics, plastics, clothes, and other goods. Mining and other industrial processes also release gases, as does the construction industry.

Cutting down forests: Since forests absorb carbon dioxide, destroying them also limits nature's ability to keep emissions out of the atmosphere. Deforestation, together with agriculture and other land use changes, is responsible for roughly a quarter of global greenhouse gas emissions.

Using transportation: Most cars, trucks, ships, and planes run on fossil fuels. That makes transportation a major contributor of greenhouse gases, especially carbon-dioxide emissions. Road vehicles account for the largest part, due to the combustion of petroleum-based products, like gasoline, in internal combustion engines. But emissions from ships and planes continue to grow.

Producing food: Producing food causes emissions of carbon dioxide, methane, and other greenhouse gases in various ways, including through deforestation and clearing of land for agriculture and grazing, digestion by cows and sheep, the production and use of fertilizers and manure for growing crops, and the use of energy to run farm equipment or fishing boats, usually with fossil fuels. All this makes food production a major contributor to climate change. And greenhouse gas emissions also come from packaging and distributing food.

Powering buildings: Globally, residential and commercial buildings consume over half of all electricity. As they continue to draw on coal, oil, and natural gas for heating and cooling, they emit significant quantities of greenhouse gas emissions. Growing energy demand for heating and cooling, with rising air-conditioner ownership, as well as increased electricity consumption for lighting, appliances, and connected devices, has contributed to a rise in energy-related carbon-dioxide emissions from buildings in recent years.

EFFECTS OF CLIMATE CHANGE:

Hotter temperatures: As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record.

More severe storms: Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface.

Increased drought: Climate change is changing water availability, making it scarcer in more regions. Droughts can also stir destructive sand and dust storms that can move billions of tons of

sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.

A warming, rising ocean: The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since water expands as it gets warmer. Melting ice sheets also cause sea levels to rise, threatening coastal and island communities. Global patterns of wind and ocean current also gets disturbed by climate change.

Loss of species: Climate change poses risks to the survival of species on land and in the ocean. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not.

Poverty and displacement: Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops.

Possible Solutions to Climate change:

1. Burning of fossil fuels like coal, oil and gas must be avoided
2. Renewable energy sources like solar, wind, tidal, etc. must be used instead of fossil fuels.
3. Electric vehicles can be used to stop the emission of greenhouse gases.
4. Heating and cooling can be done by greenways like insulating walls, using solar energy.
5. Planting more trees to absorb more carbon
6. Protect forest
7. Reducing the overall consumption.
8. Avoid the usage of plastics
9. Reduce the carbon emission

CASE STUDIES: Climate change problems and adapted solution

(<https://climate-adapt.eea.europa.eu/en/about/climate-adapt-10-case-studies-online.pdf>)

This case study explains the two most occurring problems (Excessive rainfall & Excess heat/Heat wave) of climate change and its solutions in the European countries (Copenhagen & Barcelona)

1. Barcelona trees tempering the Mediterranean city climate, Spain

Barcelona's main climate change challenges include temperature rise, a decrease in rainfall and an increase in extreme events such as droughts and heatwaves. The high urban density of Barcelona can exacerbate the heat island effect. Barcelona has committed to becoming a global model of a sustainable city in response to the urban development challenges related to climate change. For many years, Barcelona has had a focus on planting and managing trees. Trees can moderate the urban climate by cooling it in two different ways. Reflection of sunlight and transpiration by the leaves lower the air temperature, and shade reduces the surface temperature

and protects people from the sun, especially during the hottest months. Furthermore, trees can prevent local flooding by helping to reduce the amount of storm water runoff. *Besides climate-related benefits, city trees can also provide co-benefits: removing air pollutants, storing carbon, reducing noise pollution, regulating humidity and balancing the water cycle, creating ecological connectivity, providing habitat for urban biodiversity and creating a pleasant urban landscape.*

Barcelona's Green Infrastructure and Biodiversity Plan 2020 (BGIBP) seeks to connect various areas of the city with green infrastructure. In line with the BGIBP goals, Barcelona's Tree Master Plan for 2017-37 identifies a number of actions to expand tree coverage and improve the climate resilience of the urban trees. These actions include the selection of tree species that are more resilient to water and heat stresses, diversification of tree species, increased use of runoff water for watering trees, automatic irrigation and control of water leaks.

2. The economics of managing heavy rains and stormwater in Copenhagen — The Cloudburst Management Plan, Denmark

Copenhagen experienced four major rainfall events in the period 2011-2016, resulting in severe damage that was expensive to repair. These types of events are expected to be more intense and more frequent as a result of climate change. The city has drawn out a Cloudburst Management Plan that aims to reduce the impacts of flooding due to heavy rains. The plan included an assessment of the costs of different measures (traditional versus new options including adaptation measures), the cost of the damage despite the measures and the resulting financial impact. The results showed that continuing to focus on traditional sewerage systems would result in a societal loss compared with the alternative solution. The alternative adaptation measures aim to store or drain excess water at ground level. The plan consists of four surface solutions as well as pipe-based solutions, including:

- Storm water roads and pipes that transport water towards lakes and the harbor, e.g. in the built-up area of central Copenhagen;
- retention roads for storing waters;
- retention areas to store very large water volumes, e.g. parks that could turn into lakes during flood events;
- green roads to detain and hold back water in smaller side streets.

The traditional sewerage system was estimated to cost DKK 20 billion (EUR 2.6 billion) compared with DKK 13 billion for the alternative solution. Despite capital investments in the traditional sewerage system, financial losses from flooding would remain high (net loss of DKK 4 billion). On the other hand, the chosen combined solution — consisting of expanding the sewer network and surface projects focusing on water retention and drainage — would result in a net saving of DKK 3 billion. The plan is also likely to contribute to a growth in property values, increased employment, upgrade of urban spaces and increased tax revenues. The Cloudburst Management Plan was developed during 2013 and includes 300 surface projects. The projects have started to be implemented at around 15 projects per year for the next 20-30 years. The projects are prioritized according to the level of flood risk, a socio-economic assessment and the availability of co-benefits.