

Environmental Sustainability: A Primer

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ABSTRACT

Environmental sustainability is about ensuring that future generations can enjoy the natural resources our planet has to offer. It is responsibly interacting with the planet to maintain natural resources and not jeopardize the ability for future generations to meet their needs. The concept of environmental sustainability has gained increasing public interest in recent years. It is mentioned in relation to all aspects of our lives, from creating environmentally conscious communities to sourcing sustainable food. This paper provides a primer on environmental sustainability and its applications.

KEYWORDS: *sustainability, environmental sustainability, sustainable development, environmental protection, environmental stewardship, environmental threats*

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INTRODUCTION

Concern for the future of the world is a growing concern worldwide. Human wellbeing is closely linked to the health of the environment. As our wellbeing improves, we also seek improvement in a better living environment. We need clean air to breathe, fresh water to drink, and places to live that are free of toxic substances and hazards. Rapid population growth has caused increased farming and overexploitation of natural resources, which lead to greater greenhouse gas emissions and deforestation. As population increases, we rely more and more on the Earth's natural resources such as minerals, petroleum, coal, gas, and more. For example, the air we breath does not recognize local, national or even continental boundaries, so we must collectively take care of it for each other.

Nature has the potential to care for us or destroy us, depending on how we treat it. Industry waste, massive emissions, and large-scale fossil fuel consumption are threatening an unprecedented climate change. (Figure 1 typically shows plastic containers piled up at

recycling center, as a waste [1].) We make choices about the quality of our lives and the state of the global environment. Each of those choices will help to determine what kind of world our children and grandchildren will live in [2]. This requires sustainability.

Sustainability seems to mean different things to different people. Sustainability is the ability to continue a defined behavior indefinitely. If the behavior cannot be continued indefinitely, then it is not sustainable. The principle of sustainability is based on a simple fact: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Protecting the environment is the foundation of sustainability. For the complete sustainability, problems need to be solved all three pillars of sustainability. As shown in Figure 2, The three pillars are social sustainability, environmental sustainability, and economic sustainability [3]. The social pillar is mainly concerned with how companies' employees and other

stakeholders are affected and treated by a company's activities. The environmental pillar of sustainability deals with the impact business activities and business decisions have on the environment. The economic pillar addresses the bottom-line of businesses, i.e. their profit. The most important pillar is environmental sustainability [4].

WHAT IS ENVIRONMENTAL SUSTAINABILITY?

The environment is an indispensable part of our daily lives. The environment sustains life. Man needs to know the importance of the environment and keeps the environment as healthy as possible. Environmentalists around the world are constantly seeking sustainable solutions to restore a sustainable environment [5].

Environmental sustainability focuses on acting in a way that ensures future generations have the natural resources available to live an equal, if not better, way of life as the current generations. It is the responsible interaction with the environment to avoid depletion or degradation of natural resources. It is about stabilizing the currently disruptive relationship between earth's two most complex systems: human culture and the living world. Emphasis on environmental sustainability, or "going green," has become increasingly important in the planning, construction, and renovation of development projects. Population aging and population increases work in together and put pressure on environments [6].

Environmental sustainability is important because of how much energy, food, and human-made resources we use every day. This practice ensures that the needs of today's population are met without jeopardizing the ability of future generations to meet their needs. When nature is left alone, it has a tremendous ability to care for itself. For example, when an apple tree falls, it decomposes, adding nutrients to the soil. These nutrients help sustain suitable conditions so future mankind can grow apple tree. However, when man enters the picture, things change. Human actions can deplete natural resources without the application of environmental sustainability methods and compromise long-term viability. Figure 3 show some strategies of sustainable environmental management [7].

Environmental and developmental goals seem to be interrelated. Today's urgent call for sustainable development is based on the understanding that natural resources are shared and limited properties. Earth resources are finite in their capacity to provide goods and services and have limits in their capacity to absorb changes [8]. The two concepts of "environmentally sustainable" and "development"

appear to be at loggerheads in that development is based largely on destroying natural environments. Development is hardly environmentally sustainable. Environmental sustainability, without the development, has since become the preferable terminology and goal. It is now firmly established in national and local policy-making and agenda-setting for research [9].

PARTICIPATION IN ENVIRONMENTAL SUSTAINABILITY

Individuals, companies, and government all play a unique role in environmental sustainability. In the US, the Environmental Protection Agency (EPA) is responsible for setting and enforcing regulations that involve environmental sustainability and protection. These regulations cover [10]:

- Air quality
- Water quality
- Soil quality
- Plant life
- Animals and wildlife habitats
- Hazardous waste
- Greenhouse gas emissions

Environmental sustainability is something that every single individual, nation, corporation, or organization can do. We can collectively live more sustainably by taking the following actions [11]:

- Develop new technologies (green technologies, renewable energy, etc.)
- Make adjustments in individual lifestyles that conserve natural resources
- Each country works on its own concrete policy to ensure that sustainable development is carried out as a global objective.
- Cut down on red meat; it's a huge driver of food air miles and methane emissions.
- Rely less on your car and walk or cycle where possible.
- Replace incandescent light bulbs with more energy-efficient light bulbs.
- Eat locally- Try to eat foods that haven't traveled far to make it onto your plate.
- Resell, repurpose, or donate unwanted items. Repurposing may mean using old clothes or bed sheets for cleaning rags or reusing glass jars to store dry foods.
- Reduce your consumption of single-use plastic materials like water bottles, grocery bags, coffee cups, and produce wrapping.
- Switch out paper towels for reusable dishcloths.

- Buy a bamboo toothbrush or an electric toothbrush instead of using plastic ones.
- By offering businesses sustainability incentives through tax credits, governments can encourage small businesses to be more eco-friendly.

APPLICATIONS

Environmental issues are one of the top priorities of all the governments and researchers around the world. It is difficult to find an industry sector in which environmental sustainability is not of significant relevance. Environmental sustainability is being applied in many ways such as in sustainable agriculture, sustainable forestry, and energy [12-16].

- **Sustainable Agriculture:** This is the use of farming techniques that protect the environment. Farming operations are highly sensitive to weather. Although industrial agriculture can produce abundant amounts of food at affordable prices, the method of farming heavily depends on chemical fertilizers and pesticides and can be detrimental to the environment. With sustainable agriculture, farmers minimize water use and lower the dependence on chemical pesticides and fertilizers.
- **Sustainability Forestry:** This is the practice of regulating forest resources to meet the needs of society while preserving the health of the forest. Forests are important to local and national economies. Wood can be used as a source of fuel, timbers can be used in the construction industry and wood pulp can be used in the manufacture of paper. If forests are cleared without environmental sustainability methods in place, these benefits are lost.
- **Workplaces:** Environmental sustainability specifically refers to a company's activities relative to natural resources and efforts to protect and preserve the environment. Economic activities and workplaces of today are going through unprecedented change in terms of their impacts on and relations with the natural environment.
- **Sustainable Business:** Business growth should not come at the expense of the environment. Going green can help your business save or make money by reducing your utility bills. Employees can bring their spare tools to work to share with one another. Promoting green business practices could also encourage other companies in the community. For example, an environmentally responsible manufacturer can support recycling program. For businesses, being environmentally sustainable refers to being profitable through well
- planned, socially, and environmentally sensitive practices. Sustainability can be a win/win situation for companies. In recent years, there has been a global shift towards more environmentally sustainable ways of doing business. The world's biggest companies assess risk and opportunity at a global level, which means that their actions can reverberate across the planet. They are increasingly disclosing their greenhouse gas emissions and other energy metrics. Corporations are expected to make long-term, sustained efforts to solve global environmental issues. For most businesses, sustainability is becoming a competitive advantage.
- **Sustainable Industrialization:** Industrialization is crucial for economic growth, but it needs to be sustainable. For sustainable industrialization, it is essential to shift to less energy-intensive industries, use of cleaner fuels and technologies, and strong energy efficient policies. Industries should be built in some specific locations, keeping in mind that waste from one industry can be used as raw materials of the other. Use of renewable energy can lower the demand of fossil fuels like coal, oil, and natural gas.
- **Smarter Energy:** Energy production is an economic activity wherein the requirement for sustainability is evident. Energy use is critical for a sustainable energy future. Smarter energy ranges from providing the intelligence that enables us to manage our consumption of energy from any source to the use of renewable energy sources such as wind and solar. IBM is helping utilities in mature and emerging markets around the world add a layer of digital intelligence to their grids. These smart grids use sensors, meters, digital controls, and analytic tools to automate, monitor, and control the two-way flow of energy across operations—from power plant to plug. The solution combines weather prediction and analytics to accurately forecast the availability of wind power and solar energy.
- **Sustainable Cities:** The planet's urban population is expected to almost double by 2050. IBM is helping many cities leverage their data with analytics to address the challenge of meeting the needs of all these people effectively and sustainably. Cities are “systems of systems”—with separate but interconnected challenges. The cities of Minneapolis, Minnesota and Montpellier, France, are working with IBM to make data-driven decisions to rapidly transform the way they provide water, transportation, and emergency management. Transportation management

provides city-wide traffic visibility to help alleviate congestion, improve traffic management, optimize road capacity, rapidly respond to incidents, and deliver travel advisories to citizens. Water management provides the ability to use analytics and decision support to improve flood protection, water quality and integrated water resource management. It also helps forecast future demands on the water supply and helps city leaders coordinate responses to flood or drought.

Other applications include sustainability entrepreneurship, urban planning, aging, manufacturing, transportation, environmental valuation, cement industry, mining industry, semiconductor industry, sport industry, food safety regulation, and information strategy.

BENEFITS

Environmental sustainability involves making life choices that ensure an equal, if not better, way of life for future generations. It is responsibly interacting with the planet to maintain natural resources and avoid jeopardizing the ability for future generations to meet their needs. It provides huge benefits for human health and that of all other species. Environmental sustainability is an increased concern in the development of elderly residential environment. Other benefits of environmental sustainability include the following [11]:

- 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
- For businesses, the benefits include [11]:
- You reduce your energy usage and thus save money
- You produce less waste, which can help you save money, costs, and will make you a better choice for eco-conscious customers
- You can produce less pollution, which in some areas can offer you incentives or cut costs while also making you a better choice for eco-conscious customers
- Improve your brand image
- Attract and keep better quality investors, employees, and shareholders

- You can rest easy at night knowing you're not damaging the planet for future generations.

CHALLENGES

All human activities have a negative impact on the Earth. Environmental sustainability is achieved when an ecological integrity is maintained, all of earth's environmental systems are kept in balance while natural resources are consumed at a rate where they are able to replenish themselves. It is also essential to meet the sustainable environmental goals and protection of global environmental resources, such as the global climate and biological diversity. Other challenges include [17]:

- **Sustainability Transition:** The global sustainability combines an empirical assessment and a normative claim. Societal development paths should meet fundamental human needs, while maintaining the planet's life-support system and conserving living resources.
- **Economic and Technological Conditions:** This is the greatest challenge in the transition to sustainability. This approach advocates the greening of production processes through technological innovation, offering 'win-win' solutions.
- **Regulating for Sustainability:** The crisis of unsustainability is a crisis of governance. The challenge to regulate for sustainability is formidable.
- **Quantitative measurement:** Researchers face many challenges in developing quantitative measurement of sustainable environmental. Countries still lack adequate metrics to monitor environmental sustainability across a range of relevant environmental and resource issues.
- **Democratizing Sustainability:** The full political implications of the sustainability transition have yet to be grasped due to the inequities of current resource allocation patterns around the globe. It is clear that ensuring an equal opportunity for all to satisfy their basic needs is not possible without a significant redistribution of resources from affluent groups to the world's poor.

CONCLUSION

Sustainability seeks human–ecosystem equilibrium, and it rests on three pillars: environmental, social, and economic. Sustainability issues arise when there is a risk of difficult or irreversible loss of the things or qualities of the environment that people value. Environmental sustainability is ensuring that in meeting our needs for water, food, shelter as well as engaging in activities that make our lives enjoyable,

we do not cause damage to our environment or deplete resources. This practice in turn results in long term availability of those resources.

It is unfortunate that engineering education have, for the most part, ignored environmental sustainability issues. It is, therefore, essential and expedient that all facets of engineering, design, and manufacturing take action on environmental sustainability concerns through appropriate strategies [18]. The environmental sustainability is now offered in some institutions as part of the Environmental Engineering program. For example, the University System of Maryland brings its resources to bear in three critical areas: Practices, Programs, and Policies, as illustrated in Figure 4 [19]. Libraries have played an important role in acting as promoters of knowledge on environmental sustainability. More information about environmental sustainability can be found in the books in [5,20-27] and the following journals:

- Journal of Environmental Sustainability
- Current Opinion in Environmental Sustainability
- Organization & Environment
- Sustainability

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Figure 1 Plastic containers piled up at recycling center [1].

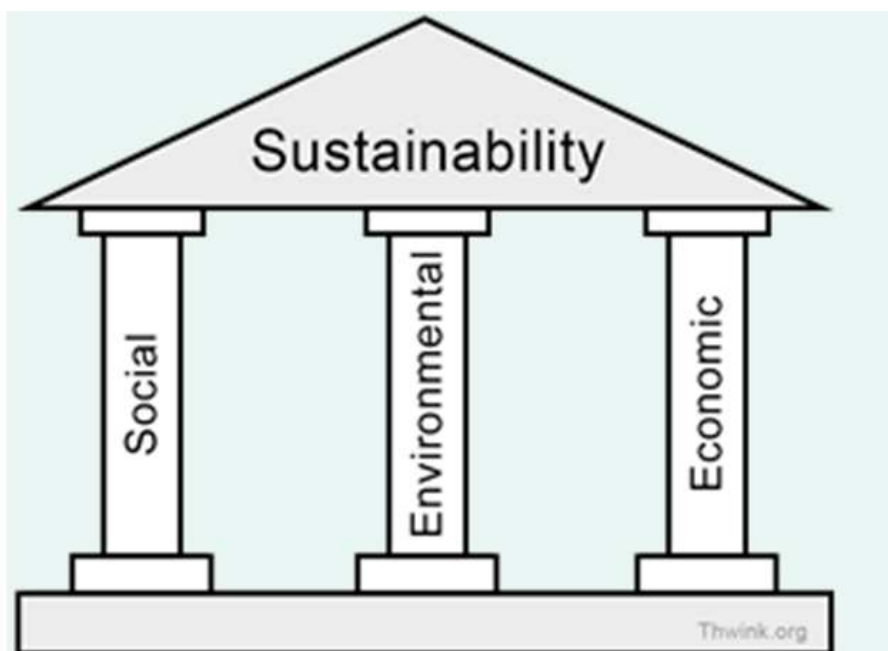


Figure 2 The three pillars of sustainability [3].



Figure 3 Strategies of sustainable environmental management [7].

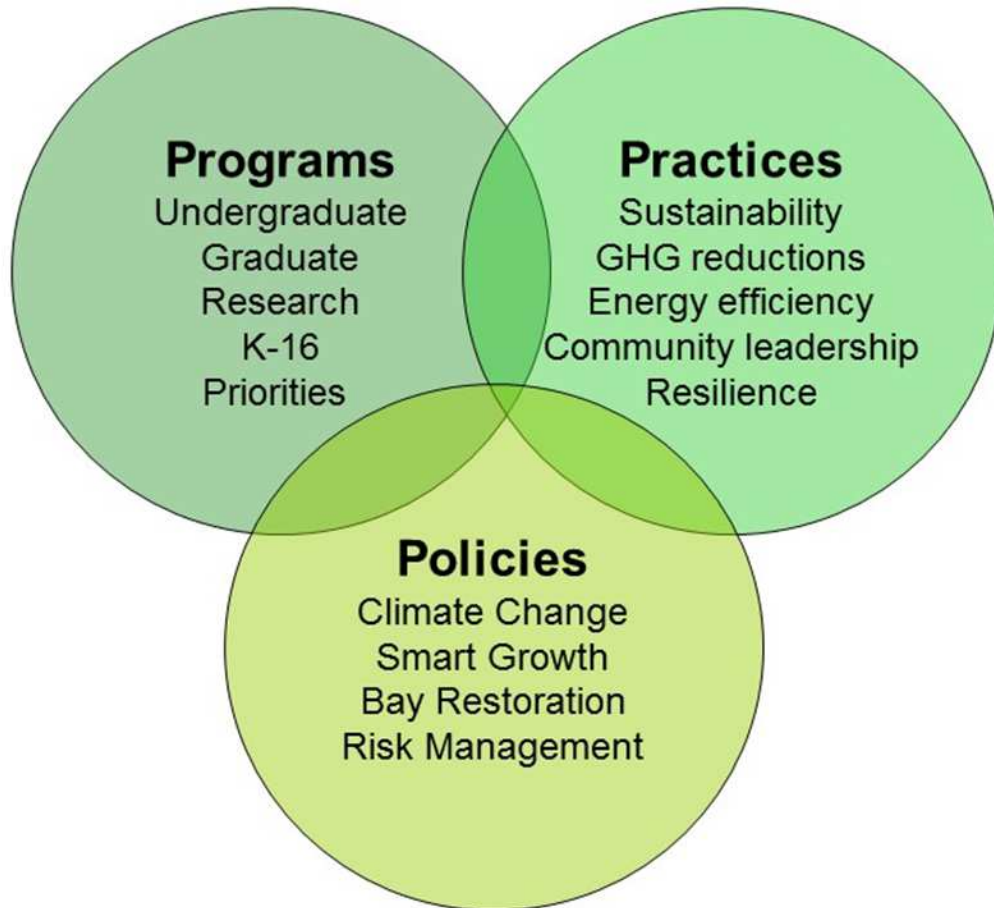


Figure 4 Three integrated pillars concept [19]