

Sustainable Development: A Matrix of Change for Future

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Abstract

Science & technology in its bid to fulfill developmental needs of the world are constantly churning out endless numbers of products; many of them do have latent damaging impacts on Ecosystem. Sustainable development refers to the establishment of resource-optimizing industrial systems for pursuing cleaner production technologies; the promotion of energy efficient processes and the use of new energy and renewable energy resources. Ever increasing exploitation of natural resources coupled with environmental degradation has reached a point where it now threatens the well-being and future of mankind. The task in the hand of technology is thus to maintain the integrity of the ecosystem vis a vis people's needs. A sustainable society seeks for itself a development module and its practices, while preserving the nature around. Thus, we share a responsibility to work on the developmental agenda while being equally responsible for environmental sustenance.

Key words: Eco-system, Environmental sustenance, Renewable energy, Sustainable development.

Introduction

The World Conservation Strategy adopted by the International Union for the Conservation of Nature and Natural Resources (IUCN or World Conservation Union) accepts the 'sustainable development' as the development allowing ecosystem services and biodiversity to be sustained¹. In 1992, the "Rio Summit" adopted the *Rio Declaration* for achieving *Sustainable Development* in the 21st Century². On the 25th of September 2015, the Sustainable Development Summit of UN member states to adopt the 2030 Agenda, which included a set of 17 Sustainable Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030³.

The World Commission on Environment and development (Brundtland Commission) defined sustainable development as "Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs." (United Nations General Assembly, 1987, p. 43). Sustainable development emphasizes that the rate of consumption and replenishment of natural resources must balance. Economic and industrial development must go on in such a way that no irreparable damage be done to the environment. Mammoth effort is required to ensure environmental sustainability in most areas of commercial exploitation of natural resources. All societies are to ensure serious attention to environment protection for maintaining balance between the developmental requirements and the environmental sustainability. Sustainability is therefore the way to go, a continuous process, not an end in itself.

Technology and Sustainability

In relentless pursuit of using technology to maximize resource-utilization, we run a risk of compromising the environmental concerns. The role of science and technology for building a sustainable future has become a concern that is being discussed across the world. With the resources steadily depleting, the onus to find a solution now lies on science to find alternate ways and methods for current practices. Perhaps the greatest challenge of the 21st century is to sustain the developmental needs of the world without damaging ecosystems. It has become rather important now to evolve newer technologies for sustainable development and to fight against the challenges posed by man-made climate change. For meeting sustainable social, economic or environmental goals, science and technology need to be employed in a way never being thought before; this would be the biggest 'disruptive' change, a paradigm shift in the way science & technology practised. This is where the newer innovative thrust on science

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and technology come into play. Most of the countries are now using science and technology to find the answers towards achieving a sustainable future and to solve the environmental problems that they are facing.

Early approach to this problem was cleaning up and controlling the pollution, but this method however failed to address the real causes of the problem. Now, the thrust has shifted to innovate and adopt cleaner technologies, change production processes and find product substitution that are eco-friendly. Technology is now seen as the enabler of such gigantic waves of changes, while conscious global political action plans are discussed for collective future response to this crisis.

Sustainability ensues a co-production of scientific and policy knowledge to translate into actions, hence merging the concepts 'science for science', 'science for society' and 'politics for science'. Herein, not only do the policy makers need to be adept with the scientific research on the issues to be tackled, but the researchers also need to be aware of the changing goals of the politics of sustainability. Mahatma Gandhi had once said, "One must care about the world one will not see". Indeed, time stands witness that humanity has progressed when it has collectively risen to its obligation to the world and responsibility to the future. The economic growth that occurred in developing countries over the past two decades is unprecedented, and will continue to have a pivotal role as an enabling resource to address sustainable development needs. There are five key thematic areas:

1. Energy,
2. Transportation,
3. Housing,
4. Materials resources,
5. Health

The table below (table-1) summarizes different human activities and their impacts⁴.

Human activities	Intended impacts	Unintended fallouts (Environmental cost)
Fisheries	Food production	Habitat fragmentation
Forestry	Fibre production	Soil degradation
Fuel consumption	Shelter	Deforestation
Grazing	Water supply	Pollution
Industrialisation	Consumer goods	Desertification
Land cleaning	Culture	Eutrophication
Mineral extraction	Knowledge	Acid precipitation
Recreation	Enjoyment	Loss of Biodiversity
Urbanisation		Climate change
Water diversion		

Table 1: Human activities affecting sustainability of the biosphere different human activities and their impacts

Some of the issues that pose major environmental sustainability problems include:

1. Destruction of the living environments (habitats) of native species.
2. Discharge of polluting chemicals and other materials into the environment.

3. Emission of greenhouse gases into the atmosphere can cause climate change.
4. Depletion of low cost oil and other fossil fuels

Environmental sustainability is the ability to maintain the qualities that are valued in the physical environment. It's about preserving the whole which sustains life as humanity wants to sustain-

1. Human life
2. The capabilities that the natural environment has to maintain the living conditions for people and other species (eg. clean water and air, a suitable climate)
3. The aspects of the environment that produce renewable resources such as water, timber, fish, solar energy.
4. The functioning of society, despite non-renewable resource depletion.
5. The quality of life for all people, the liveability and beauty of the environment.

Sustainable development is the practice of using guidelines for environmentally responsible and energy-saving means to create new development projects. Environment protection is a global concern for sustainability of mother earth & nature. Table 2 is about some of the measures which common people must be encouraged to adopt.

Energy conservation	<ol style="list-style-type: none"> 1. Save electricity by minimizing use of electrical gadgets 2. Switch off fans lights and air-conditioners when not required.
Water Conservation	<ol style="list-style-type: none"> 1. Check/ control the pollution of water bodies like rivers, lakes, canals etc. 2. Use only as much as you require. 3. Recycle used water. 4. Check on leaking pipes and taps. 5. Do rain water harvesting. 6. Participate in river cleaning programmes like "River Bachao Andolan".
Green cover preservation	<ol style="list-style-type: none"> 1. Plant and take care of trees. 2. Reduce use of paper and paper products. 3. Recycle papers. 4. Cutting down commercial & domestic use of hazardous materials.
Air decongestion	<ol style="list-style-type: none"> 1. Do not burn papers, dry leaves and other wastes. 2. Use cleaner fuel technology, renewable energy sources. 3. Stop smoking. 4. Strict Implementation of waste treatment & pollution control measures in commercial establishments.
Waste management	<ol style="list-style-type: none"> 1. Promote goods with less/recyclable packaging. 2. Reuse/recycle paper, metal, glass, plastic items. 3. Minimize/ recycle the use of plastic. 4. Composting the kitchen and garden waste. 5. Promote use of natural products as fertilizers, disinfectants cleaning etc.

Environmental consciousness	<ol style="list-style-type: none"> 1. Support environmental issues like cleaning of rivers, air etc. 2. Demanding action on environmental issues by approaching & writing to government representatives. 3. Try to follow an eco-friendly lifestyle. 4. Help society to be environment friendly.
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Table 2: Beyond Science: gravitating masses for environmental consciousness

Chemistry: the way forward

Chemistry can play a very important role in this area. Major environmental degradations are caused by unabated use of natural resources, untreated industrial waste and hazardous industrial practices. This damage to the environment can be mitigated by careful substitution through replenish-able resources and using chemical research for cleaner and cheaper waste management processes across industries. This may ensue a new wave of research in chemistry, with a new social environmental audit support from the government. Table 3 gives a brief of the activities that will promote sustainable development.

Area	How chemists can promote sustainable development
Research and development (In industry, government agencies, academia etc.)	Development of new & more environmentally friendly products and processes. Improvement in energy production and energy use systems. Improvement in understanding and knowledge of relevant environmental factors. Identifying and anticipating problems. Refining the techniques to assess environmental impact.
Production	Considering environmental impact. Good product management (for example: optimizing raw materials, waste reduction etc.). Waste disposal techniques. Sustainability auditing and reporting at regular intervals.
Analysis and Monitoring	Developing improved methods. Interpreting results and long term effects. Advising where caution is necessary
Broader Approach	Following management principles. Adopting better ways to 'meet the need'. Following standards, relevant legislation, codes of practice, using appropriate tools and techniques. Making impact-assessment and following up with adequate policy changes for the environmental, social, and economic impacts.

Table 3: Important measures for promoting sustainable development

Think globally and act locally

Any environmental problem either local or regional can become a global crisis if not addressed in time. If communities address their local problem (issues) in eco-conscious ways, bigger problems would start mitigating themselves and smaller ecosystems start healing and rejuvenating themselves. A smaller and yet the most powerful intervention local

communities can make towards mending a humongous damage done to the environment.

On national and global level though, this needs to be done by decoupling growth from exploiting natural resources relentlessly and replacing it with knowledge based economy, taking into account its economic, environmental and social parameters, as well as methods for assessing and measuring sustainability of development. The Policy Making is to be revamped across the board, irrespective of the local challenges. The world is to think as a unit rather as a divided commotion of greedy interest bidders.

Aim of Study

Study focuses on assessing the impacts of relentless commercialization and industrial production which is causing irreparable damages to the environment and its social consequences. Green chemistry has a role not just in arresting this damage but also in reversing the process. The task before science is to rejuvenate the earth for the future.

Conclusion

Environmental Sustainability is a dynamic concept that demands a multilateral engagement of Economic, Technological and Social concerns of a collectivity. Sustainability has to transcend the ethical moral realm to be *the way of life*, a dynamic composite of practices viable enough to live by while preserving the nature around. The challenge to an effective public policy for sustainability would come from a balancing act between economic goals to be pursued through viable technologies and preserving the environment while chasing numbers and satiating demands.

Though this might look like a tall order for any government, this can effectively be addressed by putting up an interactive mechanism of assimilating divergent interests which at the outset might look conflicting too. Forging a bridge between state goals and civil society activism formulates a viable democratic set-up for ensuring development through popular participation. Thus, sustainability can be sustained by comprehensive engagement of all stakeholders.

Enhanced global partnership among stakeholders for sharing of knowledge, for mobilising expertise, technologies and financial resources are the need of the hour to achieve these sustainable development goals for rescuing a *future for the future*.

References

1. *United Nations General Assembly (1987): Report of the world commission on environment and development: Our common future. Oslo, Norway: United Nations General Assembly, Development and International Cooperation: Environment.*
2. *United Nations Conference on the Human Environment (1992). Rio Declaration on Environment and Development. Rio de Janeiro, Brazil: United Nations.*
3. *United Nations Sustainable Development Summit 2015, 25 - 27 September 2015, New York: Transforming our world: the 2030 Agenda for Sustainable Development.*
4. *Lubchenco et al. 1991: The Sustainable Biosphere Initiative: An Ecological Research Agenda Ecology. 72(2), 1991, pp. 371-412.*
5. *Mary M. Kirchoff EPA Region 6 QA Conference American Chemical Society, The Role of Green Chemistry in Sustainability.*
6. *Philip J. Vergragt GTI Paper Series Frontiers of a Great Transition How Technology Could Contribute to a Sustainable World*