

## SCIENCE AND TECHNOLOGY FOR SUSTAINABLE FUTURE

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### **Abstract**

The article presents the integral role of science and technology in fostering a sustainable future, addressing global challenges such as climate change, poverty, and resource management. It highlights the transition from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs), emphasizing the need for innovative, interdisciplinary approaches to achieve these objectives. It also argues for enhancing scientific capacities, promoting open access to information, and investing in education and research as crucial steps toward sustainable development. By leveraging advancements in energy technology, biotechnology, and resource efficiency, the article asserts that science can provide effective solutions tailored to local needs. Ultimately, the successful implementation of the SDGs relies on equitable access to scientific innovation and collaborative efforts across all sectors of society.

**Keywords:** Sustainable Development Goals, Science and Technology, Sustainable Future

### **Introduction**

Humanity of the third Millennium, have achieved incredible progress in technological, economic and political aspects which is reshaping our lives, but in spite of all these the world's foremost challenges are hunger and the exclusion of millions from basic health and education. As a response to this felt need of the hour, the leaders of the world came together at United Nations Headquarters in New York and the Millennium Summit 2000, as it was named, which was focused on making sure that the world becomes a better place to live in, where the global problems are eliminated. The historic Millennium Declaration committed nations to a new global partnership to reduce extreme poverty, and set out a series of 8 time bound targets, known as the Millennium Development Goals (MGDs). Since the MGDs were remain unachieved, in the year 2015 the world adopted 17 universal Sustainable Development Goals (SDGs), which necessitated significant rethinking in the development processes. SDGs are officially known as "Transforming our world: 2030 Agenda for Sustainable Development", are

an intergovernmental set of aspiration goals with 169 targets. They are also known as Global Goals build on the MDGs. However, SGDs go much further than the MGDs, addressing the root causes poverty and the universal need for development that works for all people. It focus on peace, prosperity, and wellbeing, and to preserve our planet.

The key aim for the 21st century is “sustainable development,” which the international community embraced at the 1992 UN Conference on Environment and Development. Sustainability and sustainable development have been defined in many ways, but the most frequently quoted definition is from the Report of the World Commission on Environment and Development “Our Common Future”, also known as the Brundtland Report: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.” Sustainable development seeks to reconcile economic growth, social development and environmental protection; it means nothing more than using resources no faster than they can regenerate themselves, and releasing pollutants to no greater extent than natural resources can assimilate them. There are several possible ways to achieve environmental compatibility in lifestyles and economies. Technical and scientific innovations provide excellent prospects for environmental protection. It is vital that we use our growing knowledge and capabilities responsibly, and that we use them in the interest of environmentally appropriate development.

### **Objectives**

- To mention about the role of science and technology in sustainable future
- To highlight the guidelines for making science and technology for sustainable future
- To outline the areas in which science and technology contribute for sustainable future
- To suggest actions to maximize the contribution of science and technology beyond being a means of implementation with regard to achieving the 2030 Agenda and the SDGs

### **Role of Science and Technology in Sustainable Future**

To develop innovative, green solutions to address the climate, food and energy crisis facing the world today, science, technology, research and development capacities for sustainable development must be strengthened. Open Access to scientific information is a

prerequisite for generating knowledge for sustainable development. Science supports the prudent management for the daily survival and future development of humanity. For this, it will be essential to enhance scientific understanding, improve long term scientific assessments, strengthen scientific capacities in all countries and ensure that the sciences are responsive to emerging needs. At first step towards improving the scientific basis for these strategies is a better understanding of land, oceans, atmosphere and their interlocking water, nutrient and biogeo-chemical cycles and energy flows which all form part of the earth system. The sciences can provide this understanding through increased research into the underlying ecological processes and through the application of modern, effective and efficient tools that are now available such as remote sensing devices, robotic monitoring instruments and computing and modelling capabilities.

### **Guidelines for making Science and Technology for Sustainable Future**

***Recognize science as a universal public good:*** Science is universal and scientific knowledge in its pure form is a global public good: Science in itself is a way of crossing national, cultural and mental borders. It thus helps lay the foundation for a sustainable world.

***Acknowledge basic science as a principal requirement for innovation:*** Applied sciences and basic sciences are equally important for sustainable development and should not be played out against each other; they are two sides of the same coin. While curiosity-driven research may not be immediately utilized, it is indispensable for scientific innovation. In order to advance fundamental knowledge about the world, basic science requires a productive environment, which makes national, regional and international long-term investments necessary.

***Enhance diversity in science for sustainable development:*** Unleashing the full potentials of science for sustainable development requires promoting gender equity in science. Only by building on the entire spectrum of society, capitalizing on all talents, including women and underrepresented groups such as ethnic, racial and religious minorities, science can contribute to solving the greatest challenges of the future and building a sustainable world. Enhancing diversity in science also includes strengthening the scientific institutions in the South. In addition, providing equal participation and representation from the whole world in science will enhance democratic practices. All research must be conducted with integrity.

***Strengthen science education:*** Science possesses a strong educational component. Science literacy provides the basis for solutions to everyday problems, generally, in uncontroversial ways. Access to and investments in science education and capacity-building in science at all levels need to be strengthened, especially where the appreciation of the benefits of science and the resources

for sciences are less developed. Scholarships for scientific programs should be made available in each country.

***Raise investments in science:*** Raising investments in science will contribute to economic development and scientific progress. Building up and expanding scientific infrastructure, i.e. schools, colleges and universities as well as centers of excellence for frontier science, will further support science education and scientific research. The international community should therefore aim at establishing minimum national target investments. A balanced allocation of especially public resources in basic and applied science in line with respective national priorities is advisable to achieving sustainable growth. In the long-term, special allotments for basic science will help break the cycle of dependency of low and middle income countries on scientific solutions from high- income countries.

***Promote an integrated scientific approach:*** Building a sustainable world requires overcoming disciplinary boundaries. Inter-, trans- and multidisciplinary cooperation, both with regard to basic and applied science, can contribute to developing an integrated scientific approach. It should be based on a broad understanding of science, which covers the whole range of disciplines from natural sciences to engineering to social sciences and the humanities, and address the social, economic and environmental dimensions of sustainable development. In this respect, international cooperation among National Academies of Sciences needs to be expanded and intergovernmental research organizations, which play an important role in ensuring sustainability, need to be strengthened. To make the most of the transformational power of science, the diversity of knowledge systems within academia and society, including indigenous and local knowledge, must be respected.

### **Areas in which Science and Technology Contribute for Sustainable Future**

Science and technology play an important role in the pursuit of sustainable development, especially in the following categories:

***Energy use:*** The key technologies of sustainable development include new energy and propulsion technologies that will help reduce emissions of climate-damaging greenhouse gases. Simply to stabilize atmospheric greenhouse-gas concentrations at twice their preindustrial levels, we will have to reduce current global greenhouse emissions by over 50%. Achieving this goal involves focusing on improved thermal insulation in buildings, on the use of heat/power cogeneration, and on efficient support for the use of renewable energies. Currently the most progress is found in the area of wind energy; in the medium term, the use of solar energy, with photovoltaic technology, will continue to grow in significance. An honest

consideration of our options indicates that we cannot afford to discontinue peaceful use of nuclear energy.

***Closure of substance cycles:*** Modern Microsystems and control technologies are also providing new opportunities to design environmentally friendly production processes. While filter and wastewater-treatment technologies have considerably enhanced air and water quality in recent years, they are never more than the second-best solution, and have been surpassed by integrated environmental technology, that is, technology that optimizes the use of materials and energy. This involves material-efficient, energy-efficient production processes as well as the manufacture of environmentally compatible products, especially those that generate little waste. We have created the necessary framework for this with the Closed Substance Cycle and Waste Management Act, which came into force in 1996. Instruments such as eco-audits, which help identify the saving potentials from environmental protection investments, also promote development of such “clean” technologies.

***Environmentally compatible mobility:*** Environmentally compatible traffic concepts are a particularly important category for innovation. “Three-liter cars” (that is, cars consuming less than 3 liters of gasoline per 100 km), natural-gas engines, electric cars, hydrogen engines, and fuel-cell engines can all play a role in eliminating motor-vehicle emissions. Telematics can enable traffic to move more efficiently. Information and communication technologies can eliminate the need for physical transports in some areas, and computerized logistics in goods transports can reduce total transport distances.

***Biotechnology:*** Biotechnology is expected to bring important advances in medical diagnosis and therapy, in solving food problems, in energy saving, in environmentally compatible industrial and agricultural production, and in specially targeted environmental protection projects. Genetically altered microorganisms can break down a wide range of pollutants by being used, for example, in bio-filters and wastewater-treatment facilities, and in the clean-up of polluted sites. Genetically modified organisms can also alleviate environmental burdens by reducing the need for pesticides, fertilizers, and medications.

**Actions to maximize the contribution of science and technology beyond being a ‘means of implementation’ with regard to achieving the 2030 Agenda and the SDGs**

***Consider the 2030 Agenda for new research and integrate the SDGs into research agendas at all levels:*** Sustainability needs to become the corner-stone for future research both in basic and applied science. It remains paramount to identify critical research priorities via national and international research agendas as well as new and interdisciplinary approaches. The integrative

nature of the 2030 Agenda requires maximizing resources for and impacts of research towards sustainability.

***Anchor science as a reliable partner in the implementation and review process and thereby enhance the science-policy interface:*** Effective mechanisms and modalities are required to allow the scientific community to contribute to the national and global follow up and review processes of the 2030 Agenda and the SDGs. As a reliable partner, science and scientists can effectively contribute to problem (re-)definition, problem prioritization and assessing of policy choices. But to achieve this, high quality science – both basic research and applied science – needs to be adequately represented in the emerging implementation and review architecture, especially with regard to the High Level Political Forum for Sustainable Development, Global Sustainable Development Report and the Technology Facilitation Mechanism.

***Establish independent scientific monitoring mechanisms and promote evidence-based decision-making for sustainable development:*** In addition to the voluntary, state-based review process, the scientific community should simultaneously and independently monitor progress and evaluate success towards achieving the 2030 Agenda and the SDGs. As a constructive corrective, scientists need to take the initiative when identifying emerging risks as well as unsustainable paths and call for policy adjustments on the basis of scientific findings and evidence-based solutions.

## **Conclusion**

The integration of science and technology is pivotal for achieving a sustainable future, as it provides innovative solutions to pressing global challenges such as climate change, poverty, and resource management. The United Nations emphasizes that advancements in science and technology are essential for implementing the Sustainable Development Goals (SDGs), enabling societies to develop sustainable practices while improving the quality of life for all. Moreover, the role of interdisciplinary research and open science is crucial in fostering collaboration and sharing knowledge, which can lead to more effective solutions tailored to local needs. As we face increasing environmental pressures, investing in research and development must be prioritized, with a focus on sustainable energy sources, biotechnology, and resource efficiency. Ultimately, the successful transition towards a sustainable future hinges on our ability to harness scientific innovation and technological advancements while ensuring equitable access to these resources across all communities.

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