

ENVIRONMENTAL, ECONOMIC, AND ECOLOGICAL SUSTAINABLE DEVELOPMENT

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Summary

Sustainable development is a demanding challenge for human beings to survive generation after generation while retaining economic growth and improving living standards. Some current positive trends are that world population growth is slowing, industrial and food production are rising, life expectancy for most people is rising, and living standards and environmental quality in some regions are improving. Sound regulations, taxes, price mechanisms, and trading system are necessary to integrate the economy with other aspects and establish a sustainable production and consumption structure.

1. Sustainable Development

Sustainable development has two components: “sustainability” and “development.” The basic meaning of the word sustainability is the capacity for continuance indefinitely into the future. Sustainable development has been viewed as an interaction between three systems: biological, economic, and social.

The concept of sustainability or sustainable development arose from increasing evidence that human activities have destroyed the global equilibrium and cannot be sustained forever. Sustainable development is an interdisciplinary science. It is related

to environment, ecology, economics, anthropology, sociology, psychology, and computer science. Sustainable development calls for a long-term and more general policy oriented consideration of all aspects.

The concept of sustainable development was born in the early 1970s and was described in the book *Limits to Growth*. Since the 1980s and publication in 1987 of what is generally known as the Brundtland Report, an initiative of the United Nations (U.N.) World Commission on Environment and Development (WCED), sustainability has been widely recognized as a policy theme. The Brundtland Report defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Norway, Denmark, the Netherlands, Canada, and other governments have officially adopted a sustainable development policy. Many international organizations such as the World Bank, the Food and Agriculture Organization of the U.N. (FAO), and the U.N. Industrial Development Organization (UNIDO) have increasingly applied the criteria of sustainable development in their program evaluation. As early as the 1990s the World Bank had already done environmental analysis on about 200 projects. About 60 projects were investigated by comprehensive environmental assessments.

The Rio Declaration of 1992 marked the beginning of stressing the great importance of sustainable development for policy makers and researchers at all levels of world society. In 1992, the Business Council for Sustainable Development presented a report to the U.N. Conference on Environment and Development (UNCED) in which it stated: “We cannot continue in our present methods of using energy, managing forests, farming, protecting plant and animal species, managing urban growth and producing industrial goods.” The World Resources Institute (WRI), together with the development and environment programs of the U.N., states on the basis of one of the world’s most comprehensive resources and environmental databases that “the world is not now headed toward a sustainable future, but rather toward a variety of potential human and environmental disasters.” The enormous global growth of population and human activities and high demands on energy and production makes it increasingly evident that people are facing the threat of depletion of natural resources and health and well-being of global society.

Sustainability does not simply mean retaining the material standards of living and environmental preservation. It is a matter of active participation of humankind in the improvement of natural systems and the redesign of global systems that leads to the conservation of our planet for future generations. By the beginning of the twenty-first century there were more than one billion subsistence farmers in the world. Inefficient use of land, soils, water, energy, and inappropriate growing of crops and domestic animals are among the major obstacles to sustainable development in improving living standards and the environment.

The following major international agreements have been achieved since the middle of the 1980s.

- Montreal Protocol on Ozone Depleting Substances. Adopted by 25 countries in 1987, the protocol has been ratified by 127 parties. It called for the ban of halon

emissions by 1993 and the complete phase out of fully halogenated chemical emissions by the end of 1995.

- Framework Convention on Climate Change. Ratified by 50 countries, the convention became law on March 21, 1994.
- Convention on Biological Diversity. Ratified by 30 countries, the convention became law on December 29, 1993. Its aim is the conservation of biological diversity and sustainable use of all elements in ecosystems.
- Kyoto Protocol. Commitment of legally binding reductions in emissions of six greenhouse gases had been reached by industrialized nations in December 1997 targeted at an average 5.2% reduction below the 1990 level for Annex-1 countries, including Organisation for Economic Co-operation and Development (OECD) countries and central and eastern Europe by the second decade of the twenty-first century.

2. Trends

Many factors such as population, energy use, and the environment can influence sustainable development. Economic growth is essential for many reasons. First, world population growth accelerated after 1950, resulting in an estimated population of 6.055 billion in the year 2000, almost two-and-a-half times the population in 1950. The major increase of population is in developing countries where regional economic growth is needed to feed all the people. Second, most of the world's population lives in poverty. Many people cannot obtain the basic needs of enough food, clean water, housing, safety, education, and health care.

2.1. Population

At the end of the twentieth century, the world population stood at six billion people and was growing annually at 1.33%, a net increase of 78 million people per year; it is expected to reach 7.5 billion by 2020. About half of the world's population is urban and the trend is that urbanization will intensify and the majority, or over five billion people, are expected to live in urban surroundings.

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Biographical Sketch

Bingzhang Xue received his B.S. and M.S. degrees in physics from Tsinghua University, Beijing, and Shanghai University of Science and Technology in 1985 and 1988, respectively, and his Ph.D. in materials science from the Federal Institute of Technology in Zurich, Switzerland, in 1994. Since 1994, Dr. Xue has worked with the ABB Corporate Research Center in Switzerland and is currently engaged in global sustainability, global environmental problems, greenhouse effects and global warming, impact assessment of energy systems, and hydrogenation of carbon dioxide. Dr. Xue has published nearly 30 papers including one booklet.