

Sustainable Development Policy of Global Economy

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Abstract In the 21st century sustainable development is an essential issue for the humankind. Modern economic growth began in England in 1760 and eventually spread to the entire world. Before the Industrial Revolution the world was nearly equal in its poverty. Industrial Revolution changed human history and human destiny but increases huge gap between the rich and the poor. At present at least 1.2 billion people live in absolute poverty, whose income is \$1.25/day, they live in for mere survival every day, and most of them are in Sub-Saharan Africa and in some countries of Asia. They face the daily life-and-death challenges of insufficient nutrition, lack of health care, unsafe shelters and the lack of safe drinking water and without sanitation facilities. In 2014, population of the world become 7.29 billion and it is estimated that this figure will be 9 billion by the early 2040s. In 2014, about 50% of the populations of the world live in the cities and global urbanization is increasing very rapidly. Global climate change and loss of biodiversity are great problems and it is believed that recent increase of natural calamities is due to global warming. The world is economically developed but not achieved sustainable development. Human has become a serious threat to its own future well-being, and perhaps even survival in the 21st century.

Keywords: *climate change, Industrial Revolution, Kondratiev wave, planetary boundaries, poverty, sustainable development, sustainable economy, sustainable transport, threat to civilization*

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1. Introduction

Sustainable development (SD) first became prominent in international discussion in the 1980s and was the central theme of the United Nations (UN) Conference on Environment and Development in Rio de Janeiro in 1992. SD tries to make sense of the interactions of three complex systems: i) the world economy, ii) the global society and iii) the earth's physical environment. The development is sustainable if economic progress is widespread, extreme poverty is eliminated, social trust is encouraged through policies that strengthen the community, and the environment is protected from human-induced degradation. SD contains a useful and successful approach that the nations of the world have agreed to have as their guidance in their effort to solve some of the most pressing problems of the 21st century [168].

Education, health, acquisition, creation and adaptation of information, knowledge, skills and values, is a key lever of sustainable development [152].

SD is the main view of every nation for the 21st century how humanity addresses multiple threats to the stability of the planetary social and ecological system [52]. The increases of population and economic activities since the Industrial Revolution has steered the coupled human environment system into the Anthropocene [135].

Over the last 50 years, humanity has moved from being a 'small world on a large planet' to becoming a 'large

world on a small planet,' transforming the atmosphere, oceans, ice sheets, waterways, forests, and biodiversity by exceeding boundaries that determine the planet's ability to support human development [119,140]. In order to improve human well-being and social equity, we need SD by reducing environmental risks and ecological scarcities [150].

Life of human species has been around for roughly 150,000 years and our agricultural civilization is roughly 10,000 years old, the Holocene era to geologists [70].

2. Objective of the Study

The objective of the article is to conscious the humanities about the sustainable economic development. In 2014, the population of the world becomes 7.29 billion [72,171]. For the sustainability of these people and their off springs all the countries need to be conscious about the unsustainable procedure of economy. In the 21st century all the countries should work together to make the world livable for all the creatures. We hope our attempt will be partial helpful for the readers to know about the fate of the future generations.

3. Definition of Sustainable Development

Sustainable development (SD) means very different things to different people. It is a contestable concept. For SD requires the integration of a range of approaches,

including policies, actions and development strategies to satisfy present and future population needs, improve quality of life, and protect the environment [116].

The term Sustainable Development was first put forward by the World Conservation Strategy in 1980 [69]. Later, the Brundtland Commission Report [14] made SD a policy objective for the world community.

The most widely accepted definition is creatively ambiguous [167] “*Humanity has the ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.*”

Brundtland Commission’s definition is [74] “*Sustainable development is ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.*”

According to the direct Government website UK [55] “*Sustainable development means a better quality of life now and for generations to come. It means not using up resources faster than the planet can replenish, or re-stock influences decision making with organizations, and therefore can go towards forming principles and business ‘values’.*”

Kates et al. [74] defined the SD in the eyes of various experts as follows:

In the eye of Societalist “*Sustainable development is of human society, operating within nature, in a fair and just manner. Humanity is not considered to be better or above other species, and certainly does not hold a special place in nature. Not accepting this understanding is seen to be the cause of many problems. The emphasis is on actions and solutions rather than debating the situation, representing a pragmatic rather than a philosophical way of thinking.*”

In the eye of Ecologist “*Sustainable development is about maintaining a good quality of life for humanity by developing societal structures that recognize that humans are just one species living within and dependent on the environment. The focus is on preparing for a better future by recognizing humanity’s dependence on nature.*”

In the eye of Futurist “*Sustainable development is distinguished by a very long-term perspective that is almost evolutionary in its timescale. Humanity is seen as dependent on nature and humans as just one species that may or may not survive into the distant future. The past will provide some guidance for the change required to establish a future, although there is seen to be no blueprint for today’s situation.*”

In the eye of Individualist “*Sustainable development is as having to do with people and their wellbeing. There is little regard for the environment beyond being a resource to achieve quality of life. There is acceptance that some people will do better than others, and that humanity has the right to use the environment to achieve a better quality of life.*”

In the eye of Realist “*Sustainable development is its grounding in the real world and the present. A ‘big picture’ view of the world and its environmental problems considers how these could be remedied. There is a strong focus on issues and tangible solutions, and a firm belief that humanity can find solutions if it tries. Continuous change and new solutions are seen as needed to respond to the issues and situations as they arise.*”

Bo Kjellen represents a diamond shape of sustainability which “*Illustrates the fundamentals of social sciences in dealing with economic, political and social problems, the challenge now is to integrate the social sciences into developing policy focusing on long-term global sustainability.*” The Kjellen diamond (Figure 1) is particularly useful as a graphical representation of the principles of sustainability [1].

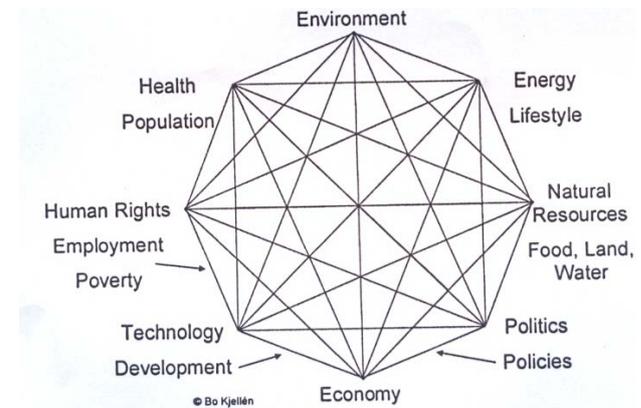


Figure 1. Kjellen diamond of sustainability. Source: [1]

4. Industrial Revolution and Economic Development

Scientific Revolution happened in the 1500s and 1600s. Galileo had paved the way for a new physics. Isaac Newton one of the two greatest physicists of all time (another one is Albert Einstein) changed the way that humanity looked at the world, in terms of timeless and discoverable laws of nature. Newton wrote *Principia Mathematica* in 1687, which was one of the most important books ever written. Sir Francis Bacon predicted that science and technology could dramatically transform the world for human benefit [125].

The Industrial Revolution was a slow and progressive process of production method over the manual method of mechanized industrial production [31]. Before the Industrial Revolution around 1750, the world was fairly equal in income levels i.e., the world was nearly equal in its poverty and the economy was based on manual labor and farming, and so the production was limited. The world before 1750 was a world of poverty [6]. Although some beautiful treasures for human history are produced, for example, the Egyptian pyramids, the Acropolis, the Great Wall of China, the Hagia Sophia in Constantinople, and the Notre Dame Cathedral. But famine, war, disease and early death were common matters of that period [125]. If the harvest could poor due to drought or sever flood, the broke out of famine is sure, which resulted huge death in that part of the world. Before 1 AD the estimate of the total world output is essentially flat for more than 1,800 years [21,134].

After 1750 some parts of the world experienced sustained increases of GDP, transformation from rural to urban, from peasant agriculture to high-yield agriculture, and from cottage industry to modern industry [2].

Annual growth rates were one-third of 1% for the 18th century, 1% for the entire 19th century and 2.4% for the first 60 years of the 20th century [83]. At present the

economy of the world is growing 3–4% per year and highly unequal in the distribution of income within countries and among the countries. The modern economic growth become sharply and dramatically. This upward sloping curve become approximately vertical straight line in recent years and continues upward, because the world economy is growing very strongly today [114].

The Industrial Revolution changed human history and human destiny [5]. Modern economic growth began in England in 1760 and eventually spread to the entire world economy [56,98]. The Industrial Revolution spread to the USA around 1840, a time of remarkable investment-specific technological progress [50].

The modern concept of underdevelopment began in 1949, when the US President Truman suggested a new pattern for the postwar era, namely the division of humanity's sphere into the *developed* and *underdeveloped* regions [91].

According to the British economist John Maynard Keynes the economy of the world before Industrial Revolution was as follows [77]:

“Back say to 2000 years before Christ, down to the beginning of the 18th century there was no very great change in the standard of life of human. This slow rate of progress, or lack of progress, was due to two reasons—to the remarkable absence of important technical improvements and to the failure of capital to accumulate.”

4.1. Discrimination of Modern Economy

Present world is divided into three categories [125]: i) 55 high-income (above \$20,000 in per capita income) countries, such as, the USA, Canada, Western Europe, Japan, Australia and New Zealand (about 1.3 billion people), ii) 103 middle-income (between \$4,000 and \$20,000) countries, such as, most of Eastern Asia (Korea, Singapore etc.), Central Europe, the former Soviet Union and Latin America (about 4.9 billion people), and iii) 36 low-income (\$4,000 and below) countries, such as, South America, Southern Asia, part of Eastern Asia and sub-Saharan Africa (0.8 billion people).

In 1776, Adam Smith observed that the inland parts of Africa and Asia were the least economically developed areas of the world. Nine of the twelve countries with the lowest Human Development Index (HDI) scores are landlocked [146]. Some countries situated in tropical region or landlocked, for example, Ethiopia, Niger, Mali, Kenya, Bolivia, Chad, Mali, Burkina Faso, Uganda, Rwanda, Zimbabwe, Zambia, Lesotho, Laos, still have not achieved the modern economic growth that some other countries of the world have experienced two centuries ago [124]. Landlocked countries like Bolivia, Ethiopia, Chad, Niger, Kyrgyzstan, Bhutan and Nepal still face the disadvantages of high transport costs [44]. These landlocked countries not only face the challenge of distance, but also the challenges that result from a dependence on passage through a sovereign transit country to access international shipping markets [124].

At present at least 1 billion people of the world live in for mere survival every day. The extremely poor of the different parts of the world are facing challenges of insufficient nutrition, lack of health care, unsafe shelters, and the lack of safe drinking water and sanitation [117]. The inequitable distributions of wealth within countries

have created social instability and public health concerns and multiple forms of social deprivations [111,130]. Also those are above the extremely poor level are looking for improved prosperity and a brighter future for their children. On the other hand rich people are hoping that technological advances will offer them and their families even higher levels of well-being [125].

The 3 richest people in the world have assets that exceed the combined GDP of the 48 least developed countries [147]. Recent Oxfam [109] analysis found that the richest 85 people in the world have more money than the poorest 3.5 billion people (56% of the world population). In the 21st century about 1.2 billion people are enjoying longevity and good health and 83% of total global income, and most of them are in developed countries. Almost 90% of the wealthiest adults are in North America, Europe and Japan.

At least 1.2 billion people live in absolute poverty, whose income is \$1.25/day, equivalent to 22% of the world population (in the USA cost of a half-dozen eggs is \$1.25), that they struggle for mere survival every day [133]. About 2.4 billion people, 35% of the world population, live on less than \$2.00 per day. These poorest of the poor people face the daily life-and-death challenges of insufficient nutrition, lack of health care, unsafe shelters and the lack of safe drinking water and sanitation [110,133,156]. Although in 1807 the British Empire abolished the slave trade and in 1833 abolished slavery in the British holdings entirely but yet in the 21st century approximately 21 million people are working as modern day slaves, falling victim to trafficking, forced labor and sexual exploitation [95,144].

The economic development is not equally distributed throughout the world, rather it becomes in different rates in different parts of the world. At present the per capita income of the USA is more than \$50,000 per year and that of Niger is under \$500 per year. On the other hand, the present world is deeply interconnected which is called *globalization*. This large gap between the rich and the poor and also this close interconnection did not exist around 1750. Hence, present huge gap is due to modern economic growth since the start of the Industrial Revolution [125].

At present most parts of the world, for example, mass population of Sub-Saharan Africa and some countries of Southern Asia (Bangladesh, India, Pakistan, Nepal, Afghanistan etc.) remain in the extreme poverty. People of these regions live in rural areas or in slums. They live without modern sewerage or household sanitation, often having to defecate in empty fields. They walk through unpaved muddy road that is not really passable by vehicles. They are deprived from emergency health care, electricity, adequate nutrition, clean cook stoves, safe water and sanitation. They may earn just enough to buy a minimum of food, water, clothing, and shelter. Some people have no house and live in the streets or open fields. Some live in the refugee camps in an unhygienic ways [133].

5. The Industrial Revolution of England

One of the great technological breakthroughs came in 1712, with the invention of a steam engine by Thomas

Newcomen. This engine burned coal to create motive force that could be used to pump water out of the shafts of coal mines. James Watt, working in a Glaswegian university lab of England, improved the Newcomen's steam engine in 1776, which harnessed massive amounts of coal-powered energy efficiently and economically [157]. This invention created the early modern industrial era in the worldwide, which brings revolutions in textiles, mines, steam-powered railroads, steam-powered ocean freighters, steel production, and other areas of economic activities. This made massive expansion of cities, industries, and infrastructure of all kinds [125,170].

Due to Industrial Revolution the following developments are happened among the nations [4,27]:

- agricultural productivity started to rise,
- urbanization has increased,
- business has increased,
- more sophisticated market economy began to take hold,
- the rule of law deepened,
- invention of scientific laws,
- invention of new machineries,
- discoveries of various items and
- invention of new technologies.

The year 1776 is renowned for four incidents. This year Adam Smith, rightly known as the father of modern economics, published *The Wealth of Nations*, the American colonies declared their independence, James Watt improved the modern steam engine and Edward Gibbon published *The Decline and Fall of the Roman Empire* [125]. A James Watt steam engine cost £500–800 [92]. Operating a steam engine consumed £3,000 of coal per annum [80]. Adam Smith was the first economist to explain the workings of a modern economy in terms of specialization and the division of labor, efficiently market transactions, and an increase of productivity [4].

The steam engine used for steam-powered railroads and steam-powered ocean freighters, which Marx and his co-author Friedrich Engels wrote *The Communist Manifesto* in 1848. This book made bold steps to create the new industrial economy and the breakthroughs in industrial technology [27,89,125].

6. Rapid Growth of World Population

From 10,000 BC to around 2,000 BC, the human population was well under 100 million. Around 1 AD, at the time of the Roman Empire, the world population (according to Maddison's estimate) was around 225 million. As of 1000, it was 267 million, in 1500, around 438 million. At the start of the industrial revolution in 1750, the estimated global population was 800 million. It reached 1 billion around 1820. Between 1 AD and 1820 annual growth rate was of just 0.08% per year [86].

At present the populations of the world are increasing about 75–80 million/per year. From 1820 to around 1930, in roughly one century, the population became 2 billion, from 1930 to 1960 (only in 30 years) soared to 3 billion. In 1974 the population of the world was 4 billion, about 5 billion in 1987, about 6 billion in 1999 and 7 billion in 2011. In 2014, about 7.29 billion people are living on the world, which is about 9 times of the people of 1750. If the populations of the world increase at the present rate, the

populations of the world will be 8 billion by the year 2025, and perhaps 9 billion by the early 2040s. Of the 9 billion people, developing countries to add 2.3 billion inhabitants with 1.1 billion aged over 60 and 1.2 billion of working age. Currently the population of the less developed regions is still young, with children under age 15 accounting with 29% of the population and young persons aged 15–24 accounting for a further 19%. In the more developed regions, children and youth account for just 17% and 13% of the population, respectively, and whereas the number of children is expected to change little in the future, remaining close to 200 million, the number of young people is projected to decrease from 160 million currently to 134 million in 2050 [172].

In the more developed regions, the population aged 60 or over is increasing at the fastest growing at 1.9% per year and is expected to increase by more than 50% over the next four decades, rising from 264 million in 2009 to 416 million in 2050. Over the next two decades, the population aged 60 or over in the developing world is projected to increase at rates far surpassing 3% per year and its numbers are expected to rise from 475 million in 2009 to 1.6 billion in 2050 [172]. It is estimated that by 2100, population will reach to 9.3 billion and global GDP per capita may increase to \$50,000/person [52].

Main reason for the increase the population of the world is the increased ability to grow more food and feed a rising population due to the use of technology to raise food production. Most of the high-income world and much of the middle-income world has already reached a low fertility rate, but fertility rates in Sub-Saharan Africa, North Africa and parts of the Middle-East, remain very high [113].

6.1. Rapid Urbanization

In the developing countries urbanization is taking place very rapidly. Only in China is expected to increase around 250 million new urban citizens from 2010 to 2025. Global investments in urban infrastructure and building are expected to rise from \$10 trillion in 2013 to more than \$20 trillion by 2025 [118].

In recent years, many leading cities like New York, Beijing, Moscow, New Delhi, Paris, and others have suffered from extraordinary environmental calamities, such as, massive storms, flooding, heat waves, droughts etc. [121].

In 2014, about 50% of the population of the world (about 3.5 billion) live in cities, but in 2050 that figure is expected to increase by 84% (about 6.4 billion), which is the same size as the world's population was in 2004 [29,36,143]. Much of this urban population growth will occur in low- and middle-income countries, especially in Asia and Africa. About 50% urban citizens of Latin America, Eastern Europe, Central Asia, the Middle East and North Africa live in extreme poverty [45]. Of the 3.5 billion, about 1 billion live in slums [163]. The numbers of people living in slums are rising even faster, from 1 to 1.4 billion in just a decade [23].

All the cities contribute significantly to national and global output and employment. More than 600 cities account for 60% of the world's GDP. Hence, cities are key drivers and participants in a SD transition [90]. Annual urban infrastructure and building investments are expected

to rise globally from \$10 trillion in 2012 to more than \$20 trillion by 2025. Rural areas help provide the ecosystem services and food security essential to urban functioning and sustainability [34].

Urban areas add up to 70% of GHG emissions, primarily because of the concentration of industrial production and construction within urban centers [66].

7. Economic Development

Since the industrial revolution farmers used better seed varieties, better farm techniques, such as, rotating their crops through the years to maintain soil fertility. They learned to use chemical fertilizers to boost soil nutrients, and machinery to sow seeds, harvest crops, process food stuffs, and store and transport food to cities [2,56].

The scale of the present world economy is estimated to produce \$90 trillion of output per year. The sum of the economy is called the Gross World Product (GWP), which is at least 100 times larger than back in 1750 [127]. GWP is calculated as follows:

$$\text{GWP} = \text{Gross world product per capita} \\ \times \text{world population}$$

The GWP rose from \$695 billion in 1820 to about \$63 trillion by 2012. At the same time, the population of the world increased from 1.068 billion to 7 billion respectively. Hence, the GWP per capita increased from \$651 to \$5,942 respectively. GWP increased from 7% in 1938 to 10% in 1970 and to more than 18% in 1996 [148].

In 2014, the population of world became 7.29 billion and annual GDP became about \$70 trillion, human impacts on the environment have already reached dangerous levels. By 2050 there may well be 9 billion people and global GDP of more than \$250 trillion. The challenges of governance for sustainable development in a globalizing world become an essential item for the welfare of the humanity [72].

In the early 19th century technological leader was certainly England, in the middle to end of the 19th it was Germany and the USA, and in the 20th century the USA was by far the most technologically dynamic country in the world. In the early 21st century, poor Asian countries like Japan, South Korea, and now China, have made a difference in speeding catch-up growth [125].

Britain, the USA and Australia had achieved modern economic growth (measured by achieving \$2,000 per

capita GDP) during 1827–1860. These countries had vast arable land and energy resources, good coastlines for trade, strong connections with British industry and technological knowledge [64]. The second group Argentina, Uruguay, Chile, and Japan has touched such position during 1861–1900. Japan became the first Asian economy to achieve catch-up growth, as it has lots of geographical similarities with Great Britain. Countries of this group are in temperate-zone with favorable conditions for agriculture. Most countries of the rest of the world had to wait till after 1950 to have to reach the modern economic growth. Most countries of Africa and some countries of Asia (Bangladesh, Nepal, Pakistan, Bhutan, Mongolia etc.) will touch the modern economic growth by 2020 to 2050. By the end of the 19th century, India, much of Asia, and virtually all of Africa (except Ethiopia) was under European colonial rule. Most of the colonized regions did not experience modern economic growth until decolonization in the 1940s–1960s [125].

This massive world economy is creating a gigantic environmental crisis, which threatens human wellbeing. Humankind is changing the global climate, the availability of fresh water and the habitats of other species [94,119].

In 2010, humanity emitted around 14 billion tons of carbon dioxide (CO₂) through coal burning, close to half of the world's total emissions of CO₂ due to fossil fuels. There is a growing global consensus that current production and consumption patterns are not environmentally sustainable [148].

7.1. Kondratiev Long Waves of Sustainable Growth

Russian economist Nikolai Dimitrievich Kondratiev (1892–1930) worked at the time of the Russian Revolution, whose greatest masterwork, *The Major Economic Cycles*, was published in 1925. His main concept was that economic development propelled by long waves (40 to 60 years) of major technological change dating back to the Industrial Revolution (Figure 2). He was exiled to Siberia by Bolshevik officials who flatly rejected his conclusions. He was convicted of being a member of a secret peasants' society and executed by firing squad in 1938 at the age of 46. His work was later updated by other economists using his original methodology roughly four to six long waves of technological change [7,47,79].

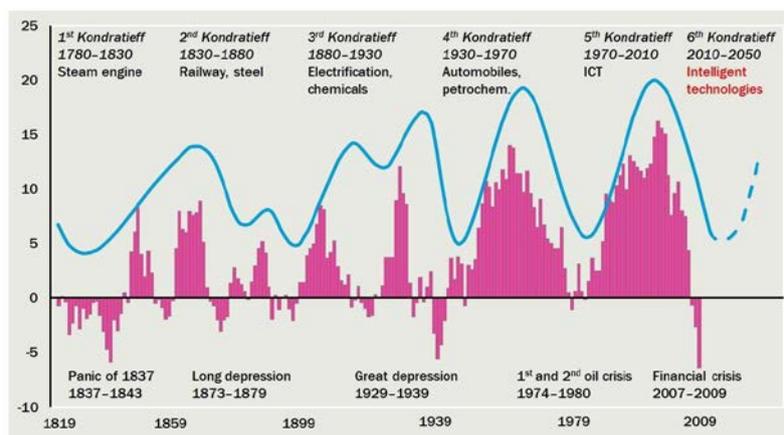


Figure 2. The Kondratiev waves. Source: [169]

Kondratiev believed that it was possible to forecast and foster future economic growth and the tendency of development based on social, cultural and, economic factors, reflecting the social welfare. In studying volumes he used per capita data. He calculated deviation from the trend through the method of least squares. He took his data-base from the French, British, German and the US economy [7,47,85]. He used several key indicators, such as, commodity prices, raw materials production and consumption rate, work wages, foreign trade turnovers and private bank savings [169].

The 1st of the Kondratiev wave (K-wave) period was 1780–1830, which is roughly from the time of steam engine widespread application. Mechanization in textile production was introduced in this cycle and there was a growing demand for coal [75,88]. The 2nd K-wave period was 1830–1880, which is the great burst of railway and steel. The applications of steam engine increase the technologies like, the growing metals industry, and the development of precision engineering. Main growth industries were textiles, mining, shipbuilding, railroad, iron and steel industries in Britain, France, Germany, Japan and the USA. This wave transformed national economies and the world economy by dramatically reducing transport costs and enhancing profitable international markets [30,88,125]. The 3rd K-wave period was 1880–1930, which is the age of electricity. This period electricity generation through coal-fired steam turbines and hydropower created the new power-generation industry. During this wave basic advances were electricity, chemicals, internal combustion and diesel engines, automobiles and communications [87,100,142].

The 4th K-wave period was 1930–1970, which is the age of automobile and the advent of T-Model Ford. During this period dramatically expanded mass transport, and allowed the growth of major cities, and the chemical industry, which brought new materials, including explosives, chemical fertilizers, dyes, and eventually polymers, including plastics. World War II gave a major spur to countless technologies, including semiconductors, radar, digital communications, microcomputers, coding, and others [78,100,169].

The 5th K-wave period was 1970–2010, which is the wave of Information and Communications Technology (ICT) made possible by the digital revolution. In 1965, Gordon Moore, then the CEO of Intel, noted the phenomenon that the transistor count on an integrated circuit was doubling roughly every 18–24 months. In 2015, the capacity to manage bit and bytes of information has increased by more than 1 billion times since the mid-1950s. The ICT has given rise to the new *knowledge economy*, in which massive amounts of data can be stored, processed, and transmitted globally, in every sector of the modern economy. The invention and spread of mobile phones, and now smart phones and other handheld devices, has made the ICT revolution also a mobile revolution [100,127].

The 6th K-wave is considered 2010–2050, which is the age of *sustainable technologies*, is a core part of achieving sustainable development. As of 2014, there are roughly 7 billion mobile subscribers, and around 1 billion smart phone users, reaching into the most remote villages of the world. By 2020, almost all of the world will be within range of wireless broadband. The 6th Kondratieff cycle has

begun, but the main and supporting roles seem not yet to have been assigned [3,169].

7.2. Global Green Economy

At present the global economy is more than 5 times the size it was half a century ago. Such rapid economic growth has given financial benefits but it creates the gap between the rich and the poor. It has also delivered unprecedented environmental damages, for example, an estimated 60% of the world's ecosystems have been degraded in the last 5 decades. Hence, current economy has not grown in sustainable ways. So, we have to implement a new kind of economy, which is elastic, sustainable, operates within the limits of our world's resources and creates a fairer society and we can call it 'Green Economy' [54].

The green economy (GE) proposal was introduced by Ms. Laura Altinger in October 2008, in a programme launched by the United Nation Environment Programme (UNEP) thinking the vulnerability of human welfare due to the unsustainability of economic development. A GE is defined as, growth in income, and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. GE improves human well-being and social equity significantly reducing environmental risks and ecological scarcities. Activities of GE include renewable energy, low-carbon transport, energy-efficient buildings, clean technologies, improved waste management, improved freshwater provision, sustainable agriculture and forest management, and sustainable fisheries [149].

In 2012, in the UN Conference on Sustainable Development in Rio de Janeiro addressed how a green economy could help eradicate poverty and how could achieve the MDGs [138].

Economists, politicians and the media refer to gross domestic product (GDP) as a representation of overall success (the flow of goods and services produced within a market), but it does not take any account of environmental status, health, education or other forms of well-being. Research indicates that, beyond a certain threshold, increases in GDP may have a negative effect on well-being and suggests four types of alternative measures of progress as follows [25, 136]:

1. The General Progress Indicator (GPI), that is designed to measure the sustainability of income, and the Green GDP, which factors in estimates for environmental degradation and depletion of natural resources, in addition to economic indicators.
2. Instead of measuring economic activity, indexes that do not use GDP, measure environmental, social or human capital.
3. Composite indexes including GDP which combine GDP, or variants of GDP, with environmental or social indexes. For example, the Human Development Index (HDI), which combines life expectancy, literacy rate, school enrolment and access to a decent standard of living.
4. Indicator Suites, which do not attempt to combine different indexes, but instead report a number of indicators and let the user interpret them. For

example, the UN Millennium Development Goals (MDGs) and Indicators, which define 48 indicators to measure progress towards its eight goals.

8. Global Sustainable Transport

Black [11] defined sustainable transportation system as “Satisfying current transportation and mobility needs without compromising the ability of future generations to meet these needs.”

Sustainable transportation can be considered by examining the sustainability of the transport system itself, in view of its positive and negative external effects on: the environment, public health, safety and security, land use, congestion, economic growth and social inclusion [107].

A sustainable transportation system is one that [139]:

- allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.
- is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.
- limits emissions and waste within the planet’s ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise.

After the Industrial Revolution transportation and traffic have grown because of a combination of various demand and supply factors, especially in urban areas in both the industrialized and industrializing countries [58]. At present the negative impacts due to transportation on air, water resources and land as well as impacts on bio-systems become a global issue [160]. Hence transportation systems can be developed such a way that maximize levels of accessibility and mobility in an area without exceeding the environmental, financial and social capacities [175].

Planning for sustainable transportation systems is not a very easy task, because it involves multiple options and uncertainties. The barriers to long-term transport sustainability are [11]:

- global environmental problems,
- non-renewable resource used by current transport modes,
- excessive fatalities and injuries,
- local air pollution problems, and
- congested facilities.

8.1. Few Examples of Global Transport

About 8 billion trips are made every day in cities globally of which 47% are by private motorized modes, almost all of which are driven by fossil fuels [115]. About 200 million cars operated in 1970, about 650 million cars in 2005 and it is expected to reach 12 billion by 2030 [18].

Due to the rapid motorization of transportation systems in many developing countries, the amount of transport fuel being consumed is rapidly rising [61]. For example, between 1982 and 2002 the number of motorcycles in India increased from 3 million to 42 million and in China numbers increased from 200,000 to more than 50 million [114].

In Beijing, China about 1,300 new vehicles are registered each day, while in Bangalore, India the daily figure is more than 900 [22].

The transport sector currently accounts for 23% of global CO₂ emissions and is expected to increase to 50% by 2030 and 80% by 2050 [68,155]. In 2005, globally 81 countries had still not banned leaded petrol, 80 of which were non-OECD countries [81].

Current transport systems are non-sustainable. Because they emit CO₂ that result a warmer planet and sea level rise.

8.2. Policy of Sustainable Transport

Sustainable transport can benefit the economy of a country. Walking, bicycling, rollerblading, public transport and other non-motorized modes have become much more acceptable and agreeable, because they need less land for infrastructure and parking and also they are healthier, more energy efficient and comparatively less polluting [61].

Light rail can be between 2.5 and 5 times more energy efficient per capita than buses, and between 17.5 and 35 times more efficient than cars [61].

A single lane of railway is able to carry up to 50,000 persons per hour (pph), a bus lane 7,000 pph, and a highway lane just 2,500 pph [76]. Companies are moving their own freight by rails which are at least 80% more efficient than companies trucking their freight [71,106].

Japan has initiated high-speed bullet trains carrying almost one million passengers a day. Japan’s high-speed rail network now stretches for 1,360 miles, linking nearly all its major cities. China already has the world’s longest high-speed rail network with about 7,431 km of routes in service by 2010, including 1,995 km of rail lines with top speeds of 350 km/h [61].

China has invested \$292 billion to improve and extend its rail network from 78,000 km in 2007, to over 120,000 km by 2020, much of which will be dedicated to freight [174].

Car sharing is that individuals gain the benefits of private vehicle use without the costs and responsibilities of ownership. One car sharing vehicle generally displaces 4–10 new privately owned cars in continental Europe, 7–10 vehicles in Australia, and between 6–23 cars in North America [132].

India is also investing in rail, in the amount of \$4.3 billion, which will finance the building of two dedicated freight corridors, an eastern corridor that will run for 1,279 km, and a western corridor that will run for 1,483 km, most of which will be double tracked [32].

To progress sustainable transport systems in developing countries, the developed countries should keep strong international cooperation and share international experiences as well as technology development and technology transfer to the developing countries [61].

At the vehicle scale, vehicles must become more fuel- or energy- efficient. Urban buses, light rail, intercity rail, and intercity bus are lower GHG emissions per passenger mile.

8.3. Benefits from Sustainable Transport

Some benefits from sustainable transport are as follows [63]:

1. Environment

- reduced GHG emissions,
- increased the use of non-renewable resources,
- reduced air pollutants,
- reduced noise, and
- reduced impact in wetlands and protected areas.

2. Social

- reduced accidents,
- reduced particulate matters (PM), CO₂, CO and other chemicals,
- equitable accessibility, and
- increased sense of community pride and belonging and higher quality of life.

3. Economic

- increased economic productivity,
- increased employment,
- reduced accident damages,
- better labor conditions for transport operators,
- increased accessibility to job, business, and education opportunities, and
- avoided future costs of climate change.

4. Public Health

- reduced health impacts due to global warming,
- reduced deaths and respiratory diseases from air pollutants,
- reduced deaths and disabilities from traffic accidents,
- reduced stress, and
- increased physical activity when cycling and pedestrian amenities are improved.

5. Transport

- reduced travel time,
- reduced travel time uncertainty,
- reduced traffic congestion, and
- reduced long - term economic costs of transport.

6. Urban Development

- increased density and mix of land uses,
- improved design and creation of public and open spaces,
- reduced cost of utility networks in integrated land - transport developments,
- increased social interactions, and
- improved accessibility to transit and to destinations.

9. GHG Emissions and Climate Change

Every nation in the world has realized that global warming is due to continuous GHG emissions. The six gases; Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphurhexafluoride (SF₆), hydrofluorocarbon (HFC) and perfluorocarbon (PFC), together constitutes six GHG emissions. These six gases briefly called carbon dioxide equivalents (CO₂e). The current concentrations of GHG in space have increased since 1750 from a CO₂ equivalent of 280 parts per million (ppm) to 430 ppm [137]. The National Academy of Sciences (NAS) has expressed its expert opinion that concentrations of CO₂ in the atmosphere have increased and continue to increase more rapidly due to human activity [101,102]. The atmospheric concentrations of CO₂ grew 80% from 1970 to 2004, and recently exceed by far the natural range over the last 650,000 years [67].

The Intergovernmental Panel on Climate Change (IPCC) has expressed its expert opinion that the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations and the temperature has been rising most rapidly since 1970 [67,153]. After the industrial revolution the global average temperature increases about 0.76°C. The global surface temperature has increased ≈ 0.2°C per decade in the past 30 years. Global warming is now +0.6°C in the past three decades and +0.8°C in the past century, and continued warming in the first half of the 21st century is consistent with the recent rate of +0.2°C per decade [59, 64].

The four warmest years were, in ascending order, 2002, 2003, 2005 and 1998. The last decade was the warmest on record, followed by the 1990s and then the 1980s, so the world is definitely warming up [9].

Scientific research shows that ice loss from Antarctica and Greenland has accelerated over the last 20 years which will raise the sea level. From satellite data and climate models, scientists calculated that the two polar ice sheets are losing enough ice to raise sea levels by 1.3 mm each year and scientists observed that the sea levels are rising by about 3 mm per year. By 2006, the Greenland and Antarctic sheets were losing a combined mass of 475 gigatons (GT) of ice per year. If these increases continue water from the two polar ice sheets could have added 15 cm to the average global sea level by 2050. A rise of similar size is expected to come from a combination of melt water from mountain glaciers and thermal expansion of sea water [10]. The global warming seems to be affecting many glaciers and ice caps have declined in both hemispheres, as a result melting water raise the sea levels. On the other hand the average Arctic sea ice has melted by 2.7%/decade [131].

Oceans have warmed from surface of the sea to up to a depth of at least 3 km. It is estimated that absorbed 80% of the additional heat added to the climate. Warmer water taking more spaces of the sea than the colder water, as a result sea level is rising [131].

Africa is one of the most vulnerable continents due to global warming. It is estimated that water stress will affect between 75 and 250 million people of Africa by 2020. The cultivable land will decrease, the rain-fed agriculture could be cut in half and fisheries must be declined. As a result almost all African countries will seriously affect food security and malnutrition. Forests of different countries will affect by pests, diseases and fire. The citizens of most of the cities of the world will suffer from heat waves, earth quake, tsunami, shortage of water supply and energy supply by 2020 [67]. IPCC [67] also expressed that 450 ppm is regarded by many climate scientists as the “tipping point” to contain rises in average temperatures to around 2°C. That is still enough to wipe out 20% to 30% of the earth’s animal and plant species, and for the world’s coral to be bleached, crop product will fall, and millions of people and other creatures suffer from water and food shortages.

Experience of hotter summer days which could increase heat related mortality, ground-level ozone concentrations, storm water runoff, and negative impacts from erosion and invasive species. Rising temperatures may increase air pollution levels, with their attendant increases in respiratory illness and death. GHG emissions and climate

change pose a serious threat to the economic well-being, public health, natural resources and environment of the earth. Snowpack in summer stream flows to provide energy, municipal water supply, watershed health and irrigation. The potential rise in sea levels threatens coastal communities, increased vector-borne diseases [42].

10. Planetary Boundaries

The concept of planetary boundaries has recently been introduced to define a “safe operating space for humanity” in the Anthropocene. Nine planetary boundary processes (Figure 3): climate change, stratospheric ozone depletion, ocean acidification, land use change, freshwater use, rate of biodiversity loss, interference with global nitrogen and phosphorus cycles, aerosol loading and chemical pollution have been identified [119].

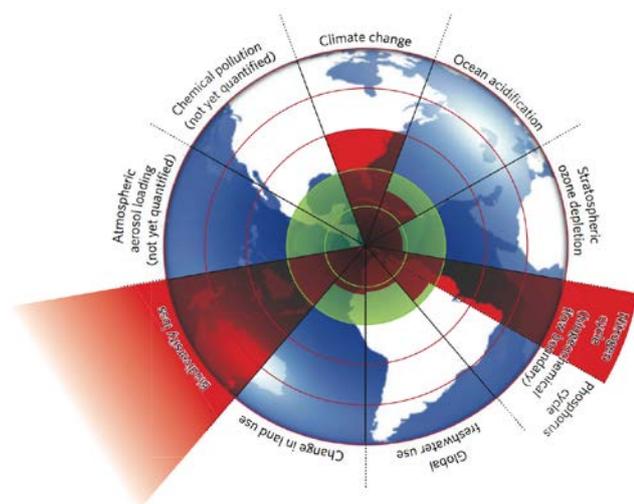


Figure 3. Planetary Boundaries. Source: [119]

An international Planetary Boundaries research network (PB.net) is being established in 2014 to support the development of new dynamic modeling tools and conceptualizations of human environment system interaction [40].

The red areas show the position of each boundary. The safe operating spaces for the boundaries are within the green area (Figure 3). Out of these nine boundaries at least three have already been passed: climate change, biodiversity loss, and the nitrogen cycle [121].

10.1. Climate Change

Climate boundary is based on two critical thresholds parameters: atmospheric concentration of CO_2 and radiative forcing [67]. We have discussed about climate change in section-9.

It has been suggested within the planetary boundary framework by focusing on the concentration of 350 ppm CO_2 in the atmosphere, a safe temperature increase should be limited to 2°C above the pre-industrial level [60]. The suggested boundary of 350 ppm CO_2 was passed some years back and in 2014, the CO_2 level is crossed 400 ppm. The radiative forcing should not exceed 1 Wm^{-2} above pre-industrial levels but now the change in radiative forcing is 1.5 Wm^{-2} [121,127].

10.2. Biodiversity Loss

Biodiversity (a measure of variation in nature) is the natural capital we depend on to sustain ecosystem functions, which is another planetary boundary of major concern that has been passed. Before industrialization the extinction rate was less than one species per million species each year. At present more than 100 species out of a million are going extinct each year. The proposed boundary is set at 10 species per million species per year [140].

Biodiversity is not only about species numbers but also concerns variability in terms of habitats, ecosystems, and biomes [108].

If the corals are degraded due to temperature rise, as a consequence of climate change, not only the corals disappear but also the fish species associated with them [51].

10.3. Nitrogen and Phosphorus Cycle

The cycles of Nitrogen (N_2) and Phosphorus (P) are essential for life on the earth. The availability of N_2 and P in the biosphere has increased massively over the last decades [121]. Modern agriculture is a major cause of environmental pollution, for the increase of large scale N_2 and P. About 121 million tons of N_2 is used (the proposed boundary is set at 35 million tons per year) from the atmosphere per year into reactive forms to make fertilizer for food production and other non-food cultivation [48]. Finally this N_2 releases in the environment polluting waterways and the coastal zone, accumulating in land systems and adding some N_2 to the atmosphere. Nitrous oxide (N_2O) is one of the non- CO_2 greenhouse gases and causes global warming in the atmosphere [84]. Phosphorus (P) is mined from rock and its uses range from fertilizers to toothpaste. About 20 million tons of phosphorus is mined every year and around 8.5 million–9.5 million tons (the proposed boundary is set at 11 million tons per year) of it finds its way into the oceans [8].

10.4. Recent Natural Calamities

In 2010, the Haitian earthquake killed hundreds of thousands. In terms of the overall number of disasters, 2011 was a terrible year (302 disasters): floods in Australia, a devastating earthquake in Christchurch and a horrific tsunami and nuclear accident (estimated loss \$210 billion) in Japan and more than 813 people had died. The USA was particularly hard hit as Mississippi River floods were followed by a string of deadly tornadoes, terrible wildfires and then Hurricane Irene which closed down much of the country's east coast for several days. In October 2011, Bangkok experienced serious floods resulting in \$ 46.5 billion worth of economic losses, inundating 9.1% of the total land area (69 provinces) of the country affecting more than 13 million people, with 728 deaths [19,46,112].

Over the past 30 years, disasters have affected more than 40 million people in the Middle East and North Africa (MNA) region and have cost their economies about \$20 billion [164].

Over the last thirty years, Bangladesh has experienced nearly 200 of these climate-related disasters, which have

killed thousands of people, destroyed homes and livelihoods and cost the nation around \$16 billion in damage and economic losses [53]. In Bangladesh, the predicted rise in sea level will cover 17% of the country by 2050, displacing 18 million people [62].

In 2012–2014, Beijing experienced massive floods following especially heavy rains. Indonesia experienced heavy flooding in early 2014 [38]. In 2013–14, the UK has been affected by an exceptional run of severe winter storms, culminating in the coastal damage and widespread flooding [17].

Deloitte Access Economics [28] estimated that the annual economic cost of natural disasters would rise from \$6 billion in 2012 to \$12 billion by 2030 and \$23 billion by 2050. All of these events were huge setbacks for the economy, with losses of life, massive losses of property, billions or even tens of billions of dollars of damage, and disruptions to the global economy.

11. Water for Sustainable Development

Adequate and safe water and sanitation services make strength the nation's health, education, life expectancy, well-being and social development, economy, security and ecology [105,165]. At the beginning of the 21st century, the demand for clean water is a worldwide challenge. Population growth, rapid urbanization, industrialization, food production practices, changing lifestyles, poor water use strategies and economic development have led increase pressure on water resources globally. On the other hand increasing demands for sources of clean water, combined with changing land use practices, aging infrastructure, and climate change and variability, pose significant threats to the international water resources. Waterborne disease also continues to threaten drinking water supplies [23,42].

Water is not distributed evenly around the world. About 9 countries of the world, for example, Brazil, Russia, China, Canada, Indonesia, the USA, India, Columbia and the Democratic Republic of Congo possess 60% of the world's available fresh water supply [165].

Despite the advances made during the past 40 years, there are 21st century challenges that continue to threaten the water supplies of every country. Failure to manage the water to every people in an integrated, sustainable manner will limit economic prosperity and jeopardize human and aquatic ecosystem health [42].

11.1. Source of World Water

Water sustains all life on the earth. Fresh water is essential for healthy and safe lives of human beings. Clean water is needed for drinking, cooking, washing, and sanitation. It is also a key element of sustainable social and economic development. Fresh water is found in lakes, rivers, and groundwater aquifers. The use and abuse of water has increased in the last few decades due to population growth and economic expansion, which will create widespread water scarcity, water quality deterioration, and the destruction of freshwater resources. It is estimated that by 2025, about 3.5 billion people of the world will live in water-stressed countries [73].

Less than 3% of the water of the earth is fresh; the rest is sea water and undrinkable [165]. Of this more than

2.5% is frozen, locked up in Antarctica, the Arctic and glaciers and not available to human. Hence humanity must rely only on 0.5% of all men's and ecosystems fresh water needs [151]. Of this 0.5% of world water the major use is in the following [166]:

- About 10^7 km³ is stored in underground aquifers. Since 1950 there has been a rapid expansion of ground water exploitation providing 50% of all drinking water, 40% industrial water and 20% of irrigation water [49].
- About 119,000 km³ net of rainfall is falling on land after accounting for evaporation.
- About 19,000 km³ is in natural lakes.
- More than 5,000 km³ is manmade storage facilities reservoirs, which has been 7 fold increases in global storage capacity since 1950 [159].
- About 2,120 km³ water is in rivers.

Water resources are decreasing (especially in many developing countries) across the planet. Even in the 21st century 1 person in 6 (1.1 billion people) has no access to safe drinkable water and 42% of the world's population (2.6 billion people) live in families with no proper means of sanitation. About 4,500 children died in a day for the lack of drinking water supply and sanitation facilities. About 1.8 million people die every year from diarrhoeal diseases. Most of the people of Africa (especially girls) have to collect water from far distance and struggle to survive at subsistence level [171].

11.2. Global Water Use

The daily drinking water requirement per person is 2–4 liters, but it takes 2,000 to 5,000 liters of water to produce one person's daily food [43].

Water used for agricultural production is also scarce and its misuse has a negative impact on the water levels available, which points out to the need to develop appropriate water management systems. Desertification in regions, such as the Sahel threatens livelihoods in the drylands, which are home to one-third of the world's people, is another vital problem for humanity. More than 250 million people are directly affected by desertification and nearly 1 billion people are currently at risk [148].

Industrial use of water increases with country income, going from 10% for low- and middle- income countries to 59% for high-income countries. Domestic use of water is 11% in high-income countries and 8% in low- and middle-income countries. Water use in agricultural is 30% in high-income countries and 82% in low- and middle-income countries. But in many developing nations, irrigation accounts for over 90% of water withdrawn from available sources for use [151].

Bottled water sales worldwide have increased rapidly with global consumption now at more than 1,000 billion gallons a year. Bottled water can cost as much as 10,000 times more than tap water. The USA is the biggest consumer of bottled water. Peoples of the USA are consuming water from disposable plastic bottles at a rate of more than 10 billion gallons each year which costs \$11 billion. China is the 2nd largest consumer of bottled water and it uses 7.7 billion gallons (12.5% of global use), Mexico (population is one-third of the USA) is the 3rd largest consumer and it uses 7.5 billion gallons (12.3% of global use) annually. Brazil uses 4.5 billion gallons and

Indonesia uses 3.8 billion gallons of bottled water annually [122].

11.3. Increase of Wastewater

Urban areas are both consumers and producers of large amounts of wastewater. Wastewater is created in various ways, such as, dissolved contents of fertilizers, chemical runoff, human waste, livestock manure and nutrients [23].

The cultivation of nitrogen fixing crops and the manufacture of fertilizer convert about 120 million tons of nitrogen from the atmosphere per year into reactive nitrogen containing compounds. Every year about 20 million tons of phosphorus is used as fertilizer [120].

Wastewater may contain a range of pathogens including bacteria, parasites, viruses and toxic chemicals such as heavy metals and organic chemicals from agriculture, industry and domestic sources [35].

Lack of wastewater management has a direct impact on the biological diversity of aquatic ecosystems, disrupting the fundamental integrity of our life support systems. In many developing countries more than 70% of industrial wastes are dumped untreated into waters where they pollute the usable water supply [173].

12. Global Health for Sustainable Development

Invention of antibiotics, vaccinations, development of diagnostics, and vast improvements in surgery made revolution in medical science. On the other hand improved provision of water supplies, sewerage and household sanitation increased the global health. Around 1950, infant mortality rate was about 137/1,000 and in 2014 that becomes only 37/1,000. These 3.7% infants are dying mainly in developing countries due to malaria, pneumonia, diarrheal disease or other preventable diseases. This enormous decrease of infant mortality is due to economic development, social consciousness and a tremendous advance in public health systems [99,127].

In 2009, about one-quarter of the children in the developing world were underweight, with the poorest children most affected. About 4 million young children die each year, due to hunger, malnutrition, and unsafe drinking water. Approximately 1.3 billion people did not have access to reliable electricity services in 2009 and nearly 2.7 billion were without clean cooking facilities. Estimated 780 million people lacked access to safe drinking water in 2010, and 2.5 billion lacked access to modern sanitation systems [148].

In 2011, almost two thirds (64%) of the world population relied on improved sanitation facilities, while 15% continued to defecate in the open. Only in sub-Saharan Africa the number of people defecating in the open still is increasing. By the end of 2011, 89% of the world population used an improved drinking-water source, and 55% enjoyed the convenience and associated health benefits of a piped supply on premises [128].

Life expectancy at birth has increased globally. In 1950, the average life expectancy at birth for the entire world population was about 47 years. The present estimated life expectancy at birth is roughly 71 years, and as high as 80 years in the developed countries [20].

Progress in alleviating non-income poverty becomes as follows [148]:

- The under-5 mortality rate has declined from 59 in 1990 to 19 in 2010 (per 1,000 live births).
- The infant mortality rate has dropped from 50 in 1990 to 17 in 2010 (per 1,000 live births).
- The maternal mortality rate has fallen from 120 in 1990 to 58 in 2008 (per 100,000 live births).
- The share of the population suffering from malnutrition has dropped from 11% in 1991 to 6% in 2007.
- The share of the population with access to safe drinking water has increased from 89% in 1990 to 98% in 2010.
- The share of the population with access to improved sanitation facilities has risen from 68% in 1990 to 79% in 2010.

13. Economic Development of China

Both China and India are ancient civilizations that in important ways were far ahead of Europe not so many centuries ago. China was once in the leading position but it lost the lead by 1500. China was clearly the world's technological superpower, and had been so for at least a millennium. By 1975, China's per capita income was a mere 7.5% of Western Europe's but it has soared to 20% of Europe's income level by 2000 [125].

Since 1978, China has been among the fastest growing economies in world history. After came to power Deng Xiaoping, China undertook some basic market reforms which make the country on a trajectory of extraordinary economic growth. Recent economic growth of China is roughly 10% per year in GDP growth. By the rule of 70, a growth of 10% means that China has been doubling its GDP roughly every 7 years (70/10). Since 1978 (about 37 years), economic growth of China becomes roughly 5 doublings (35 years/7 years per doubling), i.e., the Chinese economy has grown roughly by a factor of $2^5=32$ times since Deng Xiaoping opened the Chinese economy to market forces and international trade. Recently China has become the largest trading country of the world. It is estimated that more than 200 million people of China have gathered from the countryside to the cities in search of new jobs in industry and services [125].

In 1981, about 64% of the population of China lived on an income below \$1.00 per day. By 2001, the number was reduced to 17% and in 2010 to 10% [127].

In the beginning of 2015, the population of China becomes about 1.398 billion, which is more than one-fifth of global population. The economy of China has proceeded from rural to urban, from agricultural to industrial and service-oriented. In 2014, China becomes the world's first-biggest economy in the world [26].

The economy of China has grown with an average 10% per annum during the last two decades. Its per capita gross domestic product (GDP) in Purchasing Power Parity (PPP) has increased more than 20 times from \$379 in 1980 to \$7,632 in 2010 [15]. This type of emerging economies of China is called *catch up* growth, which is different from endogenous growth. China applied import technologies from abroad rather than develop them at the country.

It has gone from high fertility rates to low fertility rates (one child policy), and from high child mortality to low

child mortality. Life expectancy has soared, public health has improved, and educational attainment has gone up steeply. China now turns out more PhDs per year than any other place in the world [26].

China is now the world's largest energy consumer [12] and energy demand is expected to continue growing rapidly through 2030 [13]. The quality of air in many Chinese cities exceeds both national and international standards due to rapid urbanization, industrialization and increased energy consumption [65]. Coal-dominated energy consumption structure in China faces some of environmental problems such as acid rain, air pollutions and a large amount of GHG emissions [104].

According to the World Bank [162], due to rapid industrialization the air pollution in China is in the highest in the world. In 1995 about 178,000 premature deaths, 346,000 registered hospital admissions, more than 75 million asthma incidences happened in China due to the air pollution. Due to the expansion in manufacturing industries and fueled by coal in China, the source of more than 70% of the energy consumed nationwide [103]. Tianbao et al. [141] indicate that China is one of the countries in the world which suffers from severe acid rain contamination. Hence, China has achieved rapid economic growth but has not yet achieved sustainable development.

14. Sustainable Economy

In a society if many people are very poor and some limited people are very rich, then we cannot say the economy of this society a sustainable economy. A socially and environmentally sustainable economic system operating with the purpose of facilitating a good life with dignity for all while respecting nature as an integral part of life. To achieve this, a fundamental shift in economic rationality is required [129].

A good society must give priority to save the natural environment. If a society breaks the physical systems of water and biodiversity, destroy the oceans and the great rain forests, then that society will not survive profitably and comfortably and must face severe danger situation. Of course a good society must think about environmental sustainability for the well-being of its children and its future generations [24].

Corruptions, lawlessness, untrustworthy politicians, unfair government services, discriminations of gender and minorities etc. create a lot of unhappiness in the society. Citizens feel happier and better when they can trust their government, but unfortunately in many countries their governments not so to trust them. A sustainable and caring society, the economy should be perceived as an instrument for assuring the development of human capabilities and the expansion of real freedoms, while preserving and protecting life support systems of the Planet's Commons [158].

15. Govern of Economy

The World Bank defined the governance as "*The manner in which power is exercised in the management of a country's economic and social resources for development*" [161].

In the 21st century good governance of the world economy cannot perform only by the governments, the multinational companies play the most powerful role. The well-being of the humanity depends on their obeying the law, respecting the natural environment, and helping the communities in which they operate, especially to overcome extreme poverty. These multinational companies are often the agents of public corruption, bribing officials to bend regulations or tax policies in their favor, tax evasion, money laundering and reckless environmental damage [125].

Governments of some countries have used engineers and inventors to design and build new weapons and defenses for their safety. For example, World War II brought advances in computers, radar, semiconductors, rocketry, antibiotics, communications, and countless other advances led by state-supported research; including the USA's Manhattan Project, which brought together world-leading physicists to design and construct the first atomic bombs and two atom bombs destroyed two towns of Japan (Hiroshima and Nagasaki) killing millions of innocent people in 1945. But technological advances through peaceful means can create sustainable development. We need new technologies for sustainable energy, transport, construction, food production, health delivery, education etc.

16. Present Unsustainable Development Practices

For the competitive global economic development every nation practices more or less unsustainable development policies.

In the developing countries the wetland has been reduced in size due to unsustainable abstraction of water for use in agriculture [33]. Water table has decreased for the unsustainable irrigation and over ground water use [82]. Support for the irrigation of dryland areas has been criticized by environment experts for being unsustainable, and has also had negative impacts on biodiversity [37].

China's ecosystems are moving towards unsustainable level due to unsustainable economic development. Over the past few decades China faces difficulties for unsustainable production, distribution and consumption practices [39].

Biodiversity loss, climate change, food insecurity, chemical pollutions and excess use of fossil fuels are for the unsustainable economic development. Tipping point and peak oil are obviously unsustainable [119]. Fishing industries in some countries have become unsustainable due to overexploitation of fish stocks [16].

17. Threat to Civilization and Economic Development

The world faces in the shortage of the cycles of water, nitrogen, and carbon; upon which life of human and other organisms depends. If we cannot save these cycles properly, then 10,000 years of human civilization will be in threat. For sustainable development, the interactions of three complex systems: the world economy, the global

society, and the earth's physical environment are essential [168].

Present GWP is \$12,000/person (for 7.29 billion people), which is 100 times larger than at the start of the Industrial Revolution. For this enormous economic development human has destructed many kinds of natural assets. As a result, human has become a serious threat to its own future wellbeing, and perhaps even survival, as due to unprecedented human-caused harm to the natural environment. Rich or poor nation, nobody can escape from natural calamities [125]. A quarter of the CO₂ emitted by humans is dissolved in the oceans, which is leading to increase the ocean acidification [93,123].

18. The Millennium Development Goals (MDGs)

The MDGs express widespread public concern about poverty, hunger, disease, illiteracy, gender inequality and environmental degradation. Developing countries have made substantial progress towards achievement of the MDGs but some countries have achieved very few. Worldwide environmental objectives are needed to a higher profile alongside the poverty reduction objectives [126]. The MDGs stressed to make free all women, men, children from the hopeless and dehumanizing conditions of poverty [154]. They were also a pledge to uphold the principles of human dignity, equality and equity and free the world from extreme poverty [145].

There are 8 MDGs as follows [145]:

Goal 1: Eradicate extreme poverty and hunger.

Goal 2: Achieve universal primary education.

Goal 3: Promote gender equality and empower women.

Goal 4: Reduce child mortality.

Goal 5: Improve maternal health.

Goal 6: Combat HIV/AIDS, malaria and other diseases.

Goal 7: Ensure environmental sustainability.

Goal 8: Develop a global partnership for development.

18.1. Progress and Retreat in MDGs

Goal 1: In 1990, about 50% (1.9 billion) of the population in developing countries lived on less than \$1.25 a day but this rate dropped to 22% (1.2 billion) by 2010. A total of 842 million people (about 1 in 8) in the world, were estimated to be suffering from chronic hunger in 2011–2013 and most of them are living in the developing countries. The undernourished people in developing countries have decreased from 24% in 1990–1992 to 14.9% in 2011–2013 [154]. Since 1990, about 40% of children under-5 was stunted but in 2012 this has reached to 25%. But the number of stunted children increased alarmingly by one-third, from 44 million to 58 million between 1990 and 2012 in Sub-Saharan Africa. In developing regions, 60% of women were in vulnerable employment in 2013, compared to 54%. Although most of the developing countries likely to meet the MDG-1 but the Sub-Saharan Africa will be unlikely to meet the target by 2015 [145].

Goal 2: In developing countries a substantial progress made towards universal primary education between 2000 and 2012, with the adjusted net enrolment rate in primary education increasing 83–90%. The number of children out

of primary school declined from 102 million to 57 million between 2000 and 2011; most of them are girls from poor rural households and children with disabilities those belonging to ethnic minorities, children living in conflict-affected areas, rural areas or urban slums. Without renewed efforts, the target of universal primary education by 2015 seems beyond reach [154].

Goal 3: In Southern Asia the primary school enrolment ratios were the same for girls as for boys by 2012. In sub-Saharan Africa, Oceania and Western Asia, girls still face barriers to entering both primary and secondary school. In developing countries gender disparities become more prevalent at higher levels of education. Women members of parliament accounted for 21.8% of all parliamentary seats in January 2014. In January 2014, 46 countries hold more than 30% of seats in national parliament in at least one chamber [145].

Goal 4: The mortality rate for children under-5 dropped about 41%, from 90 deaths per 1,000 live births (12.6 million) in 1990 to 47 (6.6 million) in 2012 [154]. Oceania, sub-Saharan Africa, Caucasus and Central Asia, and Southern Asia still fall short of the 2015 target. It will take until 2028 to reach Goal 4 globally at the current rate. In 2012, one child in ten in Sub-Saharan Africa did not live until their 5th birthday [145].

Goal 5: In 2013, about 300,000 women died globally from causes related to pregnancy and childbirth. Globally, the maternal mortality ratio dropped by 45% between 1990 and 2013, from 380 to 210 deaths per 100,000 live births. In 2013 alone, about 289,000 women died during pregnancy or childbirth. Most of the maternal deaths in 2013 took place in Sub-Saharan Africa (62%) and Southern Asia (24%). Sierra Leone has the highest maternal mortality rate, with 1,100 maternal deaths per 100,000 live births, while Belarus has a rate of 1 maternal death per 100,000 live births. Almost one-third of all global maternal deaths are concentrated in two populous countries: India, with an estimated 50,000 maternal deaths (17%), and Nigeria, with an estimated 40,000 maternal deaths (14%). In most developing countries, about 80% of pregnant women visited a skilled health-care provider at least once, except in Southern Asia, where only 72% of women received this care. More than 32 million of the 40 million births not attended by skilled health personnel in 2012 occurred in rural areas of developing countries [145].

Goal 6: In 2012, there were an estimated 35.3 million people living with HIV (human immunodeficiency virus) worldwide. Globally, the number of new HIV infections adults (aged 15 to 49) declined by 44% between 2001 and 2012. Still there are an estimated 2.3 million (Sub-Saharan Africa was the region where 70%) cases of people of all ages newly infected and 1.6 million deaths from AIDS-related causes. About 210,000 children died of AIDS-related causes in 2012. In 2012, there were an estimated 17.8 million children aged 0 to 17 years globally who had lost either one parent or both, due to AIDS. Access to life-saving antiretroviral therapy (ART) has been increasing dramatically over recent years, saving ever more lives. In 2012, an additional 1.6 million people received ART treatment. A total of 9.5 million people in developing countries were receiving treatment in 2012 [145,154].

In 2012, about 207 million cases of malaria occurred around the world, and the disease killed about 627,000 people (80% of them children under-5). Two countries,

the Democratic Republic of the Congo and Nigeria, account for 40% of malaria mortality worldwide. Between 2000 and 2012, an estimated 3.3 million deaths (90 were children under-5) from malaria were turned away due to the substantial expansion of malaria interventions. But still about 3.4 billion people are at risk of infection of malaria [96].

About 2 billion people are thought to be infected with tuberculosis (TB) and about 1.3 million died each year from the disease, of whom 320,000 are HIV-positive. Since 1995, the intensive efforts to fight TB have saved an estimated 22 million lives worldwide [97].

Goal 7: About 13 million hectares of forest lost worldwide each year between 2000 and 2010, either through destruction by natural calamities or the land use for cultivation. Deforestation decreases biodiversity and access to clean water and increases soil erosion and the release of CO₂ into the atmosphere. Global CO₂ emissions have continued their upward trend, increasing by 2.6% between 2010 and 2011. Global emissions of CO₂ reached 32.2 billion metric tons in 2011, a 48.9% rise above their 1990 level. Global consumption of ozone-depleting substances (ODS) decreased by over 98% between 1986 and 2013 [145].

More than 2.3 billion people gained access to an improved source of drinking water between 1990 and 2012. But there are 748 million people still relying on unsafe drinking water sources in 2012. Between 1990 and 2012, almost 2 billion additional people gained access to an improved sanitation facility. Despite the large increase in sanitation coverage, from 49% in 1990 to 64% in 2012, it seems unlikely that the MDG target of 75% coverage will be met by 2015 [154].

Goal 8: Developed countries' net Official Development Assistance (ODA) to developing countries in 2013 rose by 6.1% in real terms compared to 2012. In 2011–2012, out of a total of \$98.8 billion of sector allocable aid, aid worth \$23.5 billion was focused on the achievement of the Goal of gender equality and women's empowerment [145].

In 2012, about 80% of imports from developing countries entered developed countries duty-free. About 3 billion people will be using the Internet by the end of 2014. By the end of 2014, the number of mobile-cellular subscriptions will reach almost 7 billion globally. Almost all countries in the world have launched at least third generation (3G) mobile-broadband services [145].

19. Sustainable Development Goals (SDGs)

In Griggs et al. [57], it is argued that the twin priorities for the formulation of SDGs must be the protection of earth's life-support system and poverty reduction. Six provisional SDGs are proposed as follows:

1. Thriving lives and livelihoods.
2. Food security.
3. Water security.
4. Clean energy.
5. Healthy and productive ecosystems.
6. Governance for sustainable societies.

To achieve SDGs we need to be serious in the followings [121]:

- Extreme poverty (\$1.25 or less per day) in all its forms (hunger, child stunting, malnutrition, and food insecurity) should be eliminated from every society and by 2030; all societies should be middle-income or higher.
- Countries contribute to planetary boundaries and incorporate them, together with other environmental and social indicators, into expanded GDP measures and national accounts.
- Improved technologies, farming practices and policies to ensure higher and sustainable yields, crop resilience, protection of ecosystem services, reduced post-harvest losses, and lower food waste.
- All people must enjoy equal opportunities regardless of gender, race and religion.
- Violence and exploitation, especially for women and children must be prevented and eliminated.
- Sustainable food production systems with high yields and high efficiency of water, soil nutrients, and energy must be ensured, supporting nutritious diets with low food losses and waste.
- Quality education must be ensured through universal quality education (primary, secondary and higher). Communication and information technologies can play a central role in expanding access to quality education in all areas.
- Personal security, gender equality, the rule of law, universal access to public services and human rights must be ensured in every nation.
- Job skills must be created through the school-to-work policies including vocational training.
- Every country should have a healthy life expectancy of at least 70 years by 2030. This can be achieved through universal access to health services, improved lifestyles, and healthy diets.
- All cities should be socially and economically productive, environmentally sustainable, secure, and resilient to climate change. Basic urban services including housing; water, sanitation and waste management; low-carbon energy and transport; and mobile and broadband communication must be ensured.
- Universal access in rural areas to basic resources and infrastructure services, such as, land, water, sanitation, modern energy, transport, mobile and broadband communication, agricultural inputs, markets, and advisory services must be ensured.
- All countries achieve universal health coverage at every stage of life, including the prevention and treatment of communicable and non-communicable diseases, sexual, mental and reproductive health, family planning, routine immunization, with particular emphasis on primary health services. So that, all the people will be healthy and live peacefully.
- To avoid a 2°C rise of the earth's temperature energy efficiency and renewable and low-carbon technologies must be initiated in every sector. Redesign of industrial processes for materials efficiency, recycling, and safe waste management is needed.
- Protection of all key ecosystems, marine and terrestrial are necessary by ensuring sustainable

practices of land use, waste management, water use, and other practices.

- Promotion of transparency, accountability and good governance must be established in public sectors, business, civil society, academia and the research community.

20. Recommendations for SD

All the developed and industrialized countries should try to reduce GHG emissions and must be conscious in harmful chemical pollutions. They will also try to remove the absolute poverty from the society by 2020 to make the world poverty free. Every nation will try to achieve MDGs and SDGs. The government of the developed and developing countries will not cross the planetary boundaries to make the world livable for the future generation. They also respect the green economy and sustainable transport. The leaders of developing countries must be conscious about population growth. Global urbanization should be in sustainable ways. Economic, social and environmental sustainability must be ensured in every nation. Free health services for all are necessary globally for the sustainable development in health sector.

21. Concluding Remarks

In this article we have discussed the sustainable development policy. Thinking for the welfare of the humanities, we have tried to give a preliminary idea of the SD to the readers. SD economy will be established in the society if all the nations act cordially uniquely. For the survival of the humanities there is no alternative of SD economy. From the Industrial Revolution all the nations have progressed in economy but the gap between the rich and the poor has increased. This gap must be reduced in near future for the SD of the modern economy. Within 2020 extreme poverty of all the countries must be eliminated. So that they can be self dependent and can develop themselves within very short time. If educated people are increased in the societies then the SD goals will be achieved very rapidly. On the other hand the natural calamities have increased due to global warming. All the nations must be unifying to reduce the green house gas emissions, which increase global warming.

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