**Topic of Study Materials: Economic Growth and Sustainable Development**

**Study Materials -2**

**Paper/ Course No. ECO 203 (PG. Sem II)**

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**Group A**

**Teacher: Dr. Sebak Kumar Jana**

**4. Economic Growth and Sustainable Development**

**4.1 SUSTAINABLE DEVELOPMENT**

Sustainable development has been defined in various ways by various authors ( Pearce 1998, Dexhage et al 2010, Stavins 2003, Arrow et al 2010, World Enviro, Daly 2005, Mukherje et al 2006). According to Pezzey “Sustainability is defined as non-declining utility of a representative member of society for millennia into the future”. Barbier and Markandy has opined “Sustainable activity is...that level of economic maximization of net benefits of economic development, subject to maintaining the services quality of natural resources over time.” According to World Commission on Environment and Development (WCED, 1987) “Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”. The alternative approach to sustainable development is to focus on natural capital assets and suggest that they should not decline through time (Pearce et al. 1989). According to Daly “Sustainable economy is one that can be maintained indefinitely into the future in the face of biophysical limits.”

One economic perspective on sustainability, referred to as **weak sustainability**, assumes that natural capital and other types of capital (produced, human, or social) are substitutes. Thus, weak sustainability asserts that natural capital depreciation is justified as long as it is compensated for with adequate increases in other types of capital. So, for example, the destruction of a wetland in order to construct a new highway would be justified if the economic benefits of the highway exceeded the lost ecological value of the wetland. On the other hand **Strong sustainability** is defined solely in terms of natural capital. According toe strong sustainability, natural and other types of capital are not substitutes to each other. Strong sustainability doesn’t mean that natural capital can never be degraded, but it requires that any degradation of a particular type of natural capital (such as the cutting of a forest for timber) be compensated for with restoration of appropriate form pf natural capital (like replanting trees or restoring a wetland).

Another perspective on sustainability considers whether the overall scale of human environmental impacts is within the carrying capacity of the planet. This approach measures the human **ecological footprint**, which estimates the amount of biologically productive land that is required, both to supply the natural resources a society uses and to assimilate the waste and pollution that results from economic activity.

**4.2 THE ENVIRONMENTAL KUZNETS CURVE**

Economic growth implies increased per capita availability of goods and services. Sustained economic growth requires the use of increasing quantities of environmental goods and services, which is affected by the size of the population and a host of other factor including per capita income. The nature of relation between the quality of environment and economic growth could be explained in terms of several paradigms including the EKC hypothesis.

The relationship between GDP and the environment is rarely monotonic. Sometimes a country’s growth is first bad for the environment and later good. The reason is the three conflicting forces. On the one hand, when GDP increases, the greater scale of production leads directly to more pollution and other environmental degradation. On the other hand, there tends to be favorable shifts in the composition of output and in the technologies of production.

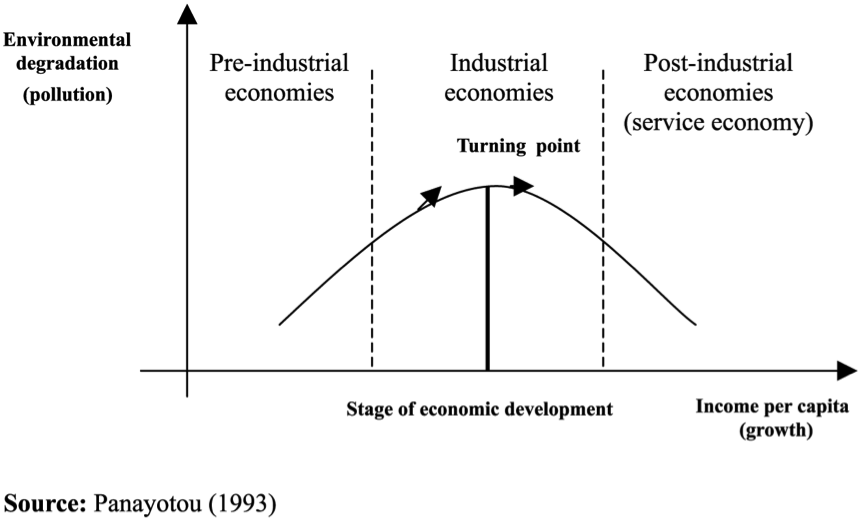
A look at data across countries over time allows out to throw light on this. For some important environmental measures, a U-shaped relationship appears. At relatively low levels of income per capita growth leads to greater environmental damage, until it levels off at an intermediate level of income, after which further growth leads to improvements in the environment. This empirical relationship is known as the Environmental Kuznets Curve. The World Bank (1992) and Grossman and Krueger (1993,95) brought to public attention this statistical finding for a cross section of countries.

The idea behind the environmental Kuznet Curve is that growth is bad for air and water pollution at the initial stages of industrialization, but later on reduces pollution, as countries become rich enough to pay to clear up the environments. The dominant theoretical explanation is that production technology makes some pollution inevitable, but that demand for environmental quality rises with income. The standard rationale is thus that, at higher levels of income per capita, growth raises the public’s demand for environment quality, which can translate into environmental regulation. Environmental regulation, if effective, then translates into a cleaner environment.

Empirical researchers are far from agreement that the environmental Kuznet curve provides a good fit for the available data, even for conventional pollutants.Stern (1998) argues that the evidence for the inverted-U relationship applies only to a subset of environmental measures; for example, air pollutants such as suspended particulates and SO2.

The EKC hypothesis proposes that there is an inverted U-shaped relation between quality of environment, as measured by some of the indicators of environmental degradation and per capita income **(Fig 1**). This means that environmental degradation is low initially when the per capita income is low, then it increases with growing per capita income and eventually it declines with further increase in per capita income.

**Fig.1 Environmental Kuznets Currve**



The hypothesis has been criticized by many scholars on both theoretical and empirical grounds. But overall, the general consensus is that it holds for some but not all environmental indicators and that economic growth alone cannot solve all environmental problems. The best fit is for air pollution and a few indicators of water pollution, as articulated by Edward B. Barbier (1997).

The EKC hypothesis states that as per capita incomes grow, environmental impacts rise, hit a maximum and then decline. This implies an ‘inverted—U’ shape, as shown in Fig1.

Two parts of the curve can be identified – rising and falling. Emissions fall and environment quality rises. Why?

* There is an increasing demand for environmental quality as incomes go up. This lead to an increase in government protection of the environment and increasing green consumption.
* Technical improvements over time make production permit of output cleaner.
* Changes in the structure of the economy occur, such as moves from manufacture to service sector or high-tech industries.
* Increasing scarcity of ‘environmental quality’ drives up its relative price, and this means “less is consumed”, and more is preserved.

**Relevance of the EKCs in the Indian context:**

In the Indian context, we could say that the EKC hypothesis holds partially in the sense that air pollution and water pollution are both increasing with moderate increase in per capita income in conjunction with growing commercialization of agriculture, urbanization and industrialization. India has not yet reached a stage of economic growth when per capita income is high enough for people to adopt eco-friendly livelihood strategies. Environmental degradation in India is due partly to the abject poverty and partly to wasteful use of natural resources, particularly common pool resources (CPRs) by the rich. The poverty-driven degradation includes: (i) indoor air pollution due to use of biomass as fuel; (ii) water pollution; and (iii) land degradation; and the degradation induced by growing affluence includes: (i) pollution of rivers and lakes due to the discharge of toxic effluents from factories and plants; (ii) vehicular air pollution; and (iii) deforestation and loss of biodiversity due to commercial logging, and illicit lopping and poaching. Thus there is need for active policy interventions and mass awareness among people to reduce environmental degradation in India.

**4.3 GREEN ECONOMY**

The issue of the ‘Green Economy’ has gained some traction in recent times. Green growth has emerged as a panacea in dealing with a myriad of problems associated with the environment in the global platform. It reconciles the two formerly believed irreconcilable positions – economic growth and environmental sustainability. A green economy is a new approach to economic development that improves the welfare and well-being of society while reducing environmental impacts. Many economists advocate now the ambitious goal of a “green economy” that embodies the concept of sustainable development.

The definition of green economy as put forward by the United Nations Environment Program (UNEP) is:

“One that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is a low carbon, resource-efficient and socially inclusive.”

According to the OECD report “Towards Green Growth (2011)”, a green economy can open up new sources of growth through many different channels such as follows:

* Productivity: Greater resource-efficiency will enhance productivity and reduce waste and consumption. It will free resources from unproductive sectors and make them available to their highest-value use.
* New Markets: New markets will be created owing to the increasing demand for green technologies. This will in turn create more jobs in these sectors.
* Innovation: New opportunities for innovations in green technologies that will be sustainable and effective in nature.
* Confidence: It will boost the confidence of the investors as they will have greater predictability about government’s deaingl with environmental issues.
* Stability: It can promote a balanced macroeconomic condition by reducing price volatility, increasing public revenue through pollution taxation and supporting fiscal consolidation.

Economic growth in conventional economics is measured in a very narrow way. Green economists propose a move towards a ‘steady-state’ green economy from a ‘consumption-based’ economy with unlimited needs. A steady-state green economy is a sustainable economy that respects the environment and thus natural capital is considered as a scarce resource. They propose minimizing use but maximizing productivity of these scarce resources. Thus, to achieve the steady-state, policymakers should consider the number of people sharing scarce resources, the total demand for resources, and the regenerative capacity of the earth.

**4.4 CLIMATE CHANGE**

**a) Causes of Climate Change:**

The major challenge to sustainable development is climate change (World Resource Institute, GOI 2007, Parikh and Parkh 1997, Sathaye et al 2006, Kavi Kumar). Climate change is change in the statistical distribution of weather over periods of time. The major causes of climate change in India are Green House Gases, Deforestation, Land-use Change, Energy Usage, Vehicular Usage and Generation of Solid Waste.

Many scientific studies and most of the climate scientists agree that Climate-warming trends over the past century are extremely likely to be due to human activities. The 2013 and 2014 reports of the Intergovernmental Panel on Climate Change clearly attribute the majority of recently observed global climate change to human-made greenhouse gas emissions. The IPPC projects a temperature increase by 2100 of between 1.5°C (2.7°F) and 4.8°C (8.6°F), relative to pre-industrial levels. ( GADE)

**Green House Gas Emission:** Human civilization and industrialization have amplified the emissions of Green House Gases’ (GHG), which are considered to be one of the main causal factors accelerating climate change in the post industrialization era. GHGs constitute: Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (NO2), Hydrofluorocarbons (HFCs) Perflurocarbons (PFCs) Sulpurhexafluride (SF6). The per-capita emission of an Indian citizen is about 1.43 tonnes of Carbon where the world average is 4.74 tonnes.

In developed countries, there has been a rapid switch from coal to natural gas and renewable energy, lowering overall CO2 emissions. In developing countries, coal production is still expanding, but an increasing share of new energy production is also coming from renewables. Fig. 2 shows the distribution of CO2 emissions among the main emitters: China (29%), the United States (15%), the European Union (11%), India (6%), Russia (5%), Japan (4%), and the rest of the world (30%). Most of the future growth in carbon emissions is expected to come from rapidly expanding developing countries such as China and India. China surpassed the United States in 2006 as the largest carbon emitter in the world. However, per capita emission is highest in USA followed by Russia, Japan and Germany ( Fig.2).

**Fig.2 : Percentage of Some Countries Regiion in World CO2 Emissions in 2014**

**Fig. 3: Per Capita Emission of CO2**

**b) Possible effects of climate change:**

The earth has warmed significantly since reliable weather records began to be kept in the mid-nineteenth century (Fig. 4). In the past hundred years the global average temperature has risen about 1°C, or about 1.8°F. Fourteen of the fifteen warmest years in the modern meteorological record have occurred since 2000. Evidence indicates that the rate of warming, currently about 0.13°C per decade, is increasing. The Arctic and Antarctic regions have been warming at about double the global rate.

**Fig. 4: Global Annual Temperature Anomalies (°C), 1850–2015**

Harris & Roach (2015).

Based on a wide range of models with different assumptions about future emissions, the IPCC estimated in its 2014 report on ―Impacts, Adaptation, and Vulnerability that during the twenty-first century global average temperatures will rise within a range most likely to be between 1.5°C (3°F) and 4.8°C (8.6°F) above pre-industrial levels. The range of likely temperature increases is shown in Fig. 4, with a possible additional range of temperature changes up to 6°C (10.8°F).

Different possible types of impacts of climate change for rise in temperature relative to pre- industrial temperatures have been presented in Table 1.

**Table 1: Possible Effects of Climate Change**

|  |  |  |
| --- | --- | --- |
| Type of impact | 20C | 40C |
| Freshwater Supplies | Potential water supply decrease of 20-30% in some regions ( Southern Africa and Mediterranean) | Potential water supply decrease of 30-50% in Southern Africa and Mediterranean |
| Food and agriculture | Declines in crop yields in tropical regions (5-10% in Africa) | Yields decline by 15-35% in Africa some entire region out of agriculture production |
| Human health | 40-60 million more exposed to malaria in Africa | Up to 80 million more people exposed to malaria in Africa |
| Coastal Areas | Up to 10 million more people exposed to coastal flooding | Up to 300 million more people exposed to coastal flooding |
| Ecosystems | 15-40% of species potentially face extinction | Loss of half of Arctic tundra Widespread loss of coral reefs |

Source: Harris, J. M., & Roach, B. (2015)

**Damages from climate change**

A major economic analysis in 2006, funded by the British government, concluded that much more dramatic action was justified. The Stern Review of the Economics of Climate Change, written by former World Bank economist Nicholas Stern, estimated a social cost of carbon of $85 per ton of CO2. One of the differences between this and most previous analyses was the use of a lower social discount rate ( 1.4%)to weigh future costs and benefits. The Stern Review estimated the damages from climate change in the twenty-first century to be between 5 percent and 20 percent of global GDP, while the most severe effects of climate change could be avoided at a cost of approximately 1 percent of GDP. Thus, the Stern report concludes that the benefits of immediate action to minimize climate change significantly exceed the costs, and that ignoring climate change will eventually damage economic growth.

**c) Climate change and inequality:**

The effect of climate change will fall most heavily upon the poor of the world. Regions such as Africa could face severely compromised food production and water shortages, while coastal areas in south, East, and Southeast Asia will be at great risk of flooding. Tropical Latin America will sea damage to forests and agricultural areas due to drier climate, while in south America changes in precipitation patterns and the disappearance of glaciers will significantly affect water availability. While the richer countries may have the economic resources to adapt to many of the effects of climate change, poorer countries will be unable to implement preventive measures, especially those that rely on the newest technologies.

Recent studies have used geographically distributed impacts models to estimate the impact of climate change across the global domain. As Table 2 indicates, the number of coastal flood victims and population at risk of hunger by 2080 will be relatively larger in Africa, South America, and Asia, where most developing countries are located.

**Table 2: Regional-Scale Impacts of climate change by 2080 (millions of people)**

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Population living in watersheds with an increase in water resources stress | Increase in average annual number of coastal flood victims | Additional population at risk of hunger (figures in parentheses assume maximum CO2 enrichment effect) |
| Europe | 382-493 | 0.3 | 0 |
| Asia | 892-1197 | 14.7 | 266(-21) |
| North America | 110-145 | 0.1 | 0 |
| South America | 430-469 | 0.4 | 85 (-4) |
| Africa | 691-909 | 12.8 | 200 (-2) |

Source: Harris, J. M., & Roach, B. (2015).

**d) Efforts to Reduce to Global Emission**

Climate change is an international environmental issue. In economic theory terms, as we noted in Chapter 12, climate change is a public good issue, requiring global collaboration to achieve effective results. Since the United Nations Framework Convention on Climate Change (UNFCCC) was first established in 1992, there have been extensive international discussions, known as ―Conferences of the Parties or COPs, aimed at reaching a global agreement on emissions reduction .

The Paris Agreement, negotiated by 195 national delegations, formally expresses the global aim of holding temperatures to no more than 2° C above preindustrial levels, with a more ambitious target of 1.5° C. Since the current total of country pledges (INDCs) is not sufficient to secure the global goal of keeping warming under 2° C, the agreement includes 5 year cycles for countries to review their goals and ratchet up their targets, in order to reach more ambitious goals. The negotiating process has been designed to put pressure on every country to comply with its own pledges and to increase them over time. Important Events in International Climate Change Negotiations have been presented in Table 3.

**Table 3: Important Events in International Climate Change Negotiations**

|  |  |
| --- | --- |
| Year, Location | Outcome |
| 1992, Rio de Janeiro | Negotiations start completion of UN Framework Convention on Climate change (UNFCCC). Countries agree to voluntarily reduce emissions with “Common but differentiated responsibilities.” |
| 1995, Berlin | The first annual conference of the parties to the framework, known as COP, United states agrees to exempt developing countries from binding obligations. |
| 1997, Kyoto | COP-3 diplomats approve the Kyoto Protocol. Mandates developed countries to cut greenhouse gas emission relative to baseline emissions by 2008-12 periods. |
| 2000, The Hague | Outgoing Clinton administration and Europeans differ on some COP-6 terms, mainly over credit for carbon sinks such as agriculture and forests. Talks collapse. |
| 2001, Bonn | A second session of the cop-6 talks works out terms for compliance and financing. However, by this time the Bush administration had rejected the Kyoto Protocol and the United States was only an observer to the talks. |
| 2004, Buenos Airs | United States blokes formal negotiation on Post-Kyoto treaty. COP-10 diplomats try informal talks |
| 2007, Bali | COP-13 diplomats approve schedule for post-Kyoto negotiations to end in 2009. This time the United States cooperates as presidential candidates appear supportive of climate change policies. |
| 2009, Copenhagen | COP-15 fails to produce a binding post-kyoto agreement. Instead, the Copenhagen accord declares the importance of limiting warming to under 2oC, yet without any binding targets. Developed countries pledge to provide financing to developing countries of $30 billion annually, rising to $100 billion by 2020. |
| 2010, Cancun | Nations meet to work out details of the “Green Climate Fund” agreed to in Copenhagen. The framework is set for a possible new binding treaty in 2011. |
| 2011, Durban | COP-17 participating countries agreed to adopt a universal legal agreement on climate change as soon as possible, and no later than 2015, to take effect by 2020. |
| |  | | --- | | 2015, Paris | | |  | | --- | | COP-21 195 nations sign the Paris Agreement, providing for worldwide voluntary actions (INDC’s) by individual countries. | |

Source: Harris, J. M., & Roach, B. (2013).

**e) Actions or Initiatives taken in India:**

Under the ambit of National Action Plan on Climate Change, 8 Missions have been initiated by Government of India to implement the sustainable development programmes. These eight missions covering the various sectors are:

* National Solar Mission
* National Mission for Enhanced Energy Efficiency in Industry
* National Mission on Sustainable Habitat
* National Water Mission
* National Mission for Sustaining the Himalayan Ecosystem
* National Mission for a ‘Green India’
* National Mission for Sustainable Agriculture
* National Mission on Strategic Knowledge for Climate Change

The major policies and actions for climate change mitigation and adaptation cut across different sectors and areas of the economy. The initiatives in some of the major areas are as presented in Table 4.

**Table 4: Measures taken at Government Level**

|  |  |
| --- | --- |
| Sector | Measures/Initiatives taken by GOI |
| Energy Efficiency | National Mission for Enhanced Energy Efficiency  (NMEEE) |
| Power Plants |  |
| Renewable Energy | The Electricity Act 2003 together with the National  Electricity Policy 2005 (NEP) and the Tariff Policy  (TP) |
| Nuclear Energy | Three-stage nuclear power programme |
| Transport | Upgradation of vehicular emission norms such as Bharat Stage II, Bharat Stage III and Bharat Stage IV. The |
| Agriculture and Forestry | National Mission for Sustainable Agriculture, National Forest Policy (1988), Participatory Forest Management/Joint Forest Management Programme, National Afforestation Programme, National Forestry  Action Programme, and National Watershed Development Project |
| Marine and Coastal Environment | Coastal Ocean Monitoring and Prediction Systems (COMAPS),Land Ocean Interactions in the Coastal Zone (LOICZ),Integrated Coastal and Marine Area Management (ICMAM), and Society of Integrated  Coastal Management (SICOM). |
| Initiatives for Enhancing Knowledge and Scientific findings | National Mission on Strategic Knowledge for Climate Change, |

Source: Economic Survey, GOI (2012)

**References:**

1. Harris, J. M., & Roach, B. (2013). *Environmental and natural resource economics: A contemporary approach*. ME Sharpe.
2. Harris, Jonathan M., Brian Roach, Pratistha Joshi Rajkarnikar, and Neva Goodwin. (2019) "Growth and Sustainability in the Twenty-First Century."
3. Goodwin, N., Nelson, J., Harris, J., Torras, M., & Roach, B. (2013). *Macroeconomics in context*. ME Sharpe.