Concept and Indicator of Sustainable Development

What is Sustainable Development?

- Development is concerned with the enhancement of living conditions. Sustainable development (SD) is one of the main processes of development.
- The starting point for understanding SD is the fact that human welfare requires production and distribution of goods and services.
- They in turn depend upon availability or supply of four major factors of production or resources, which are summarily grouped with some salient characteristics and discussed in our previous discussion.
- The major resources are human capital, man-made capital, renewable resources and non-renewable resources.

How does sustainable development differ from classical economic models of development?

- Sustainable development models take note of both the economic and the ecological aspects of the resources and something more.
- The creation of waste, and hence investment on its management, investments on regeneration of natural capital, and regard to exhaustibility and species extinction, valuing welfare of future generations are some of the important characteristics of the ecosystem approach to development.
- The ecosystem approach also adds the dimension of direct utility of natural resources in the form of aesthetic beauty social security and inter-generational equity.

Definition of sustainable development:

- **Paradigms of development**
- Growth -Efficiency
- Development -Efficiency and equity
- Social development-efficiency-equity-proper valuation
- Sustainable development-Efficiency-equity-proper valuation-resource stock recognition -resilience.
- One of the widely acceptable definition of SD is the definition given by WCED. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Development Rules:

- The method of arriving at sustainability rules rests heavily on the definition of sustainability itself. The concept of enhancing the living conditions while ensuring the stream of future consumption rates to be at least the same as of now' can be taken as the most acceptable guiding principle. There are several policy oriented rules to bring about sustainability.

- *Hartwick Approach:*
- As long as all the profits from the use of extracted non-renewable resources are re-invested on either man made capital formation or on regenerating renewable resources, the stream of consumption flows remains constant over generations. Then such a development process is sustainable.

- *London School Approach:*
- According to this school of thought, the societies should identify all such critical non-substitutable natural resources and must resolve to preserve them. Examples are endangered spices, several environmental services such as spiritual values etc. This concept is commonly known as holding natural capital intact, as a rule to be applied for critical natural resources.

- *Safe Minimum Approach*
- Closely linked to the non-declining natural capital stock approach is the safe minimum standards approach. The rule is to prevent reductions in the natural capital stock below a save minimum standard identified for each component of this stock, unless the social opportunity cost of doing so is unacceptably large.

Daly's Operational Principle:

Daly provides some guidelines on operationalizing sustainability in general. He sets out four basic rules.

- The main principle is to limit the human scale (throughput-number of people that are dealt with, in a particular period of time) to a level which, if not optimal, is at least within the carrying capacity and therefore sustainable.
- Technological progress for sustainable development should be an increase in efficiency rather than an increase in throughput (production rate).
- Harvesting rate should not exceed regeneration rates and waste emissions should not exceed the renewable assimilative capacity of the environment
- Non-renewable resources should be exploited at best at a rate which is equal to the creation of renewable substitutes.

Daly, while proposing these operational rules hints at population control directed by the carrying capacity of the earth and implementing Hartwick's rule simultaneously. Additionally he suggests efficiency in using renewable resources while managing the waste systematically.

Indicators of sustainable development:

- Sustainability refers to both ecological and economic attributes.
- Corresponding sustainability indicators will also have to account for both of them.
- Economic well being should reflect upon many aspects of life including GDP e.g. quality of life, dignity, status, and capability and empowerment.
- A large number of alternative indicators may be required to get a better understanding of economic development.
- The ecological dimensions invite several new indicators for discussion. Only a few of ecological attributes are quantifiable. In order to capture all aspects of ecological and environmental changes,
  - three types of indicators can be suggested. They are
    - pressure indicators,
    - impact indicators, and
    - sustainable indicators.

Pressure/ Impact indicators:

It refers to flow variables.

- They show the development over time of amounts or levels of emissions, discharges, depositions, extractions, and interventions originating from a set of economic activities.
- These indicators express the burden placed on stocks of environmental goods and resources.
- The environmental pressure originating from economic activities in a specific region does not necessarily have to affect the same region
- Emissions may be imported and exported by the directions of the wind.
- Timber extractions may take place within the region while the produce of these extractions is used outside the region.

- **Impact indicators** reflect the impact of this environmental pressure on the receptors, usually in a predetermined region
- These indicators include imported transboundary pressures.
- Ideally they show the development over time of the stocks and quantities of environmental goods and resources.
- Both pressure and impact indicators can be transformed into **sustainability indicators** by relating pressure or impact with predetermined reference values.
- These references try to indicate what is considered to be a sustainable level of extractions or a sustainable quality level of an environmental good.

Measurement of sustainable Development:

- While a variety of sustainability indicators can serve the purpose of understanding some of the dimensions of environmental and economy in terms of pressures, impact and sustainability, the need for any aggregated index cannot be underestimated.
- The index can be distinguished at project or program of economy wide levels.
- *Project level Measures:* Discounted present value of benefits.
- Net Present Value of Benefits (NPVB) = $\sum Bt\ \delta t - \sum Ct\ \delta t - \sum Et\ \delta t \geq 0$, whereas Bt, Ct and Et are annual stream of benefits, costs and environmental costs respectively and δt is the discount factor expressed as $(1+r)^{-t}$, r is the discount rates, t stands for time unit.
- As long as the present value of net benefit is non-negative the project is sustainable. The discount rates should be much smaller than the usual social discount rate, r.

Pearce-Atkinson Measure (PAM):

- Following the growth model approach, the savings rate is normally considered to be a good indicator of health of the economy.
- A higher saving rate will amply better capability of the economy to grow.
- But under sustainability conditions, both the depreciation of natural resources as well as man-made capital are to be deducted to arrive at a corrected measure of a sustainable savings rate.

Accordingly the improved measure is stated as:

- PAM =S/Y -{δm/Y}- {δn/Y}
- Where S and Y are savings and income at the economy level, δ (Omega) stands for change, 'm' and 'n' are man made and natural capital, respectively.
- Only when this PAM is greater than or equal to zero, the economy is sustainable.

MPAM

- One can marginally improve the PAM by incorporating effects of productivity changes (mainly due to technical progress) upon the use of investable resources and change in population dynamics.
- The measure is based on aggregate estimates of rate of changes in technical efficiency, population, depreciation etc.
- The modified PAM is stated as:
- MPAM = (s*p)-n-d-e
- Where s = savings rate, p = productivity of new investments, n = rate of population growth.. The rate of depreciation of man-made capital (d) and the rate of depletion or degradation of natural capital (e) are expressed as ratios to income.
- Suppose s= 0.25, p =1.12, n =0.02, d =0.10, and e =0.10
- Then estimated MPAM is 0.06