:: How to achieve Sustainable Growth ?

Sustainable Growth

The term sustainable development has its origin in the International Union for the Conservation of Natural Resources (IUCN) 1980 World Commission Strategy report. The commission defined sustainable development as 'development that meets the need for the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development was brought into common use by the World Commission on Environment and Development (the Brundtland Commission) in 1987. There are six definitions for sustainable development (not all the same).

Concepts of Sustainability

- A sustainable state is one in which utility (for consumption) is non- declining through time
- A sustainable state is one in which resources are managed so as to maintain production opportunities for the future.
- A sustainable state is one in which the natural capital stock is non-declining through time.
- A sustainable state is one in which resources are managed so as to maintain a sustainable yield of resource services
- A sustainable state is one, which satisfies minimum conditions of ecosystem stability and resilience through time.
- Sustainable development as capacity consensus building

The Brundtland report, Our Common Future, defines Sustainable development as " the development that meets the needs of the present generation without compromising the needs of future generations". However the exact implication of this definition is not clear. For instance, consider the case of exhaustible resources. If these resources are to be preserved for the future generation then we can never exploit these resources now. Hence, from the above definition it is not clear about

1. What constitutes needs and how will these change over time?
2. What reductions in the options available to future generations are acceptable and what are not? (Markandya et al., 2002, page 17).

Sustainability does not mean that resources must remain untouched, rather it means that their rates of use be chosen so as not to jeopardize future generations. In the case of nonrenewable resources, this implies using the extracted resources in such a way that it contributes to the long run economic and social health of the population. For renewable resources, it means establishing rates of use that are coordinated with the natural productivity rates affecting the way the resources grow and decline. Sustainable development does not prohibit the use of natural resources but restricts their use in such a way that enough, or as much as possible, is left for the future generations. It can be achieved by increasing efficiency or cutting down on waste or by adopting other methods such as imposing a tax on environmental use, as well as using non-traditional sources.

The earliest attempts to make the concept more precise were theoretical. These attempts focused on the economic and environmental dimensions of the debate. Pearce et al. (1990) suggested from an economic perspective Sustainable development as "the development where no generation in the future would be worse of than the present generation". Some authors view sustainable development from much broader perspective taking into account the economic, social and environmental dimensions (Munasinghe, 1993, 2000). The recent World Bank World Development Report (2000) emphasizes the quality of growth and its distribution taking poverty

alleviation overtime as the ultimate criterion of sustainable development. Figure 1 summarizes this broader vision.

Each dimension requires a mixture of skill and disciplines, from ecology, economics and sociology. Methods that bridge the economy-society-environment interfaces are especially important, including environmental and resource economics, ecological economics, conservation ecology, environmental ethics and so on.

1.1. Economic Sustainability

In the economic dimension of sustainable development only the sustainability of consumption and the contribution of natural resources to production is dealt with. Thus the economic dimension of sustainable development aims to seek answer to the question" If society is to maximize the welfare of all generations, present and future, how should it allocate resources over time?" This can be achieved by maximizing the discounted welfare of all generations. Most of the models that tried to address this concern have given a lower weight to the future generations than the present generation. The argument given by them is that because the future is so uncertain and because future generations will have access to more technology and capital than present generations.

For example, consider the case of nonrenewable resources (or exhaustible resources). What can be the optimal consumption path for these resources? In the first ever-formal analysis Dasgupta and Heal (1974) demonstrated that with a low initial man-made capital stock and high initial resource stock the optimal path has consumption rising initially and then falling over time to zero. This is because of the fact that low levels of utility far into the future are outweighed by the benefit of higher levels of utility in the near future.

This shows that under classical economic analysis, sustainable extraction may not be feasible especially when one considers non-renewable resources. Hence, three other interpretations of sustainable use can be:

Solow (1991 p.3) defines sustainability as leaving to the future ' the option or the capacity to be as well off as we are'. Based on this sustainable resource use can be defined as maintaining a capacity to provide the benefit in question, for example by investing in a substitute for the non-renewable resource or, if the resource is exported, in an alternative revenue-generation asset (Markandya et al., 2002 p.20).

Hartwick showed that if the objective is to achieve the highest constant per capita consumption then society should invest in man-made capital an amount equal to the rents from the depletion of the natural resource. This rule for sustainability came to be known as Hartwick rule (Hartwick, 1977).

Bojo et al. (1992, page 14) suggest, "The economic development in a specified area (region, nation, the globe) is sustainable if the total stock of resources - human capital, physical reproducible capita, environmental resources, exhaustible resources - does not decrease over time".

1.2. Environmental Sustainability

Under economic sustainability we have seen how the food and inputs to production provided by natural environment can be used sustainably in terms of maximizing the level of sustainable consumption. However, natural environment provides aesthetic and recreational values apart from more fundamental services without which human life cannot survive (called global life support services). These are known as global life support services, as they provide the basic necessities to allow human life such as food and shelter, provide raw materials, regulate

hydrological service (providing direct service to agricultural production), create and maintain fertile soils, break down natural and man-made waste into nutrients, maintain soil productivity etc. The natural environment provides services on a global scale also. They are necessary to maintain the composition of the world's atmosphere and therefore its system of climatic regulation. The mitigation of global warming is the best-known example of this ecological service. Though the services provided by the ecosystem are well recognized it is very difficult to predict the effect of disturbing the ecosystem due to lack of scientific knowledge of ecosystem structure due to interdependency of species and systems. Due to this very often we see the trade-off between using natural ecosystems to provide inputs to production, even if this use is sustainable, and preserving them in their natural condition to maintain life-support services. The opportunity cost of preservation is the value that could be obtained from harvesting ecosystems, and from converting the land to an alternative use.

Environmental sustainability requires that the fundamental services provided by the environment be sustained at or above some minimum levels over time. A major issue for environmental sustainability is how far ecosystems can be depleted, and pollutants allowed to accumulate in the atmosphere, without threatening global life-support systems?

1.3. Social Sustainability

Though countries may be similar with similar endowments of human, natural and physical capital, there may be substantial differences in the level of economic development achieved by the countries. This suggests that the three types of capital determine only partially the process of economic growth, overlooking the way in which the economic actors interact and organize themselves to generate growth and development. This missing link is seen as Social Capital (World Bank, 1997; 2000).

Definition of social capital
The term 'social capital' is based on the idea that the social bonds and social norms are important for sustainable development. There are several views about what constitutes social capital (Markandya et al., p. 20). The narrowest view of social capital puts emphasis on civic participation and the horizontal association between people like the social networks and associated norms that influence productivity and well-being of a community. This view is associated with the work of Robert Putnam. The broader view of social capital is given by Coleman (1990) who defines social capital in terms of the features of social organization such as trust, norms of reciprocity and networks of civil engagements. The broadest view of social capital includes the social and political environment, which enables norms to develop and shape social structures. It extends social capital to the most formalized institutional relationships and structures, such as government, the political regime, the rule of law, the court system, and civil and political liberties. It recognizes the capacity of various social groups to act in their interest depends upon the support (or the lack) that they receive from the state and private sectors. Similarly state depends on social stability and popular support (Markandya et al., 2002).

How can we measure Sustainability?

It is clear from the above discussion that there are various types of capital stock that contribute to human well-being. These include man-made capital, such as factories and machinery. Human capital is also a productive stock that can be invested in, and allowed to deteriorate. An intangible type of capital is social capital. Finally there is natural capital, which performs many different functions. The fact that there are different types of capital stock that contribute to well-being has led to a distinction between ***weak sustainability*** and ***strong sustainability*** as discussed in Rennings and Wiggering (1997).

Weak sustainability can be defined as the maintenance of the value of the aggregated stock of capital. This implies two things: First that different capital stocks can be expressed in common

terms, namely in monetary value; second, that different types of capital stock can substitute each other in a sustainable solution. Examples of weak sustainability indicators are damage cost calculations, which can be found in several studies of social costs, concepts of integrated environmental and economic accounting, Index of sustainable economic welfare, sustainability indicator of Pearce and Atkinson etc.

Strong sustainability on the other hand requires that each type of capital stock should be maintained in its own right, at least above some minimum level. In the case of natural capital, the minimum level of different types of natural capital stock might be determined by safe minimum standards and the precautionary principle. The strong sustainability indicators can be measured in physical units only. Physical indicators quantifying thresholds of critical ecological functions can be characterized as indicators of strong sustainability. Examples of such indicators are critical loads quantifying depletions, which may have significant negative impacts on the ecosystem in the long run. Depletion of the world's forests might be limited so that the remaining stock is sufficient to maintain biodiversity at safe levels, to sustain timber supplies at adequate levels, and to absorb carbon dioxide emissions.

Rules for Strong sustainability
Daly (1990) suggested three rules for strong sustainability. These rules are

1. Renewable resources must be harvested at or below the growth rate for some predetermined level of resource stock.
2. As non-renewable resources are depleted, renewable substitutes must be developed so as to maintain the flow of services over time.
3. Pollution emissions should be limited to the assimilative capacity of the environment.

The Hartwick-Solow approach

In an influential paper in 1997, John Hartwick proposed a rule for ensuring non-declining consumption through time, in the case where an economy made use of a non-renewable resource (such as oil) in its economic process. Hartwick showed that, so long as the stock of capital did not decline over time, non-declining consumption was also possible. He recommended that the stock of capital could be held constant by investing all Hotelling rents from non-renewable resource extraction in man-made capital. These rents are those resulting from the intertemporally efficient extraction programme for the non-renewable resource, although the price vector used to calculate these rents must be 'sustainable prices', prices from an inter-temporal model that includes a sustainability constraint (Toman et al., 1994). This result has been very useful in developing the economics of Sustainable Development.

Criticisms of the Hartwick rule are that individuals derive utility directly from the environment, and do not view it merely as an input to production. If this is the case, non-declining consumption is not equivalent to non-declining welfare over time. Second criticism is that the rule depends on a particular functional form chosen for the aggregate production function. Another criticism is on the basis that natural resources and man made capital are not nearly substitutable as Hartwick-Solow approach suggests. Natural capital may be defined to comprise of all gifts of nature.

Non-declining natural capital stock approach
Rather a different approach to the limited degree of substitutability between natural capital (Kn) and man-made capital (Km) is that of the approach suggested by Pearce et al. Here the view is taken that, whilst some substitution is possible between certain elements of natural capital and human capital (for example, better machinery, meaning that less raw materials are used to produce certain products), many elements of natural capital provide non-substitutable services to the economy.

The idea here was that, if it is necessary to maintain some amount of the natural capital stock

constant in order to allow future generations to reach the same level of utility as the average held by this generation, this holding constant of the natural capital stock becomes a rule for Sustainable Development. The three views for holding Kn constant was (1) the existing level, (2) the level consistent with maintaining the critical element of Kn, (3) Some amount in between these two.
A rule for Sustainable Development suggested preventing reductions in the level of Kn below some constraint value. If natural capital are held constant in physical terms, the level at which the category is defined will become all-important. All the three alternatives, however assume that we can measure the value of Kn at any point of time; in other words that the different elements of Kn can be aggregated together in comparable units.

The Safe Minimum Standards approach (SMS)
Another rule, which is associated with the land use and non-declining natural capital stock, is the Safe Minimum Standards (SMS) approach. This was developed by Ciriacy-Wantrup (1952) and Bishop (1978). It stems from a concern that the type of calculation carried out under cost-benefit analysis cannot be used to plan for sustainability, because the valuation of damage to ecosystems cannot reflect sustainability principles. In the absence of reliable calculation, it is suggested that ecosystem damage be limited so that the remaining stocks are above safe minimum levels, usually calculated as the minimum levels required for the ecosystem to remain viable. The SMS rule therefore is 'prevent reductions in the natural capital stock below the safe minimum standard identified for each component of this stock unless the social opportunity cost of doing so are "unacceptably large (Hanley et al., 1997. p. 430).

The key difference between the SMS approach and the critical natural capital approach is that, under the former, the SMS for any resource type is allowed to be breached if society deems the opportunity costs of preserving the SMS to be unacceptably high. Under the latter, however, no consideration is given to the costs of protecting the critical natural capital stock, which is to be preserved regardless of any cost consideration.