

# **ECONOMICS, ECOLOGY AND THE ENVIRONMENT**

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**Sustaining Economic Development and the  
Value of Economic Production: Different Views  
and Difficult Problems**

by

**Clem Tisdell**

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<sup>2</sup> School of Economics, The University of Queensland, St. Lucia Campus, Brisbane QLD 4072, Australia  
Email: [c.tisdell@economics.uq.edu.au](mailto:c.tisdell@economics.uq.edu.au)

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# **Sustaining Economic Development and the Value of Economic Production: Different Views and Difficult Problems**

## **ABSTRACT**

Indicates some of the different concepts of sustainable economic development and raises queries about how much present generations are concerned with future generations. A variety of conditions (ranging from very weak to very strong) have been suggested for achieving sustainable development. These are outlined. The prospect that the accumulation of man-made capital may result in unsustainable economic development is discussed and the welfare consequences of the conversion of natural capital are considered in a historical context. This leads on to a discussion of different types of capital: man-made and natural. Division of the total stock of capital into these categories is now common. However, there appears to be a gap because heritage capital (for example, varieties of crops and animals developed by human interference in nature) do not fit well into this framework. Some reasons why economic production may not be maintained or maximised are considered. They include the presence of externalities, open access to resources and the presence of public goods and bads. It is pointed out that it is undesirable to sustain everything, including all industries. While it might seem appealing to seek sustainable strategies that satisfy multiple criteria (such as economic viability, political and social acceptability and ecological sustainability), it is possible that such strategies rarely exist, if at all.

**Keywords:** Concern for future generations, externalities; heritage capital, human capital, man-made physical capital, multiple objectives for sustainability, open-access resources, public goods and bads, sustainable development, sustainable economic activities.

**JEL Code:** Q01

# **Sustaining Economic Development and the Value of Economic Production: Different Views and Difficult Problems**

## **1. Introduction**

The question of whether continuing economic growth can be sustained and how it can be made to last has become an international political issue and a subject for scholarly debate (see Tisdell, 2012b). The purpose of the first part of this article is to discuss some of the concepts of sustainable development, outline different views of scholars about how it might be achieved and to specify the types of resources (especially the types of capital) which are needed for its realization. The second part of the paper identifies and discusses phenomena that can reduce the sustainability of economic activities; considers whether it is desirable to sustain all industries and economic activities; and examines the view that the sustainability of economic activities requires multiple criteria (objectives) to be satisfied, for example, the simultaneous achievement of economic viability, social (and political) acceptability as well as ecological sustainability.

## **2. Some Concepts of Sustainable Economic Development**

There are many different concepts of sustainable development, including sustainable economic development. Basically, however, sustainable economic growth is economic growth that lasts. The World Commission on Environment and Development (1987, p. 43) suggested that sustainable economic development is development that meets the needs of present generations without compromising the ability of future generations to meet their needs. However, it is not exactly clear what this means because there is no specification of what needs are to be met.

Another point of view is that sustainable economic development is development that ensures that the per capita income (or welfare) of each succeeding generation is not less than that of its predecessor (Pearce *et al.*, 1989). A further idea is that sustainable development is development that maximises the possible span of existence of mankind. Whatever view is adopted, it involves some value judgments about what is desirable, for example, to what extent the immediate economic interests of present generations should be sacrificed to benefit future generations. Furthermore, should only the interests of human beings count in deciding

what types of economic development are desirable? Some scholars believe that humans have a duty to try to conserve biodiversity independently of what individual human beings want.

No matter what view of sustainable economic development is adopted, all imply that mankind needs to be mindful of the **future** economic and other consequences of today's economic decisions. This includes the implications for **future** economic growth and welfare of increasing current economic growth. This is probably the main message from the debate about sustainable development.

It is often said that current generations should be careful not to impoverish future generations by their decisions about economic growth. This raises the question of how concerned current generations **should be** for the welfare of future generations. Further issues include

- (1) The extent to which current generations are **actually** concerned about the welfare of future generations and
- (2) The extent to which it is practical (given knowledge limitations) to be concerned about the welfare of far-off generations.

David Pearce(1998, pp. 70-71) has suggested that each generation is basically only concerned with its own welfare, that of its children and possibly its grandchildren. Probably the actual span of concern of an individual for the future is about 80-100 years and no longer. Each generation, however, will have a similar concern. Therefore, there is some ongoing (serial) concern for maintaining the welfare of future generations. However, it is by no means clear that decisions by individual families to sustain the welfare of their offspring will result in the best collective outcome. Families are generally only in a direct position to supply private goods to their offspring but the welfare of future generations also depends on the availability of collective goods (public and mixed goods), the supply of which must be assured by the state.

The co-efficient of concern of each generation appears to be highest for itself, still quite high for the next generation, somewhat lower for the subsequent generation, and for additional generations probably approaches zero quite quickly. However, we do not have enough empirical evidence about this. In addition, current generations may also have concerns for the

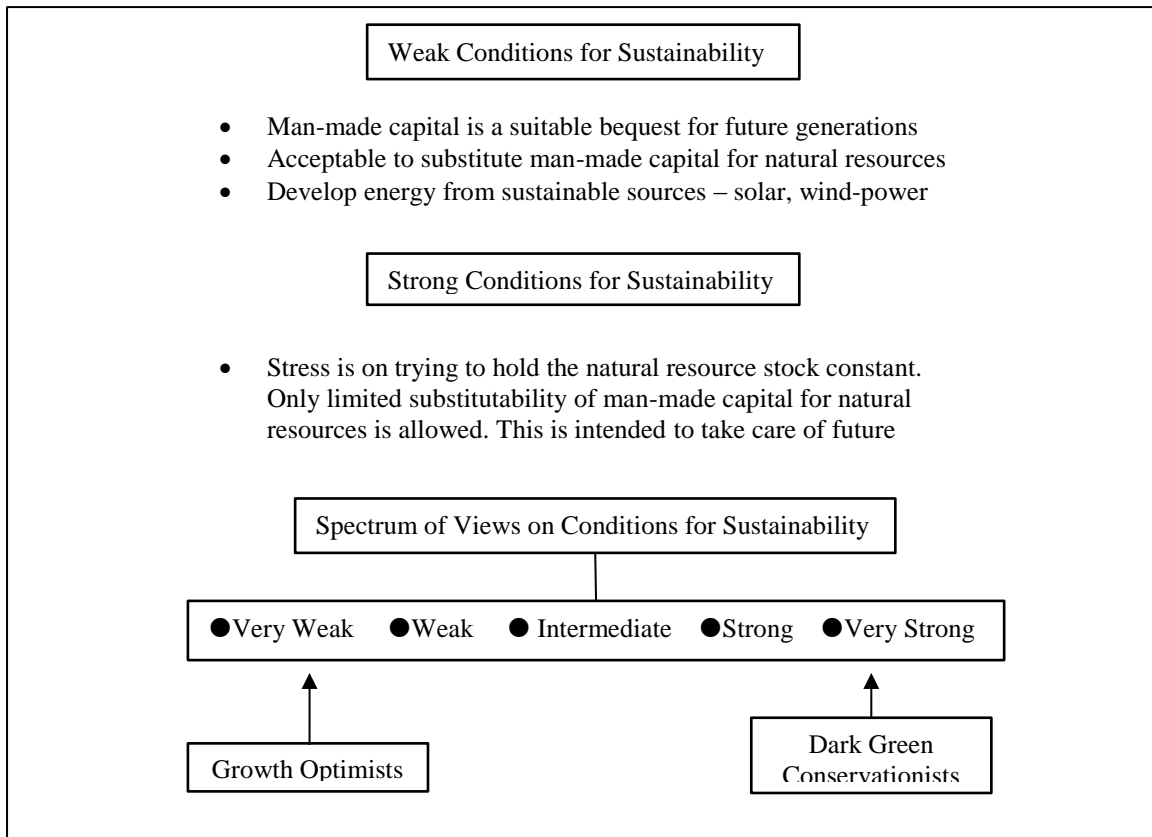
welfare of previous generations, in particular their parents and grandparents. This may, for example, be important in Asian societies influenced by Confucian philosophy. However, these concerns may now be weakening as a result of economic change. Concern for preceding generations complicates the way in which the welfare of different generations is interdependent.

### **3. Conditions Required for Sustainable Development**

A variety of opinions exist about what conditions are required to ensure sustainable development. These range from very weak conditions on the need to conserve natural resources and environments to extremely strong conditions. Very weak conditions are associated with economic growth optimists. They believe that there is no need to restrain the accumulation of man-made capital and that increased accumulation of this capital will benefit future generations. They support 'business as usual'. This accords with the perspective of Karl Marx and the implications of economic growth theories developed in the 1950s. A slightly weaker form of this view suggests that it is desirable to develop technologies for supplying energy from non-fossil sources, for example, solar power, wind power etc. However, it still remains supportive of accumulating man-made capital in order to benefit future generations.

On the other hand, those who advocate strong conditions for achieving sustainable development want to limit the accumulation of man-made capital in order to conserve natural capital (resources) to benefit future generations. According to this point of view, man-made capital 'destroys' natural capital because it converts natural resources into man-made commodities. If this continuing conversion continues unabated, natural resources will become scarce and economic production and welfare will suffer.

The range of these differing views is summarised to some extent in Figure 1. In this illustration, dark green conservationists are at the opposite end of the spectrum to growth optimists. Basically, dark green conservationists want no interference with nature. Neo-Malthusians support a strong position in relation to the need to conserve natural resources in order to ensure sustainable development but usually not the extreme position of dark green conservationists.



**Fig. 1**      **An indication of the range of different views about the conditions required for sustainable development. Based on Pearce (1993, Ch. 2).**

#### **4. A Historical Perspective on Economic Welfare and the Accumulation of Man-made Capital**

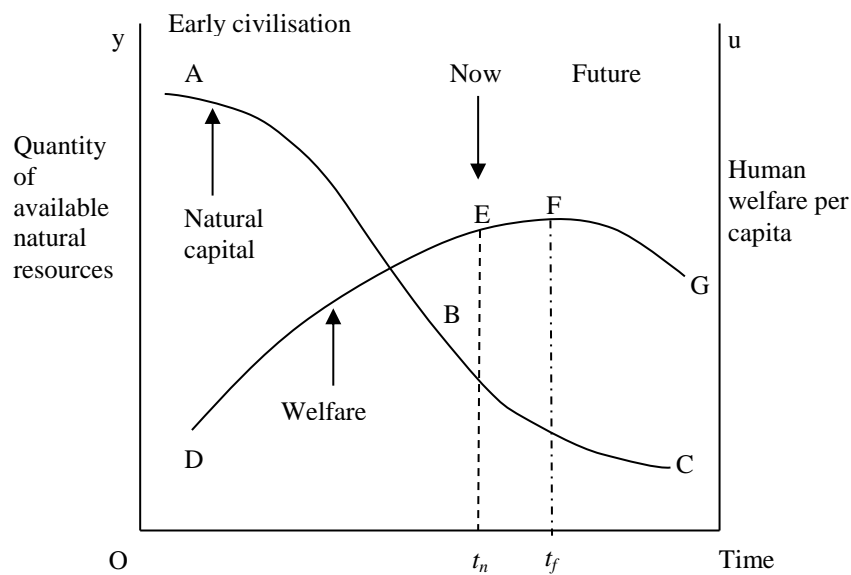
Investment in man-made capital results in the accumulation of this type of capital. Such investment is the produced means for further production. As a rule, it relies on the use of natural resources which are transformed by human efforts and abilities into products. A very important aspect of it is that it involves the transformation of natural resources and to a significant extent, this transformation process is irreversible. Thus, as capital accumulation and economic growth occur, the available stock of natural resources tends to be reduced and consequently, they become scarcer.

While in the early stages of civilisation, mankind benefited from this transformation, caution is required in continuing this process because natural resources have become scarcer. Their availability contributes to human welfare and production. If they become quite scarce, human welfare and the level of economic production are likely to suffer.



At least up to the present, the accumulation of man-made capital and the reduction in natural resource stocks appears to have added to the welfare of mankind. However, if this transformation process continues, the worry is that the dwindling stocks of natural resources might reduce human welfare and result in the reduced ability to accumulate more man-made capital. The latter can be expected because the natural resources required for conversion to man-made capital become increasingly scarce.

This relationship is indicated in Figure 2. On the left-hand scale, the quantity of available natural resources is shown and on the right-hand scale economic welfare per capita is measured. Assuming that capital accumulation (and economic production) is a continuous process, the availability of natural resources declines with the passage of time and might follow a path like ABC. Starting from early civilisations, the economic welfare of human beings tends to increase initially and appears to have done so until now. But is this process sustainable? Is it possible that human welfare will be reduced in the future as a result of this economic transformation or conversion process? For example, the welfare relationship shown by curve DEFG in Figure 2 might apply. From early times until now ( $t_n$ ), economic welfare has tended to increase as a result of the accumulation of man-made capital. However, at some time, in the future (for example,  $t_f$ ), the process may no longer be capable of raising human welfare, and economic welfare might start to decline.

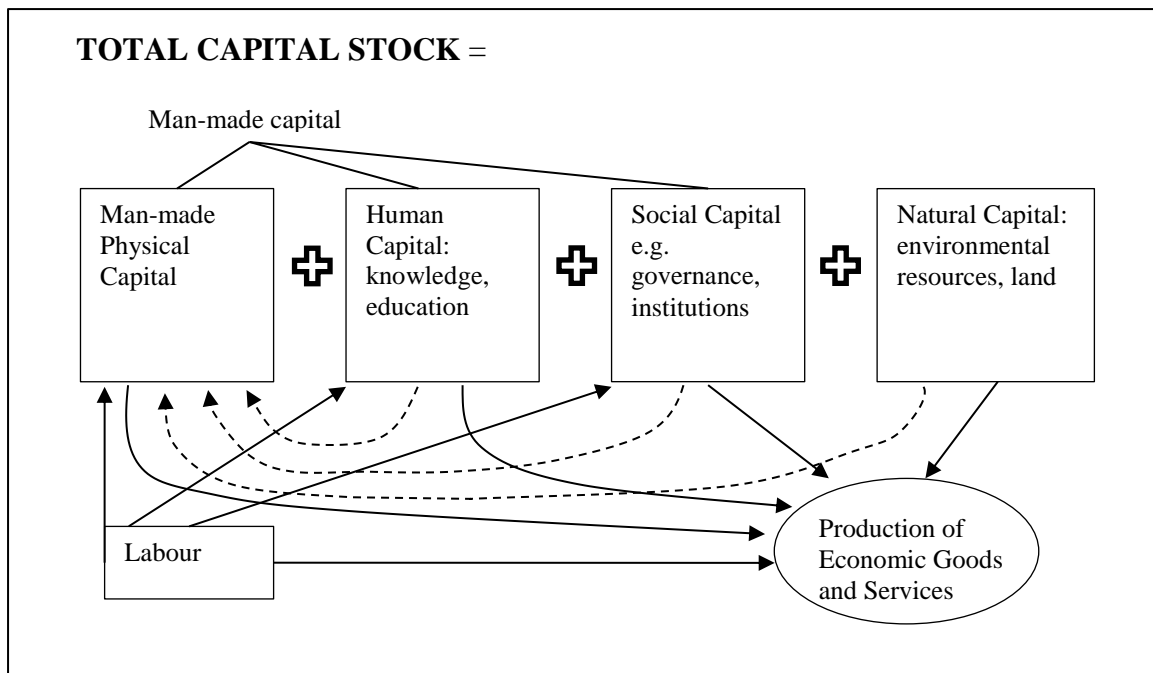


**Fig. 2 Depletion of natural resources as a result of the accumulation of man-made capital and associated economic production may eventually make it impossible to sustain human welfare.**

## 5. Different Types of Capital Contribute to Economic Production

Figure 3 provides an overview of different types of capital which together with labour make an important contribution to economic production. Three types of man-made capital are identified.

- (1) Man-made physical capital. This is mainly what I had in mind in discussing the transformation of natural capital into man-made capital.
- (2) Human capital. It incorporates measures of the knowledge, education and the health of a population.
- (3) Social capital. This includes investments in governance and institutions that help societies to function well.



**Fig. 3 Different types of capital which together with labour contribute to economic production.**

Although the classification of the stock of capital shown in Figure 3 is usual in the current literature, it is not exhaustive because it does not include heritage-type capital. I have argued elsewhere (Tisdell, 2012a) that some components of biodiversity are heritage rather than natural capital. In this particular case, these valuable assets have been developed as a result of human intervention with nature. They are not natural in the sense that their existence required human interference with natural processes. They would (in all probability) not have existed in the absence of this intervention.

Natural capital consists of all natural and environmental resources and is drawn on in producing man-made capital, especially man-made physical capital. Labour is required for the production of man-made capital and to produce economic goods and services. An appropriate balance between all these forms of capital is needed if economic production is to be sustained. Neoclassical growth economists did not pay enough attention to the importance of sustaining natural capital in order to maintain economic production.

Some countries rely very heavily on the economic exploitation of their natural capital to achieve growth in their GDP. This is particularly so of some oil rich states. However, in the

very long run, this type of dependence is not sustainable. This is because these states are depending on the use of depletable and non-renewable natural resources for their economic growth. These countries need to develop more sustainable industries to ensure that their incomes are maintained.

Countries that rely on natural renewable resources face the same issue if they exploit these at a faster rate than their natural rate of renewal. Such resources can include forests and fisheries.

Some countries appear to have been very successful in utilising their natural resources to develop a more sustainable economy. Sweden seems to be a case in point. It used its iron ore sales and timber sales to add to its human and social capital and it practices sustainable forestry. It is not clear that all oil rich Middle Eastern countries will be able to achieve a similar outcome.

It should be noted that growth in Gross Domestic Product (GDP) is not a reliable indicator of increases in the level of economic welfare nor of its sustainability. Among other things, such growth may be based on unsustainable resource use. For example, if the economic growth of a country is highly dependant on the extraction and sale of non-renewable resources or if it relies heavily on the use of renewable resources but exploits these at a faster rate than their rate of renewal, the stocks of these resources will decline and could result in falling GDP in the future, unless alternative sources of income are found.

## **6. Reasons Why Some Economic Activities Result in the Value of Economic Production not Being Maintained**

Various types of phenomena can cause the value of economic production to be lower than it could be given the resources used in the production process. In some cases, these factors can actually cause a decline in the value of economic production after a period of time. In the Western economic literature, these problematic phenomena are often said to be due to market failures. However, they are not confined to market economies and basically arise when some groups in society follow their own self-interest, ignoring the consequences of their behaviour for others. Unfortunately, such selfishness is quite common.

In this context, we shall consider how the following factors can become a problem for sustaining economic growth and maximising economic welfare. These are:

- (1) Unfavourable externalities, particularly unfavourable environmental spillovers from economic activities.
- (2) Open access to common property and failure to take adequate account of the user costs of resources.
- (3) The presence of pure public goods or public bads. This presence results in a fundamental conflict between personal self-interest and social self-interest.

Let us briefly consider each of these factors in turn.

## **7. Environmental Externalities or Spillovers**

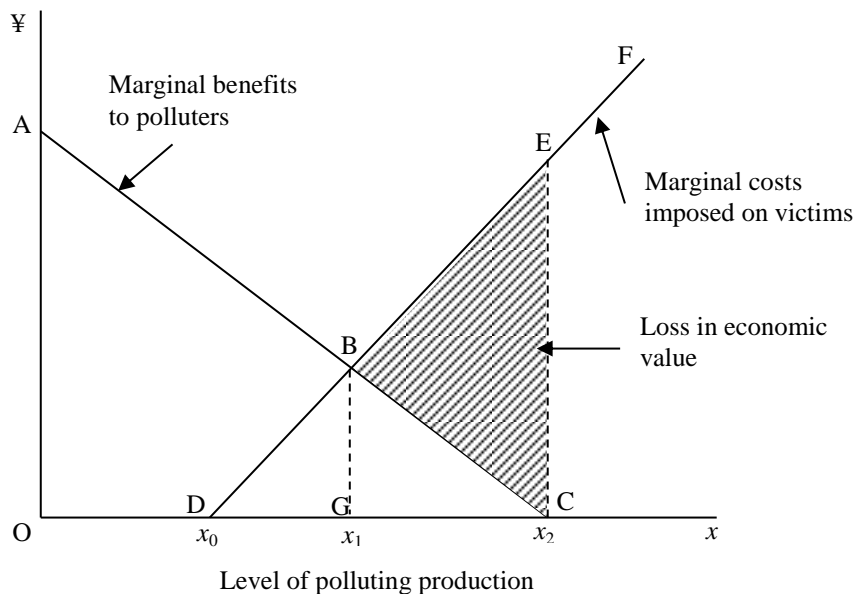
In Tisdell (2012b), I gave an example of an unfavourable environmental externality or spillover. In that case the run-off of nutrient-enriched water from the land into marine areas had a detrimental effect on fisheries production and some negative consequences for the recreational value of marine areas.

Environmental externalities from an economic activity may be favourable (positive) or unfavourable (negative). Those who engage in an economic activity that has favourable externalities confer an economic benefit on others for which they receive no economic payment or rewards. In most cases, they have no incentive to maximise the social economic benefit from their activity and it is under supplied from a social economic point of view.

By contrast, an unfavourable spillover occurs when an economic activity engaged in by one set of persons imposes a cost on others who are forced to bear this cost without payment from those causing the spillover. Hence, those responsible for these negative spillover costs do not take these into account in their decisions. Consequently, the level of their economic activity is usually greater than is socially desirable.

This can be illustrated by Figure 4. Assume that there are two groups in society, namely polluters and the victims of polluters. Line ABC indicates the marginal (added) economic

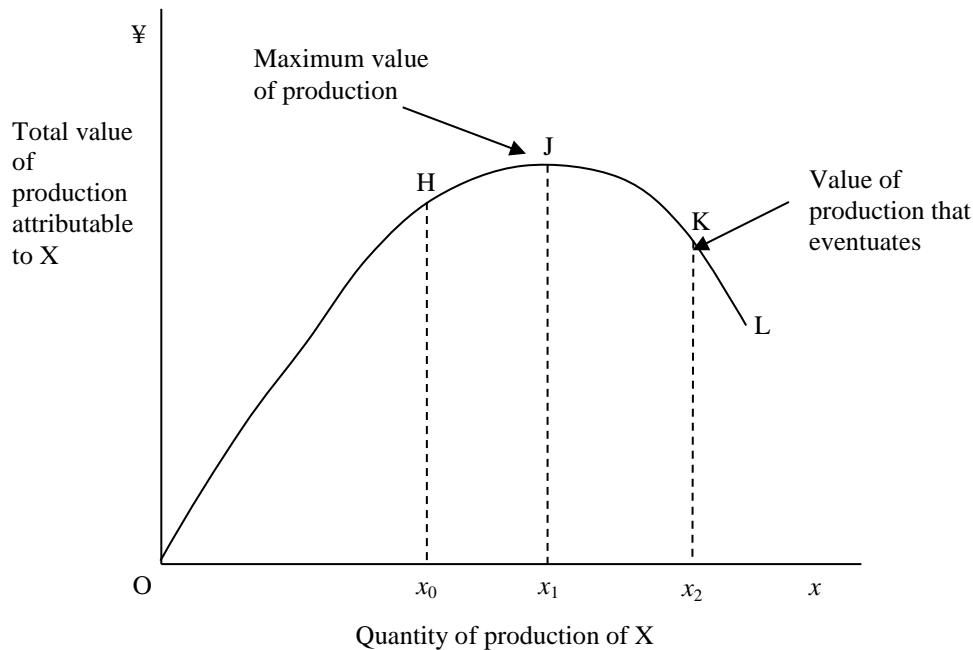
benefit that polluters obtain from being able to engage in the production of a product X which causes pollution. The amount of pollution rises as the quantity of X,  $x$ , increases. The marginal spillover costs imposed on those who are damaged by the pollution is shown by relationship ODBF. Until the level of production of X reaches  $x_0$ , there are no spillover costs but after that, they rise at an increasing rate. Polluters have an economic incentive to increase their activity to level  $x_2$  because they obtain increased economic benefits by expanding their production to this level. However, once they begin to produce more than  $x_1$  of  $x$ , the total value of economic production falls because the extra costs imposed on victims exceed the extra economic benefits obtained by polluters. If production by polluters expands from  $x_1$  to  $x_2$ , the total reduction in the value of economic production is equal to the area of the hatched triangle BCE.



**Fig. 4** An illustration that unfavourable environmental spillovers may reduce the economic value of production and result in a decline in the value of production.

It may be easier to grasp this problem by reference to Figure 5. There, curve OHJKL represents the total value of economic production associated with the production of X when its adverse externalities are taken into account. Point J corresponds to the value  $x_1$  in Figure 4

and point K corresponds to  $x_2$  in Figure 4. Clearly, the value of production is reduced if  $x_2$  of X is produced. This problem can also be illustrated using the differential calculus.



**Fig. 5** A figure corresponding to Fig. 4 to illustrate that a negative economic spillover usually reduces the value of economic production to a level lower than that which is achievable.

It is estimated that China’s GDP is reduced each year by 4.5 to 18% by environmental damage according to the China Statistics Bureau (2010) as reported by Luo *et al.* (2012). Luo *et al.* (2012) report that in China “water pollution alone is estimated to cost between 0.6 and 4.5% of GDP, with estimates averaging around 1.7% and the cost of air pollution is similar (China Statistics Bureau, 2010)”. Therefore, the reported economic costs of pollution in China are considerable.

An interesting example of a positive environmental externality involves the planting of trees on heavily sloping land. China’s Department of Forestry subsidises the planting of trees by farmers on such land via its ‘Grain for Green’ Programme. It provides grain and cash to farmers who participate in the programme which also helps to relieve poverty. Some positive environmental spillovers from the programme include less erosion of hilly areas, less

sediment in streams and rivers with reduced sedimentation of dams, and some reduction in the likelihood of flooding because forest cover tends to reduce the rate of run-off of rain water.

## **8. Open-access or Common Pool Resources**

When access to natural resources is open or relatively open, they tend to be used unsustainably if their use is profitable or if they yield a net benefit to their users. Consider the following examples:

- (1) Underground water supplies. If several users are able to access the same underground water and if its use results in a net economic benefit, they increase their use of this water. If it is being used for irrigation, the value of economic production rises. However, eventually the rate of use is liable to exceed the rate of replenishment of the water and production declines. This has become an important problem in China.
- (2) Open-access to fishing grounds results in greater effort to catch fish than is economic. At first with increased effort, yields are likely to rise but eventually yields fall below maximum sustainable yields and exceed maximum (sustainable) economic yields.
- (3) Open-access (unregulated access) to grazing lands can result in similar problems.

An additional problem that arises in the case of open-access resources is that each user takes no account of the consequences of their actions today for the supply of the resource tomorrow. They fail to take into account **user costs**.

Once users are allowed to use open-access resources to excess, it is very difficult for governments to impose policies to reduce their use of these resources because the incomes of their users may be low. Asking them to reduce their use will initially depress their already low incomes and is likely to result in political protest. For example, in the recent past, the Thai Government tried to increase the size of the mesh on fishing nets in coastal waters. Fishers protested by various actions, such as keeping their children away from school. The Thai Government could not proceed with the regulation.



Ostrom (1990) has pointed out that social or collective rules in some communities help to offset or avoid the negative consequences of open-access. However, as socio-economic conditions change and new technologies become available, such rules can become weakened or inappropriate because of altered circumstances (Tisdell, 2005, Ch. 6).

## **9. Problems Arising in the Case of Pure Public Goods and Bads**

Public goods are goods that valued by all and which if supplied are available to all without individuals paying for them. Public bads affect all and no one can be excluded from their adverse consequences. For example, nearly everyone in China may enjoy knowing that many types of wild animals in China continue to exist. Their existence is a public good. However, climate change might be regarded by all Chinese as a public bad.

In the absence of government action, public goods are either not supplied at all or are under supplied when individuals or groups act according to their own individual self-interest. Public bads are insufficiently controlled or may not be controlled at all in the absence of government action.

This can be illustrated for public bads by using a simple matrix (see Table 1) of the type commonly used in the theory of games. Suppose that the members of a society can be divided into two groups, Group I and Group II. Each group has the choice of two alternative actions or strategies: (1) to engage in positive social behaviour or (2) to engage in anti-social behaviour. If both groups engage in positive social behaviour (e.g. do not litter, do not steal) each has a benefit of 10 units. On the other hand, if Group I adopts positive social behaviour and Group II opts for negative social behaviour, Group I gains a benefit equivalent to 4 units and Group II obtains 12 units. The outcome is reversed if Group I adopts anti-social behaviour and Group II adopts positive social behaviour. Whatever the other group does, the second group always gains more by adopting anti-social behaviour. But if each group follows its own self-interest in this way, each group only has a benefit of 3. Consequently, collective or social benefit is not maximised in situations like this if groups or individuals follow their own self-interest. In order to bring about the best social outcome, governments need to penalise those who adopt anti-social environmental behaviours.

**Table 1 A matrix to illustrate a case of conflict between self-interest and collective interest.**

		Strategies of Group II	
		$\beta_1$ Positive Social Behaviour	$\beta_2$ Anti-social Behaviour
Strategies of Group I	$\alpha_1$ , Positive Social Behaviour	(10,10) <sup>†</sup>	(4,12)
	$\alpha_2$ , Negative Social Behaviour	(12,4)	(3,3) <sup>*</sup>

† Optimal social outcome

\* Equilibrium outcome if all follow their own self-interest

While the pursuit of self-interest does not always result in a negative social outcome, it does in situations like the above, which in the literature has been described as involving a prisoners' dilemma problem. In cases, like this, adequate social capital (e.g. governance, law and order) is needed to ensure a socially desirable outcome and sustain the value of economic production. While this can usually be achieved at the national level, it is more difficult to achieve at the international level because each nation guards its own sovereignty and its ability to act in its own self-interest. Consequently, many international environmental problems (such as global warming) are difficult to solve collectively.

### **10. It is Undesirable to Sustain Everything, Including All Existing Industries**

Some writers seem to suggest that sustainability is always desirable. However, this is clearly not so. Value judgements have to be made about what it is desirable to sustain and what it is undesirable to sustain. Most would agree that it is undesirable to sustain germs that cause diseases in humans, for example, smallpox. It is undesirable to maintain poverty and the abuse of children and so on.

Furthermore, it is undesirable to sustain all industries. Depending upon technological progress and changes in demand, industries rise and fall. Social choices therefore, may be necessary about which industries to sustain and which should be allowed to be replaced by others.

### **11. Multiple Objectives for the Sustainability of Economic Activities**

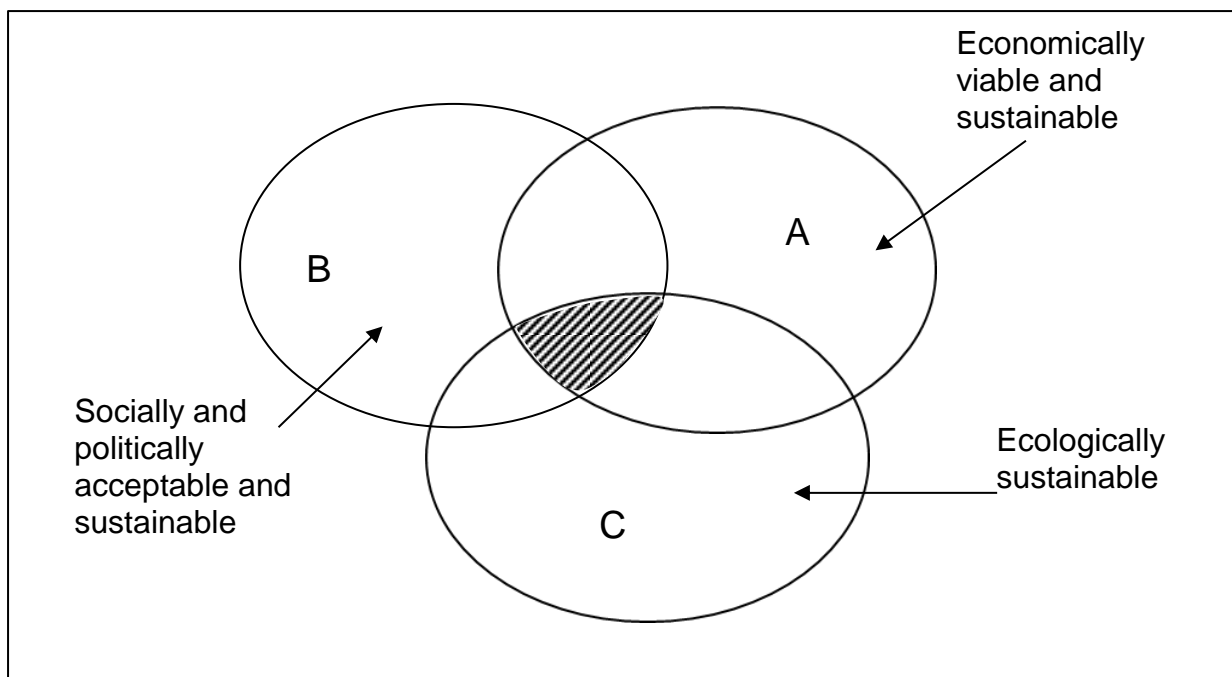
Several authors have suggested that multiple objectives have to be met if economic activities are to be sustainable. A common set of such objectives is

- (1) Economic viability
- (2) Social and political acceptability
- (3) Ecological sustainability

For example, growing millet in parts of Africa (and even China) might be ecologically more sustainable than growing corn (maize). However, consumers may prefer maize to millet and the growing of millet may not be economically viable. Only some of these objectives are met by growing millet.

While this approach brings attention to important issues, a problem is that none of the available alternative economic activities might be economically and ecologically viable forever and there may be differences of opinion about their social and political acceptability. The real world is very complex.

To be more specific, let A represent the set of strategies that are economically viable and sustainable, the set B delineate the set of strategies that are socially and politically acceptable and let C indicate the set of strategies that are ecologically sustainable. It could be that one or more of these sets are empty. Consequently, it is impossible to achieve the prescribed objective. Or one or more of these sets might be disjoint in which case the objective cannot be met. The situation illustrated in Figure 6 where all these sets overlap to some extent might be rare. Those strategies in the hatched area satisfy all the objectives.



**Fig. 6** It may be difficult or impossible to find strategies that satisfy multiple sustainability objectives. Pursuing this approach can be unworkable because of the absence of solutions.

## 12. Concluding Comments

In this paper I have explored broad views about what sustainable economic development is and different views about what is needed to achieve it. This enabled us to consider the types of resources which make an important contribution to economic production and its sustainability, for example, the role of man-made capital (physical, human and social) and natural capital in this process. The problem for sustainable development of the conversion of natural capital into man-made capital was given particular attention. In the second part of this article the effects which environmental spillovers or externalities can have on the level of production and its sustainability were covered. In addition, open-access to natural resources and the presence of public goods and bads were shown to potentially have negative effects on the sustainability of the value of economic activity.

It was also pointed out that it is not desirable to sustain everything. Furthermore, multiple objectives may need to be satisfied to ensure the sustainability of economic activity. It may however, be impossible to satisfy all of these objectives fully and none may be satisfied forever. Therefore, compromises seem to be unavoidable.

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