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CHAPTER 4

Sustainable development

Definitions

Many definitions of sustainable development (SD) (often incompatible with each other) have been suggested and debated in the literature. What this suggests is that the debate has exposed a range of approaches which differ because they are linked to alternative environmental ideologies (see Box 2.1). From the ecocentric perspective, the extreme deep ecologists seem to come close to rejecting even a policy of 'modified' development based on the sustainable use of nature's assets. For them only a minimalist development strategy is morally supportable. From the opposite technocentric perspective, other analysts argue that the concept of sustainability contributes little new to conventional economic theory and policy. Given this worldview, the maintenance of a sustainable economic growth strategy over the long run merely depends on the adequacy of investment expenditure. Investment in natural capital is not irrelevant but it is not of overriding importance either. A key assumption of this position is that there will continue to be a *very high degree of substitutability between all forms of capital* (physical, human and natural capital). The classification scheme set out in Box 2.1 labelled these two positions as *very weak sustainability* and *very strong sustainability* respectively.

The most publicized definition of sustainability is that of the World Commission on Environment and Development (WCED) (the 'Brundtland Commission', 1987). The Commission defined SD as: 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 43).

On the basis of this SD definition both *intergenerational equity* and *intragenerational equity* concerns must be met before any society can attain the goal of sustainability. Social and economic development must be undertaken in such a way as to minimize the effects of economic activity (on resource sources and waste assimilation sinks – see Chapter 1) whenever the costs are borne by future generations. When currently vital activities impose costs on

the future (e.g. mining of non-renewable minerals – see Chapter 16) *full compensation* must be paid (e.g. performance or assurance bonds yielding financial aid, or new technologies allowing resource switching say from fossil fuels to solar power, etc. – see Chapter 11).

The Commission also highlighted 'the essential needs of the world's poor, to which overriding priority should be given'. In other words, SD must allow for an increase in people's standard of living (broadly defined) with particular emphasis on the wellbeing of poor people, while at the same time avoiding uncompensated and significant costs on future people.

The Commission also took a fairly optimistic view of the possibilities for decoupling economic activity and environmental impact (see Chapter 3) and in terms of our classification system has put itself into the *weak sustainability* camp. Recall that the *strong sustainability* supporters, while not dismissing decoupling, argue that modifications to the scale of the economy (the throughput of matter and energy) will also be required. The amount of scale reduction is debated within the strong sustainability camp (which is a fairly 'broad church').

SD, it is generally agreed, is therefore economic development that endures over the long run. Economic development can be measured in terms of Gross National Product (i.e. the annual output of goods and services adjusted for exports and imports) per capita, or real consumption of goods and services per capita. In a later section we will argue that, in fact, the traditional GNP measure needs to be modified and extended if it is to measure SD. But for the moment SD is defined as at least non-declining consumption, GNP, or some other agreed welfare indicator.

The conditions for sustainable development

A more difficult task is to determine the necessary and sufficient conditions for achieving SD. Fundamentally, how do we compensate the future for damage that our activities today might cause? The answer is through the transfer of **capital bequests**. What this means is that this generation makes sure that it leaves the next generation a stock of capital no less than this generation has now. Capital provides the capability to generate wellbeing ('justice as opportunity' and the 'Lockean Standard' notions are relevant in this context – see Chapter 2) through the creation of goods and services upon which human wellbeing depends.

Weak sustainability (WS)

Under this interpretation of SD, it is not thought necessary to single out the environment (natural capital) for special treatment, it is simply another form

of capital. Therefore, what is required for SD is the transfer of an *aggregate capital stock* no less than the one that exists now (this then is the **weak sustainability constant capital rule**). We can pass on less environment so long as we offset this loss by increasing the stock of roads and machinery, or other man-made (physical) capital. Alternatively, we can have fewer roads and factories so long as we compensate by having more wetlands or mixed woodlands or more education. WS is, as we pointed out in Chapter 2, based on a very strong assumption, **perfect substitutability** between the different forms of capital.

Strong sustainability (SS)

Under this interpretation of SD, perfect substitution between different forms of capital is not a valid assumption to make. Some elements of the natural capital stock cannot be substituted for (except on a very limited basis) by man-made capital. Some of the functions and services of ecosystems are essential to human survival, they are life support services (biogeochemical cycling) and cannot be replaced. Other ecological assets are at least essential to human wellbeing, if not exactly essential for human survival – landscape, space, and relative peace and quiet. These assets are **critical natural capital** and since they are not easily substitutable, if at all, the SS rule requires that we protect them.

Measuring sustainable development

Another way of looking at the idea that SD means generating human wellbeing now without impairing the wellbeing of future generations is to think about a *sustainable flow of income*. This is a level of income that the nation can afford to receive without depreciating the overall capital stock of the nation. The danger is that a failure to adequately account for natural capital and the contribution it makes to economic welfare and income will lead to misperceptions about how well an economy is really performing. This danger is real because the current system of national accounts used in many countries fails, in almost all cases, to treat natural capital as assets which play a vital part in providing a flow of output/income over time. Extended national accounts (i.e. not restricted to market-based outputs, incomes and expenditure, as measured in the Gross National Product concept) are required in order to improve policy signals relating to SD.

Two adjustments are required, one for the depreciation of natural capital (changes in quantity) and the other for degradation of the natural capital stock (changes in quality). A framework to reflect the use of natural resources at the national level is in the process of being agreed by the United Nations

Statistical Office. However, the theory and practice of making these adjustments is complex and they are not discussed further here (we provide some suggested reading at the end of the chapter). Instead we present a simple test for SD which yields data which is at least indicative of national sustainability. The test is, however, far from a definitive sustainability indicator, but it is based on modified national accounting information.

Simple indicator of sustainable development

One SD rule states that an economy must save at least as much as the sum of the depreciation on the value of man-made and natural capital (Pearce and Atkinson, 1992). An analogy with a business is useful in this context. If our business consistently failed to save enough money to plough back into the business, to replace machinery and buildings as they wear out (depreciate), we might stay afloat for a while but not long term – our business would be unsustainable. The same is true for any economy, its national savings ratio (savings over some measure of income like Gross Domestic Product (GDP)) must be greater than or equal to depreciation in the natural capital and man-made capital stock, if it is to pass our simple sustainability test. Box 4.1 illustrates some sustainability indicators for a selection of countries. Nothing definitive is being claimed since the data available is not always comprehensive and the test itself is 'static' and ignores factors such as technological change, population growth and international trade.

Precautionary principle and safe minimum standards

For some analysts supportive of the strong sustainability position, sustainability constraints (such as the critical natural capital protection rule) should be seen as expressions of the so-called **precautionary principle** and one similar to the notion of **safe minimum standard** (SMS). The SMS concept is one way of giving shape to the intergenerational social contract idea we discussed in Chapter 2. Somehow we have to trade off using resources to produce economic benefits and conservation of resource stocks and flows to guarantee sustainable benefit flows. The trade-off decisions have to be taken within a context of *uncertainty* and possible **irreversibilities** (i.e. decisions once taken result in changes that are physically impossible to reverse or prohibitively expensive to reverse, e.g. loss of tropical forests and complex wetlands). To satisfy the *intergenerational social contract* (via the constant capital rule and capital bequests), the current generation could rule out in advance, depending on the costs (strictly known as the social opportunity costs, i.e. what society has to give up or forgo), development activities that could result in natural capital depreciation beyond a certain threshold of damage cost and

Box 4.1 Test for weak sustainable development

An economy is sustainable if it saves more than the depreciation on its human-made and natural capital.

Country	Gross savings ratio (S/Y)	Depreciation of human-made capital (d_M/Y)	Depreciation of natural capital (d_N/Y)	Sustainability indicator (Z)
Finland	28	15	2	+11
Germany	26	12	4	+10
Japan	33	14	2	+17
UK	18	12	6?	0?
USA	18	12	4	+2

Notes and sources:
Y denotes that the values are expressed as a percentage of GDP.
S/Y is taken from World Bank, *World Development Reports* –
d_M/Y is taken from the UN *System of National Accounts* (UNSO, 1990).
The test takes the form,

$$Z >= S/Y - d_M/Y - d_N/Y$$

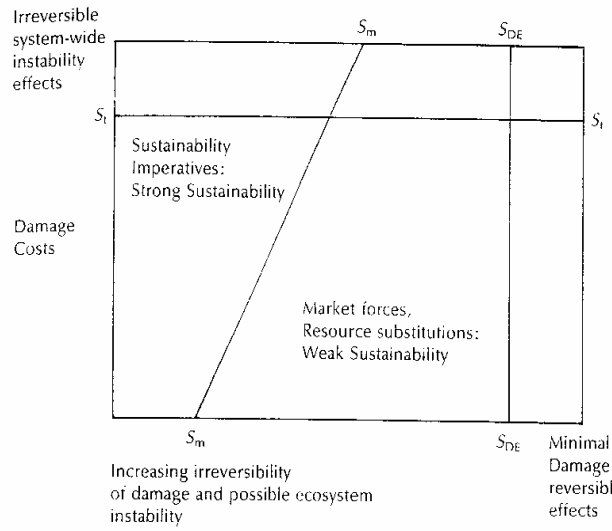
Z must be greater than or equal to zero for sustainability.

irreversibility (i.e. loss of critical natural capital, life support services, keystone species and processes) – see Box 4.2. The compatibility between SMS and strong sustainability is not, however, quite complete. SMS says conserve unless the benefits forgone are very large. SS says that, whatever the benefits forgone, loss of critical natural capital is unacceptable.

Sustainable livelihoods

Any sustainable strategy for the future will have to confront the question of how a much larger total global population can gain at least a basic livelihood in a manner which can be sustained. For the people of the South, many of their livelihoods will have to endure in environments which are fragile, marginal and vulnerable. Sustainable livelihoods can only be promoted via policies which reduce vulnerability – e.g. flood protection to guard against sea-level rise induced by climate change due to global warming (see Chapter 19); measures to improve food security and to offset market and intervention failures such as inappropriate resource pricing and uncoordinated development policies (see Chapters 5, 6 and 23).

Box 4.2 Safe minimum standards approach to sustainability



The line S_m–S_m represents some hypothetical safe minimum standard trade-off decision. Supporters of the weak sustainability (technocentric) position(s) might favour a line such as S_t–S_t; while very strong sustainability advocates, such as the deep ecologists, might favour a line such as S_{DE}–S_{DE}.

Source: Adapted from B. Norton, Georgia Institute of Technology, quoted in Toman (1992).

Sustainable development: operational principles

A number of rules (which fall some way short of a blueprint) for the sustainable utilization of the natural capital stock can now be outlined (roughly ordered to fit the VWS to VSS progression):

1. Market and intervention failures related to resource pricing and property rights should be corrected.
2. Maintenance of the regenerative capacity of renewable natural capital (RNC) – i.e. harvesting rates should not exceed regeneration rates – and avoidance of excessive pollution which could threaten waste assimilation capacities and life support systems.
3. Technological changes should be steered via an indicative planning system such that, switches from non-renewable (NRNC) to RNC are fostered; and

Box 4.3 Sustainability practice

Sustainability mode (overlapping categories)	Management strategy (as applied to projects, policy or course of action)	Policy instruments (most favoured)		
		Pollution Control and Waste Management	Raw Materials Policy	Conservation and Amenity Management
VWS	Conventional Cost–Benefit Approach: Correction of market and intervention failures via efficiency pricing; potential Pareto criterion (hypothetical compensation); consumer sovereignty; infinite substitution	e.g. pollution taxes, elimination of subsidies, imposition of property rights		
WS	Modified Cost–Benefit Approach: Extended application of monetary valuation methods; actual compensation, shadow projects, etc.; systems approach, 'weak' version of safe minimum standard	e.g. pollution taxes, permits, deposit-refunds; ambient targets		
SS	Fixed Standards Approach: Precautionary principle, primary and secondary value of natural capital; constant natural capital rule; dual self-conception, social preference value; 'strong' version of safe minimum standard	e.g. ambient standards; conservation zoning; process technology-based effluent standards; permits; severance taxes; assurance bonds		
VSS	Abandonment of Cost–Benefit Analysis: or severely constrained cost-effectiveness analysis; bioethics	standards and regulation; birth licences		

Source: R. K. Turner (1993)

efficiency-increasing technical progress should dominate throughput-increasing technology.

4. RNC should be exploited, but at a rate equal to the creation of RNC substitutes (including recycling).
5. The overall scale of economic activity must be limited so that it remains within the carrying capacity of the remaining natural capital. Given the uncertainties present, a precautionary approach should be adopted with a built-in safety margin.

Box 4.3 summarizes some of the measures and enabling policy instruments that would be involved in any application of an SD strategy. Succeeding chapters in this book cover these various elements in greater detail.

Conclusions

Although it has been defined in many different, and sometimes contradictory, ways the concept of sustainable development does have both relevance and meaning. Weak and strong versions of the concept can be distinguished, and a rudimentary measure of sustainability can be calibrated. How precisely sustainability principles can be translated into operational practice remains more uncertain. But the framework for general sustainability rules has been set out and will require adaptation to specific economic and environmental circumstances.

Further reading

The basic idea of sustainable development and the constant capital rule are covered in:

D. W. Pearce, A. Markandya and E. B. Barbier, *Blueprint for a Green Economy*, Earthscan, London, 1989

and in the context of developing countries by

D. W. Pearce, E. B. Barbier and A. Markandya, *Sustainable Development: Economics and Environment in the Third World*, Earthscan, London, 1990.

The strong sustainability position is set out in:

R. Costanza and H. Daly, 'Natural capital and sustainable development', *Conservation Biology* 6: 37–46, 1992.

Modified national income accounting is discussed in:

P. Bartelmus *et al.*, 'Integrated environmental and economic accounting: framework for a SNA satellite system', *Review of Income and Wealth* 37: 111–48, 1991.

C. Bryant and P. Cook, 'Environmental issues and the national accounts', *Income Trends*, No. 469: 99–122, HMSO, London, 1992.

H. Daly and J. Cobb, *For the Common Good*, Greenprint, London, 1990.

On the safe minimum standard see:

R. C. Bishop, 'Economics of endangered species', *American Journal of Agricultural Economics* **60**: 10–18, 1978.

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D. W. Pearce and G. Atkinson, 'Are National Economies Sustainable? Measuring Sustainable Development', CSERGE GEC Working Paper 92–11, University College London and University of East Anglia, 1992.

M. A. Toman, 'The difficulty of defining sustainability', *Resources* **106**: 3–6, 1992.

R. K. Turner (ed.) *Sustainable Environmental Economics and Management: Principles and Practice*, Belhaven, London, 1993, Chapter 1.

World Commission on Environment and Development, *Our Common Future*, Oxford University Press, Oxford, 1987.