1
Introduction and principles

1.1 Introduction

Over the last three decades there has been a remarkable growth of interest in environmental issues—in sustainability and the better management of development in harmony with the environment. Associated with this growth of interest has been the introduction of new legislation, emanating from national and international sources, such as the European Commission, that seeks to influence the relationship between development and the environment. Environmental impact assessment (EIA) is an important example. EIA legislation was introduced in the USA over 35 years ago. A European Community (EC) directive in 1985 accelerated its application in EU Member States and, since its introduction in the UK in 1988, it has been a major growth area for planning practice. The originally anticipated 20 environmental impact statements (EIS) per year in the UK have escalated to over 600, and this is only the tip of the iceberg. The scope of EIA continues to widen and grow.

It is therefore perhaps surprising that the introduction of EIA met with strong resistance from many quarters, particularly in the UK. Planners argued, with partial justification, that they were already making such assessments. Many developers saw it as yet another costly and time-consuming constraint on development, and central government was also unenthusiastic. Interestingly, initial UK legislation referred to environmental assessment (EA), leaving out the apparently politically sensitive, negative-sounding reference to impacts. The scope of the subject continues to evolve. This chapter therefore introduces EIA as a process, the purposes of this process, types of development, environment and impacts and current issues in EIA.

1.2 The nature of environmental impact assessment

1.2.1 Definitions

Definitions of EIA abound. They range from the oft-quoted and broad definition of Munn (1979), which refers to the need "to identify and predict the impact on the environment and on man's health and well-being of legislative proposals, policies, programmes, projects and operational procedures, and to interpret and communicate information about the impacts", to the narrow UK DoE (1989) operational definition: "The term 'environmental assessment' describes a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their

judgements on whether the development should go ahead." The UNECE (1991) has an altogether more succinct and pithy definition: "an assessment of the impact of a planned activity on the environment".

1.2.2 Environmental impact assessment: a process

In essence, EIA is *a process,* a systematic process that examines the environmental consequences of development actions, in advance. The emphasis, compared with many other mechanisms for environmental protection, is on prevention. Of course, planners have traditionally assessed the impacts of developments on the environment, but invariably not in the systematic, holistic and multidisciplinary way required by EIA. The process involves a number of steps, as outlined in Figure 1.1.

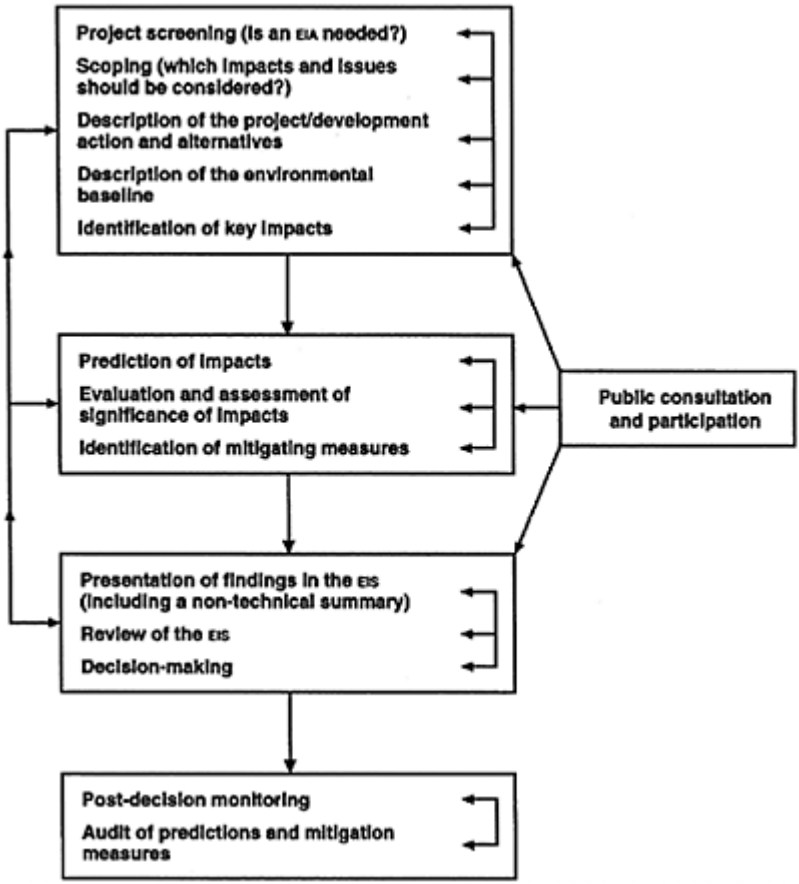

Figure 1.1 Important steps in the EIA process.

Note: EIA should be a cyclical process with considerable interaction between the various steps. For example, public participation can be useful at most stages of the process; monitoring systems should relate to parameters established in the initial project and baseline descriptions.

These are briefly described below, pending a much fuller discussion in Chapters 4–7. It should be noted at this stage that, although the steps are outlined in a linear fashion, EIA should be a cyclical activity, with feedback and interaction between the various steps. It should also be noted that practice can and does vary considerably from the process illustrated in Figure 1.1. For example, until recently UK EIA legislation did not require some of the steps, including the consideration of alternatives, and still does not require post-decision monitoring (DETR 2000). The order of the steps in the process may also vary.

- *Project screening* narrows the application of EIA to those projects that may have significant environmental impacts. Screening may be partly determined by the EIA regulations operating in a country at the time of assessment.
- *Scoping* seeks to identify at an early stage, from all of a project's possible impacts and from all the alternatives that could be addressed, those that are the crucial, significant issues.
- *The consideration of alternatives* seeks to ensure that the proponent has considered other feasible approaches, including alternative project locations, scales, processes, layouts, operating conditions and the "no action" option.
- *The description of the project/development action* includes a clarification of the purpose and rationale of the project, and an understanding of its various characteristics—including stages of development, location and processes.
- *The description of the environmental baseline* includes the establishment of both the present and future state of the environment, in the absence of the project, taking into account changes resulting from natural events and from other human activities.
- *The identification of the main impacts* brings together the previous steps with the aim of ensuring that all potentially significant environmental impacts (adverse and beneficial) are identified and taken into account in the process.
- *The prediction of impacts* aims to identify the magnitude and other dimensions of identified change in the environment with a project/action, by comparison with the situation without that project/action.
- *The evaluation and assessment of significance* assesses the relative significance of the predicted impacts to allow a focus on the main adverse impacts.
- *Mitigation* involves the introduction of measures to avoid, reduce, remedy or compensate for any significant adverse impacts.

- *Public consultation and participation* aim to ensure the quality, comprehensiveness and effectiveness of the EIA, and that the public's views are adequately taken into consideration in the decision-making process.
- *EIS presentation* is a vital step in the process. If done badly, much good work in the EIA may be negated.
- *Review* involves a systematic appraisal of the quality of the EIS, as a contribution to the decision-making process.
- *Decision-making* on the project involves a consideration by the relevant authority of the EIS (including consultation responses) together with other material considerations.
- *Post-decision monitoring* involves the recording of outcomes associated with development impacts, after a decision to proceed. It can contribute to effective project management.
- *Auditing* follows from monitoring. It can involve comparing actual outcomes with predicted outcomes, and can be used to assess the quality of predictions and the effectiveness of mitigation. It provides a vital step in the EIA learning process.

1.2.3 Environmental impact statements: the documentation

The EIS documents the information and estimates of impacts derived from the various steps in the process. Prevention is better than cure; an EIS revealing many significant unavoidable adverse impacts would provide valuable information that could contribute to the abandonment or substantial modification of a proposed development action. Where adverse impacts can be successfully reduced through mitigation measures, there may be a different decision. Table 1.1 provides an example of the content of an EIS for a project.

The *non-technical summary* is an important element in the documentation; EIA can be complex, and the summary can help to improve communication with the various parties involved. Reflecting the potential complexity of the process, a *methods statement,* at the beginning, provides an opportunity to clarify some basic information (e.g. who the developer is, who has produced the EIS, who has been consulted and how, what methods have been used, what difficulties have been encountered and what the limitations of the EIA are). A *summary statement of key issues,* upfront, can also help to improve communications. A more enlightened EIS would also include a monitormg programme, either here or at the end of the document. The *background to the proposed development* covers the early steps in the EIA process, including clear descriptions of a project, and baseline conditions (including relevant planning policies and plans). Within each of the *topic areas* of an EIS there would normally be a discussion of existing conditions, predicted impacts, scope for mitigation and residual impacts.

Environmental impact assessment and EIS practices vary from study to study, from country to country, and best practice is constantly evolving. An early UN study of EIA practice in several countries advocated changes in the process and documentation (UNECE 1991). These included giving a greater emphasis to the socio-economic dimension, to public participation, and to "after the decision" activity, such as monitoring. A recent review of the operation of the amended EC Directive (CEC 2003) raised similar, and other emerging, issues a decade later (see Chapter 2). Sadler (1996) provided a wider agenda for change based on a major international study of the effectiveness of EIA (see Chapter 11).

Table 1.1 An EIS for a project—example or contents

Non-technical summary
Part 1: Methods and key issues
1. Methods statement
2. Summary of key issues; monitoring programme statement
Part 2: Background to the proposed development
3. Preliminary studies: need, planning, alternatives and site selection
4. Site description, baseline conditions
5. Description of proposed development
6. Construction activities and programme
Part 3: Environmental impact assessment—topic areas
7. Land use, landscape and visual quality
8. Geology, topography and soils
9. Hydrology and water quality
10. Air quality and climate
11. Ecology: terrestrial and aquatic
12. Noise
13. Transport
14. Socio-economic impact
15. Interrelationships between effects

1.2.4 Other relevant definitions

Development actions may have impacts not only on the physical environment but also on the social and economic environment. Typically, employment opportunities, services (e.g. health, education) and community structures, lifestyles and values may be affected. *Socio-economic impact assessment* or *social impact assessment* (SIA) is regarded here as an integral part of EIA. However, in some countries it is (or has been) regarded as a separate process, sometimes parallel to EIA, and the reader should be aware of its existence (Carley & Bustelo 1984, Finsterbusch 1985, IAIA 1994, Vanclay 2003).

Strategic environmental assessment (SEA) expands EIA from projects to policies, plans and programmes (PPPs). Development actions may be for a project (e.g. a nuclear power station), for a programme (e.g. a number of pressurized water reactor (PWR) nuclear power stations), for a plan (e.g. in the town and country planning (T&CP) system in England and Wales, for local plans and structure plans) or for a policy (e.g. the

development of renewable energy). EIA to date has generally been used for individual projects, and that role is the primary focus of this book. But EIA for programmes, plans and policies, otherwise known as SEA, is currently being introduced in the European Union (EU) and beyond (Therivel 2004, Therivel & Partidario 1996, Therivel et al. 1992). SEA informs a higher, earlier, more strategic tier of decision-making. In theory, EIA should be carried out first for policies, then for plans, programmes, and finally for projects.

Risk assessment (RA) is another term sometimes found associated with EIA. Partly in response to events such as the chemicals factory explosion at Flixborough (UK), and nuclear power station accidents at Three Mile Island (USA) and Chernobyl (Ukraine), RA has developed as an approach to the analysis of risks associated with various types of development. The major study of the array of petrochemicals and other industrial developments at Canvey Island in the UK provides an example of this approach (Health and Safety Commission 1978). Calow (1997) gives an overview of the growing area of environmental RA and management and Flyberg (2003) a critique of risk assessment in practice.

Vanclay & Bronstein (1995) and others note several other relevant definitions, based largely on particular foci of specialization and including demographic impact assessment, health impact assessment, climate impact assessment, gender impact assessment, psychological impact assessment and noise impact assessment. Other more encompassing definitions include policy assessment, technology assessment and economic assessment. There is a semantic explosion which requires some clarification. As a contribution to the latter, Sadler (1996) suggests that we should view "EA as the generic process that includes EIA of specific projects, SEA of PPPs, and their relationships to a larger set of impact assessment and planning-related tools".

1.3 The purposes of environmental impact assessment

1.3.1 An aid to decision-making

Environmental impact assessment is a process with several important purposes. It is an aid to decision-making. For the decision-maker, for example a local authority, it provides a systematic examination of the environmental implications of a proposed action, and sometimes alternatives, before a decision is taken. The EIS can be considered by the decision-maker along with other documentation related to the planned activity. EIA is normally wider in scope and less quantitative than other techniques, such as cost-benefit analysis (CBA). It is not a substitute for decision-making, but it does help to clarify some of the trade-offs associated with a proposed development action, which should lead to more rational and structured decision-making. The EIA process has the potential, not always taken up, to be a basis for negotiation between the developer, public interest groups and the planning regulator. This can lead to an outcome that balances the interests of the development action and the environment.

1.3.2 An aid to the formulation of development actions

Many developers no doubt see EIA as another set of hurdles to jump before they can proceed with their various activities; the process can be seen as yet another costly and time-consuming activity in the permission process. However, EIA can be of great benefit to them, since it can provide a framework for considering location and design issues and environmental issues in parallel. It can be an aid to the formulation of development actions, indicating areas where a project can be modified to minimize or eliminate altogether its adverse impacts on the environment. The consideration of environmental impacts early in the planning life of a development can lead to environmentally sensitive development; to improved relations between the developer, the planning authority and the local communities; to a smoother planning permission process; and sometimes, as argued by developers such as British Gas, to a worthwhile financial return on the extra expenditure incurred (Breakell & Glasson 1981). O'Riordan (1990) links such concepts of negotiation and redesign to the important environmental themes of "green consumerism" and "green capitalism". The emergence of a growing demand by consumers for goods that do no environmental damage, plus a growing market for clean technologies, is generating a response from developers. EIA can be the signal to the developer of potential conflict; wise developers may use the process to negotiate "green gain" solutions, which may eliminate or offset negative environmental impacts, reduce local opposition and avoid costly public inquiries.

1.3.3
An instrument for sustainable development

Underlying such immediate purposes is of course the central and ultimate role of EIA as one of the instruments to achieve sustainable development: development that does not cost the Earth! Existing environmentally harmful developments have to be managed as best as they can. In extreme cases, they may be closed down, but they can still leave residual environmental problems for decades to come. How much better it would be to mitigate the harmful effects in advance, at the planning stage, or in some cases avoid the particular development altogether. Prevention is better than cure.

Economic development and social development must be placed in their environmental contexts. Boulding (1966) vividly portrays the dichotomy between the "throughput economy" and the "spaceship economy" (Figure 1.2). The economic goal of increased *gross national product* (GNP), using more inputs to produce more goods and services, contains the seeds of its own destruction. Increased output brings with it not only goods and services but also more waste products. Increased inputs demand more resources. The natural environment is the "sink" for the wastes and the "source" for the resources. Environmental pollution and the depletion of resources are invariably the ancillaries to economic development.

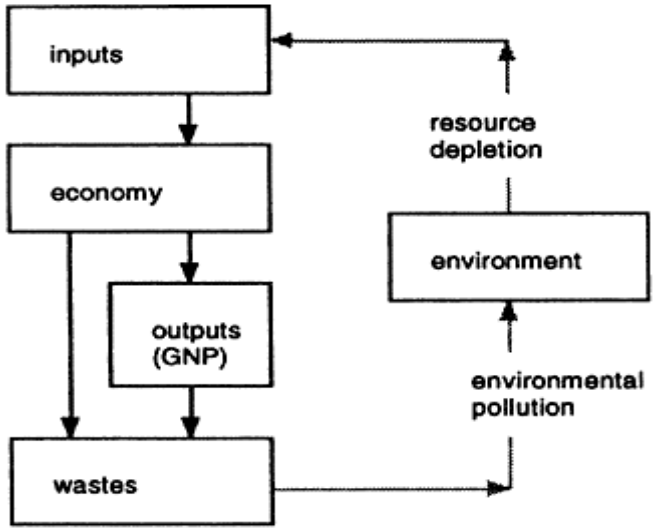

Figure 1.2 The economic development process in its environmental context. (Adapted from Boulding 1966.)

The interaction of economic and social development with the natural environment and the reciprocal impacts between human actions and the biophysical world have been recognized by governments from local to international levels. Attempts have been made to manage the interaction better, but the EC report, *Towards Sustainability* (CEC 1992), revealed disquieting trends that could have devastating consequences for the quality of the environment. Such EU trends included a 25 per cent increase in energy consumption by 2010 if there was no change in current energy demand growth rates; a 25 per cent increase in car ownership and a 17 per cent increase in miles driven by 2000; a 13 per cent increase in municipal waste between 1987 and 1992, despite increased recycling; a 35 per cent increase in the EU's average rate of water withdrawal between 1970 and 1985; and a 60 per cent projected increase in Mediterranean tourism between 1990 and 2000. Such trends are likely to be even more pronounced in developing countries, where, because population growth is greater and current living standards lower, there will be more pressure on environmental resources. The revelation of the state of the environment in many central and eastern European countries, and worldwide, added weight to the urgency of the situation.[1]

The 1987 Report of the UN World Commission on Environment and Development (usually referred to as the Brundtland Report, after its chairwoman) defined sustainable development as "development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (UN World Commission on Environment and Development 1987). Sustainable development means handing down to future generations not only "man-made capital", such as roads, schools and historic buildings, and "human capital", such as knowledge and skills, but also "natural/environmental capital", such as clean air, fresh water, rain forests, the ozone

layer and biological diversity. The Brundtland Report identified the following chief characteristics of sustainable development: it maintains the quality of life, it maintains continuing access to natural resources and it avoids lasting environmental damage. It means living on the Earth's income rather than eroding its capital (DoE et al. 1990). In addition to a concern for the environment and the future, Brundtland also emphasizes participation and equity, thus highlighting both inter- and intra-generational equity.

There is, however, a danger that "sustainable development" may become a weak catch-all phrase; there are already many alternative definitions. Holmberg & Sandbrook (1992) found over 70 definitions of sustainable development. Redclift (1987) saw it as "moral convictions as a substitute for thought"; to O'Riordan (1988) it was "a good idea which cannot sensibly be put into practice". But to Skolimowski (1995), sustainable development

> struck a middle ground between more radical approaches which denounced all development, and the idea of development conceived as business as usual. The idea of sustainable development, although broad, loose and tinged with ambiguity around its edges, turned out to be palatable to everybody. This may have been its greatest virtue. It is radical and yet not offensive.

Readers are referred to Reid (1995) and Kirkby et al. (1995) for an overview of the concept, debate and responses.

Turner & Pearce (1992) and Pearce (1992) have drawn attention to alternative interpretations of maintaining the capital stock. A policy of conserving the whole capital stock (man-made, human and natural) is consistent with running down any part of it as long as there is substitutability between capital degradation in one area and investment in another. This can be interpreted as a "weak sustainability" position. In contrast, a "strong sustainability" position would argue that it is not acceptable to run down environmental assets, for several reasons: uncertainty (we do not know the full consequences for human beings), irreversibility (lost species cannot be replaced), life support (some ecological assets serve life-support functions) and loss aversion (people are highly averse to environmental losses). The "strong sustainability" position has much to commend it, but institutional responses have varied.

Institutional responses to meet the goal of sustainable development are required at several levels. Issues of global concern, such as ozone-layer depletion, climate change, deforestation and biodiversity loss, require global political commitments to action. The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 was an example not only of international concern, but also of the problems of securing concerted action to deal with such issues. Agenda 21, an 800-page action plan for the international community into the twenty-first century, sets out what nations should do to achieve sustainable development. It includes topics such as biodiversity, desertification, deforestation, toxic wastes, sewage, oceans and the atmosphere. For each of 115 programmes, the need for action, the objectives and targets to be achieved, the activities to be undertaken, and the means of implementation are all outlined. Agenda 21 offers policies and programmes to achieve a sustainable balance between consumption, population and the Earth's life-supporting capacity. Unfortunately

it is not legally binding. It relies on national governments, local governments and others to implement most of the programmes. The Rio Conference called for a Sustainable Development Commission to be established to progress the implementation of Agenda 21. The Commission met for the first time in 1993 and reached agreement on a thematic programme of work for 1993–97. This provided the basis for an appraisal of Agenda 21 in preparation for a special session of the UN in 1997. The Johannesburg Earth Summit of 2002 re-emphasized the difficulties of achieving international commitment on environmental issues. Whilst there were some positive outcomes—for example, on water and sanitation (with a target to halve the number without basic sanitation—about 1.2 billion—by 2015), on poverty, health, sustainable consumption and on trade and globalization—many other outcomes were much less positive. Delivering the Kyoto protocol on legally enforceable reductions of greenhouse gases continues to be difficult, as does progress on safeguarding biodiversity and natural resources, and on delivering human rights in many countries. Such problems severely hamper progress on sustainable development.

Within the EU, four Community Action Programmes on the Environment were implemented between 1972 and 1992. These gave rise to specific legislation on a wide range of topics, including waste management, the pollution of the atmosphere, the protection of nature and EIA. The Fifth Programme, "Towards sustainability" (1993–2000), was set in the context of the completion of the Single European Market. The latter, with its emphasis on major changes in economic development resulting from the removal of all remaining fiscal, material and technological barriers between Member States, could pose additional threats to the environment. The Fifth Programme recognized the need for the clear integration of performance targets—in relation to environmental protection—for several sectors, including manufacturing, energy, transport and tourism. EU policy on the environment will be based on the "precautionary principle" that preventive action should be taken, that environmental damage should be rectified at source and that the polluter should pay. Whereas previous EU programmes relied almost exclusively on legislative instruments, the Fifth Programme advocates a broader mixture, including "market-based instruments", such as the internalization of environmental costs through the application of fiscal measures, and "horizontal, supporting instruments", such as improved baseline and statistical data and improved spatial and sectoral planning. Figure 1.3 illustrates the interdependence of resources, sectors and policy areas. EIA has a clear role to play.

The Sixth Programme, "Our future, our choice" (2001–10), builds on the broader approach introduced in the previous decade. It recognizes that sustainable development has social and economic as well as physical environmental dimensions, although the focus is on four main priority issues: tackling climate change, protecting nature and biodiversity, reducing human health impacts from environmental pollution and ensuring the sustainable management of natural resources and waste. It also recognizes the importance of empowering citizens and changing behaviour, and of "greening land-use planning and management decisions". "The Community directive on EIA and proposal on SEA, which aim to ensure that the environmental implications of planned infrastructure projects and planning are properly addressed, will also help ensure that the environmental considerations are better integrated into planning decisions" (CEC 2001).

In the UK, the publication of *This common inheritance: Britain's environmental strategy* (DoE et al. 1990) provided the country's first comprehensive White Paper on the environment. The report includes a discussion of the greenhouse effect, town and

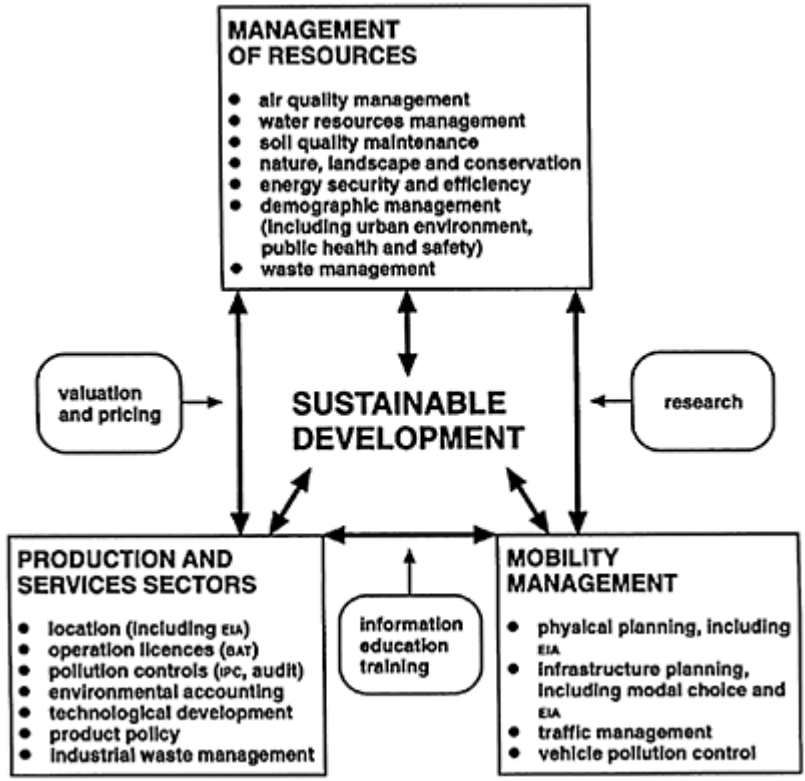

Figure 1.3 An EC framework for sustainable development. (*Source:* CEC 1992.)

country, pollution control, and awareness and organization with regard to environmental issues. Throughout it emphasizes that responsibility for our environment should be shared between the government, business and the public. The range of policy instruments advocated includes legislation, standards, planning and economic measures. The last, building on work by Pearce et al. (1989), includes charges, subsidies, market creation and enforcement incentives. The report also notes, cautiously, the recent addition of EIA to the "toolbox" of instruments. Subsequent UK government reports, such as *Sustainable development: the UK strategy* (HMG 1994), recognize the role of EIA in contributing to sustainable development and raise the EIA profile among key user groups. The UK government reports also reflect the extension of the scope of sustainable development to include social, economic and environmental factors. This is reflected in the UK Strategy

for Sustainable Development, *A Better Quality of Life* (DETR 1999a), with its four objectives of:

1. social progress which recognizes the needs of everyone;
2. effective protection of the environment;
3. prudent use of natural resources; and
4. maintenance of high and stable levels of economic growth and employment.

To measure progress, the UK government has published a set of sustainable development indicators, including a set of 15 key headline indicators (DETR 1999b). It also required a high-level sustainable development framework to be produced for each English region (see, for example, *A Better Quality of Life in the South East* (SEERA 2001)).

1.4 Changing perspectives on EIA

The arguments for EIA vary in time, in space and according to *the perspective of those involved*. From a minimalist defensive perspective, developers, and possibly also some parts of government, might see EIA as a necessary evil, an administrative exercise, something to be gone through that might result in some minor, often cosmetic, changes to a development that would probably have happened anyway. For the "deep ecologists" or "deep Greens", EIA cannot provide total certainty about the environmental consequences of development proposals; they feel that any projects carried out under uncertain or risky circumstances should be abandoned. EIA and its methods must straddle such perspectives, partly reflecting the previous discussion on weak and strong sustainability. EIA can be, and is now often, seen as a positive process that seeks a harmonious relationship between development and the environment. The nature and use of EIA will change as relative values and perspectives also change. EIA must adapt, as O'Riordan (1990) noted:

> One can see that EIA is moving away from being a defensive tool of the kind that dominated the 1970s to a potentially exciting environmental and social betterment technique that may well come to take over the 1990s… If one sees EIA not so much as a technique, rather as a process that is constantly changing in the face of shifting environmental politics and managerial capabilities, one can visualize it as a sensitive barometer of environmental values in a complex environmental society. Long may EIA thrive.

EIA must also be re-assessed in its *theoretical context,* and in particular in the context of decision-making theory (see Lawrence 1997, Weston 2000). EIA had its origins in a climate of a rational approach to decision-making in the USA in the 1960s. The focus was on the systematic process, objectivity, a holistic approach, a consideration of alternatives and an approach often seen as primarily linear. This rational approach is assumed to rely on a scientific process in which facts and logic are pre-eminent. In the UK this rational approach was reflected in planning in the writings of, *inter alia,* Faludi (1973), McLoughlin (1969), and Friend & Jessop (1977).

However, other writings on the theoretical context of EIA have recognized the importance of the subjective nature of the EIA process. Kennedy (1988) identified EIA as both a "science" and an "art", combining political input and scientific process. More colourfully, Beattie (1995), in an article entitled "Everything you already know about EIA, but don't often admit", reinforces the point that EIAs are not science; they are often produced under tight deadlines and data gaps and simplifying assumptions are the norm under such conditions. They always contain unexamined and unexplained value judgements, and they will always be political. They invariably deal with controversial projects, and they have distributional effects. EIA professionals should therefore not be surprised, or dismayed, when their work is selectively used by various parties in the process.

In the context of decision-making theory, this recognition of the political, the subjective, is reflected most fully in a variety of behavioural/participative theories. Braybrooke & Lindblom (1963), for example, saw decisions as incremental adjustments, with a process that is not comprehensive, linear and orderly, and is best characterized as "muddling through". Lindblom (1980) further developed his ideas through the concept of "disjointed incrementalism", with a focus on meeting the needs and objectives of society, often politically defined. The importance of identifying and confronting trade-offs, a major issue in EIA, is clearly recognized. The participatory approach includes processes for open communication among all affected parties.

The recognition of multiple parties and the perceived gap between government and citizens have stimulated other theoretical approaches, including communicative and collaborative planning (Healey 1996, 1997). This approach draws upon the work of Habermas (1984), Forester (1989) and others. Much attention is devoted to consensus-building, co-ordination and communication, and the role of government in promoting such actions as a means of dealing with conflicting stakeholder interests to come to collaborative action.

It is probably now realistic to place the current evolution of EIA somewhere between the rational and behavioural approaches—reflecting elements of both. It does include strands of rationalism, but there are many participants, and many decision points—and politics and professional judgement are often to the fore. This tends to fit well with the classic concept of "mixed scanning" advocated by Etzioni (1967), utilizing rational techniques of assessment, in combination with more intuitive value judgements, based upon experience and values. The rational-adaptive approach of Kaiser et al. (1995) also stresses the importance of a series of steps in decision-making, with both (scientific-based) rationality and (community-informed) participation, moderating the selection of policy options and desired outcomes.

Environmental impact assessment must also be seen in the context of *other environmental management decision tools*. Petts (1999) provides a good overview of the recent evolution. These tools are additional to the family of assessment approaches discussed in Section 1.2, and include, for example, life cycle assessment (LCA), CBA, and environmental auditing. LCA differs from EIA in its focus not on a particular site or facility, but on a product or system and the cradle-to-grave environmental effects of that product or system (see White et al. 1995). In contrast, CBA focuses on economic impacts of a development, but taking a wide and long view of those impacts. It involves as far as possible the monetization of all the costs and benefits of a proposal. It came to the fore in

the UK in relation to major transport projects in the 1960s, but is enjoying a new lease of life (see Hanley & Splash 1993, Lichfield 1996). Environmental auditing is the systematic, periodic and documented evaluation of the environmental performance of facility operations and practices, and this area has seen the development of procedures, such as the International Standard 14001 (ISO 14001). But in general, these other tools have been much less internalized into decision-making procedures and legislation than EIA, and now SEA. They also tend to be more technocentric, and with less attention paid to process and the wider stakeholder environment. However, they can be seen as complementary tools to EIA. Thus Chapter 5 explores the potential role of CBA approaches in EIA evaluation, and in Chapter 11 the role of environmental auditing is explored further, in relation to environmental management systems (EMSs).

This brief discussion on perspectives, theoretical context, associated tools and processes emphasizes the need to continually re-assess the role and operation of EIA and the importance of an adaptive EIA.

1.5 Projects, environment and impacts

1.5.1 The nature of major projects

As noted in Section 1.2, EIA is relevant to a broad spectrum of development actions, including policies, plans, programmes and projects. The focus here is on projects, reflecting the dominant role of project EIA in practice. The SEA of the "upper tiers" of development actions is considered further in Chapter 12. The scope of projects covered by EIA is widening, and is discussed further in Chapter 4. Traditionally, project EIA has applied to major projects; but what are major projects, and what criteria can be used to identify them? One could take Lord Morley's approach to defining an elephant: it is difficult, but you easily recognize one when you see it. In a similar vein, the acronym LULU (locally unacceptable land uses) has been applied in the USA to many major projects, such as in energy, transport and manufacturing, clearly reflecting the public perception of the negative impacts associated with such developments. There is no easy definition, but it is possible to highlight some important characteristics (Table 1.2).

Most large projects involve considerable investment. In the UK context, "mega-projects" such as the Sizewell B PWR nuclear power station (budgeted to cost about £2 billion), the Channel Tunnel (about £6 billion) and the proposed Severn Barrage (about £8 billion) constitute one end of the spectrum. At the other end may be industrial estate developments, small stretches of road, various waste-disposal facilities, with considerably smaller, but still substantial, price tags. Such projects often cover large areas and employ many workers, usually in construction, but also in operation for some projects. They also invariably generate a complex array of inter- and intra-organizational activity during the various stages of their lives. The developments may have wide-ranging, long-term and often very significant impacts on the environment. The definition of significance with regard to environmental effects is an important issue in EIA. It may relate, *inter alia,* to scale of development, to sensitivity of location and to the nature of adverse effects; it will be discussed further in later chapters. Like a large stone thrown into a pond, a major project can create major ripples with impacts spreading far and wide. In many respects

such projects tend to be regarded as exceptional, requiring special procedures. In the UK, these procedures have included public inquiries, hybrid bills that have to be passed through parliament (for example, for the Channel Tunnel) and EIA procedures.

Major projects can also be defined according to type of activity. They include manufacturing and extractive projects, such as petrochemicals plants, steelworks, mines and quarries; services projects, such as leisure developments, out-of-town shopping centres, new settlements and education and health facilities; and utilities and infrastructure,

Table 1.2 Characteristics of major projects.

• Substantial capital investment
• Cover large areas; employ large numbers (construction and/or operation)
• Complex array of organizational links
• Wide-ranging impacts (geographical and by type)
• Significant environmental impacts
• Require special procedures
• Extractive and primary (including agriculture); services; infrastructure and utilities
• Band, point

such as power stations, roads, reservoirs, pipelines and barrages. An EC study adopted a further distinction between band and point infrastructures. Point infrastructure would include, for example, power stations, bridges and harbours; band or linear infrastructure would include electricity transmission lines, roads and canals (CEC 1982).

A major project also has a planning and development life cycle, including a variety of stages. It is important to recognize such stages because impacts can vary considerably between them. The main stages in a project's life cycle are outlined in Figure 1.4. There may be variations in timing between stages, and internal variations within each stage, but there is a broadly common sequence of events. In EIA, an important distinction is between "before the decision" (stages A and B) and "after the decision" (stages C, D and E). As noted in Section 1.2, the monitoring and auditing of the implementation of a project following approval are often absent from the EIA process.

Projects are initiated in several ways. Many are responses to market opportunities (e.g. a holiday village, a subregional shopping centre, a gas-fired power station); others

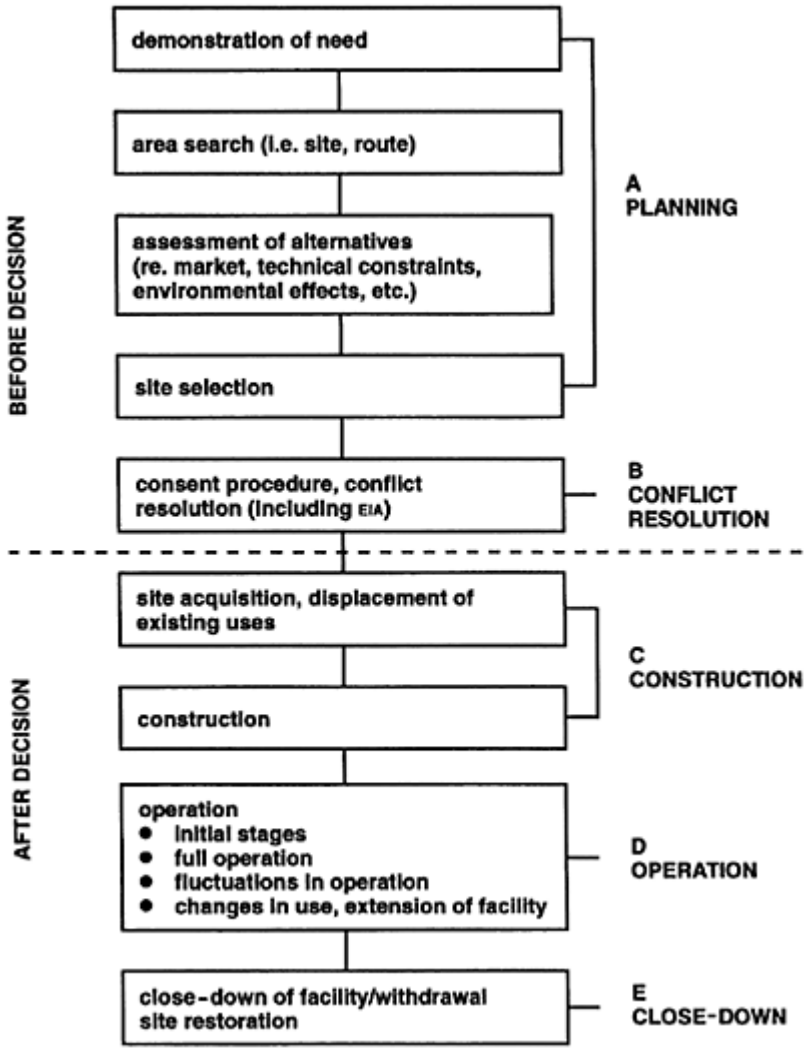

Figure 1.4 Generalized planning and development life cycle for major projects (with particular reference to impact assessment on host area). (Adapted from Breese et al. 1965.)

may be seen as necessities (e.g. the Thames Barrier); others may have an explicit prestige role (e.g. the programme of Grands Travaux in Paris including the Bastille Opera, Musée d'Orsay and Great Arch). Many major projects are public-sector initiatives, but with the move towards privatization in many countries, there has been a move towards private

sector funding, exemplified by such projects as the North Midlands Toll Road and the Channel Tunnel. The initial planning stage A may take several years, and lead to a specific proposal for a particular site. It is at stage B that the various control and regulatory procedures, including EIA, normally come into play. The construction stage can be particularly disruptive, and may last up to 10 years for some projects. Major projects invariably have long operational lives, although extractive projects can be short compared with infrastructure projects. The environmental impact of the eventual close-down/decommisioning of a facility should not be forgotten; for nuclear power facilities it is a major undertaking. Figure 1.5 shows how the stages in the life cycles of different kinds of project may vary.

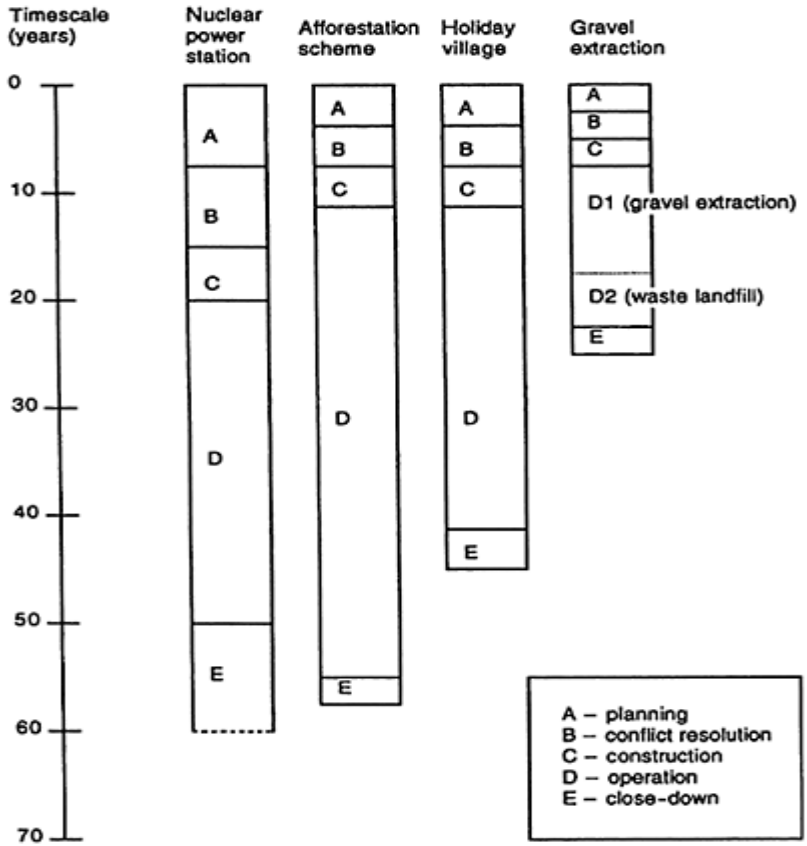

Figure 1.5 Broad variations in life cycle stages between different types of project.

1.5.2 Dimensions of the environment

The environment can be structured in several ways, including components, scale/space and time. A narrow definition of environmental components would focus primarily on the biophysical environment. For example, the UK Department of the Environment (DoE) used the term to include all media susceptible to pollution, including air, water and soil; flora, fauna and human beings; landscape, urban and rural conservation and the built heritage (DoE 1991). The DoE checklist of environmental components is outlined in Table 1.3. However, as already noted in Section 1.2, the environment has important economic and sociocultural dimensions. These include economic structure, labour markets, demography, housing, services (education, health, police, fire, etc.), lifestyles and values, and these are added to the checklist in Table 1.3. This wider definition is more in tune with an Australian definition, "For the purposes of EIA, the meaning of environment incorporates physical, biological, cultural, economic and social factors" (ANZECC 1991).

The environment can also be analysed at various scales (Figure 1.6). Many of the spatial impacts of projects affect the local environment, although the nature of "local" may vary according to the aspect of environment under consideration and to the stage in a project's life. However, some impacts are more than local. Traffic noise, for example, may be a local issue, but changes in traffic flows caused by a project may have a regional impact, and the associated CO_2 pollution contributes to the global greenhouse problem. The environment also has a time dimension. Baseline data on the state of the environment are needed at the time a project is being considered. This in itself may be a daunting request. In the UK, local development plans and national statistical sources, such as the Digest of Environmental Protection and

Table 1.3 Environmental components

Physical environment (adapted from DoE 1991)	
Air and atmosphere	Air quality
Water resources and water bodies	Water quality and quantity Classification, risks (e.g. erosion, contamination)
Soil and geology	
Flora and fauna	Birds, mammals, fish, etc.; aquatic and terrestrial vegetation
Human beings	Physical and mental health and well-being
Landscape	Characteristics and quality of landscape
Cultural heritage	Conservation areas; built heritage; historic and archaeological sites
Climate	Temperature, rainfall, wind, etc.
Energy	Light, noise, vibration, etc.
Socio-economic environment	
Economic base—direct	Direct employment; labour market characteristics; local and non-local trends
Economic base—indirect	Non-basic and services employment; labour supply and demand

Demography	Population structure and trends
Housing	Supply and demand
Local services	Supply and demand of services: health, education, police, etc.
Socio-cultural	Lifestyles, quality of life; social problems (e.g. crime); community stress and conflict

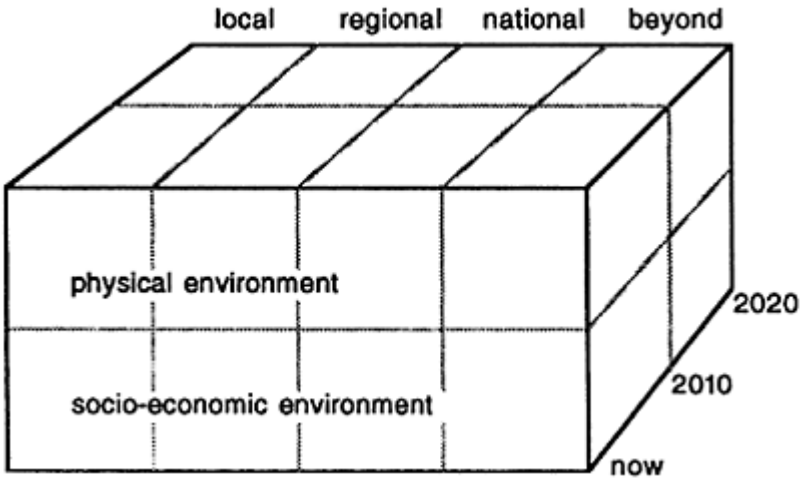

Figure 1.6 Environment: components, scale and time dimensions.

Water Standards, may provide some relevant data. However, tailor-made state-of-the-environment reports and audits are still in limited supply (see Chapter 11 for further information). Even more limited are time series data highlighting trends in environmental quality. The environmental baseline is constantly changing, irrespective of any development under consideration, and it requires a dynamic rather than a static analysis.

1.5.3 The nature of impacts

The environmental impacts of a project are those resultant changes in environmental parameters, in space and time, compared with what would have happened had the project not been undertaken. The parameters may be any of the type of environmental receptors noted previously: air quality, water quality, noise, levels of local unemployment and crime, for example. Figure 1.7 provides a simple illustration of the concept.

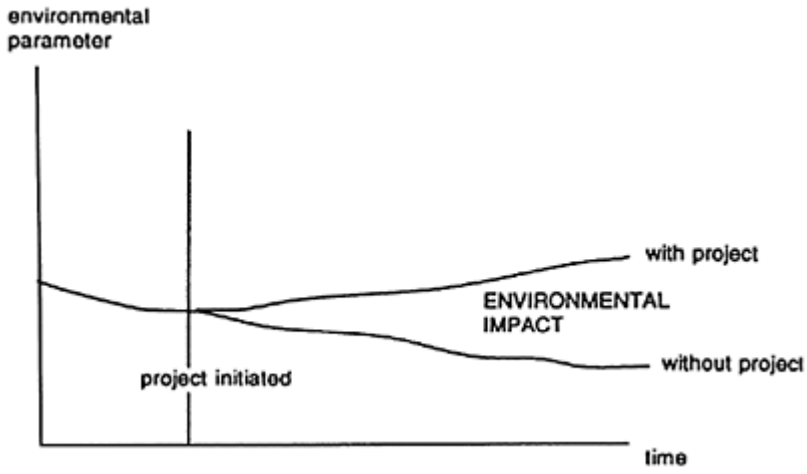

Figure 1.7 The nature of an environmental impact.

Table 1.4 Types of impact

• Physical and socio-economic
• Direct and indirect
• Short-run and long-run
• Local and strategic (including regional, national and beyond)
• Adverse and beneficial
• Reversible and irreversible
• Quantitative and qualitative
• Distribution by group and/or area
• Actual and perceived
• Relative to other developments

Table 1.4 provides a summary of some of the types of impact that may be encountered in EIA. The biophysical and socio-economic impacts have already been noted. These are often seen as synonymous with adverse and beneficial. Thus, new developments may produce harmful wastes but also produce much needed jobs in areas of high unemployment. However, the correlation does not always apply. A project may bring physical benefits when, for example, previously polluted and derelict land is brought back into productive use; similarly the socio-economic impacts of a major project on a community could include pressure on local health services and on the local housing market, and increases in community conflict and crime. Projects may also have immediate and direct impacts that give rise to secondary and indirect impacts later. A

reservoir based on a river system not only takes land for the immediate body of water but also may have severe downstream implications for flora and fauna and for human activities such as fishing and sailing.

The direct and indirect impacts may sometimes correlate with short-run and longrun impacts. For some impacts the distinction between short-run and long-run may also relate to the distinction between a project's construction and its operational stage; however, other construction-stage impacts, such as change in land use, are much more permanent. Impacts also have a spatial dimension. One distinction is between local and strategic, the latter covering impacts on areas beyond the immediate locality. These are often regional, but may sometimes be of national or even international significance.

Environmental resources cannot always be replaced; once destroyed, some may be lost for ever. The distinction between reversible and irreversible impacts is a very important one, and the irreversible impacts, not susceptible to mitigation, can constitute particular significant impacts in an EIA. It may be possible to replace, compensate for or reconstruct a lost resource in some cases, but substitutions are rarely ideal. The loss of a resource may become more serious later, and valuations need to allow for this. Some impacts can be quantified, others are less tangible. The latter should not be ignored. Nor should the distributional impacts of a proposed development be ignored. Impacts do not fall evenly on affected parties and areas. Although a particular project may be assessed as bringing a general benefit, some groups and/or geographical areas may be receiving most of any adverse effects, the main benefits going to others elsewhere. There is also a distinction between actual and perceived impacts. Subjective perceptions of impacts may significantly influence the responses and decisions of people towards a proposed development. They constitute an important source of information, to be considered alongside more objective predictions of impacts. Finally, all impacts should be compared with the "do-nothing" situation, and the state of the environment predicted without the project. This can be widened to include comparisons with anticipated impacts from alternative development scenarios for an area.

We conclude on a semantic point: the words "impact" and "effect" are widely used in the literature and legislation on EIA, but it is not always clear whether they are interchangeable or should be used only for specifically different meanings. In the United States, the regulations for implementing the National Environmental Policy Act (NEPA) expressly state that "effects and impacts as used in these regulations are synonymous". This interpretation is widespread, and is adopted in this text. But there are other interpretations relating to timing and to value judgements. Catlow & Thirlwall (1976) make a distinction between effects which are "…the physical and natural changes resulting, directly or indirectly, from development" and impacts which are "…the consequences or end products of those effects represented by attributes of the environment on which we can place an objective or subjective value". In contrast, an Australian study (CEPA 1994) reverses the arguments, claiming that "there does seem to be greater logic in thinking of an impact resulting in an effect, rather than the other way round". Other commentators have introduced the concept of value judgement into the differentiation. Preston & Bedford (1988) state that "the use of the term 'impacts' connotes a value judgement". This view is supported by Stakhiv (1988), who sees a distinction between "scientific assessment of facts (effects), and the evaluation of the

relative importance of these effects by the analyst and the public (impacts)". The debate continues!

1.6 Current issues in environmental impact assessment

Although EIA now has over 30 years of history in the USA, elsewhere the development of concepts and practice is more recent. Development is moving apace in many other countries, including the UK and the other EU Member States. Such progress has not been without its problems, and a number of the current issues in EIA are highlighted here and will be discussed more fully in later chapters.

1.6.1 Scope of the assessment

Whereas legislators may seek to limit coverage, best practice may lead to its widening. For example, project EIA may be mandatory only for a limited set of major projects. In practice many others have been included. But which projects should have assessments? In the UK, case law is now building up, but the criteria for the inclusion or exclusion of a project for EIA are still developing. In a similar vein, there is a case for widening the dimensions of the environment under consideration to include socio-economic impacts more fully. The trade-off between the adverse biophysical impacts of a development and its beneficial socio-economic impacts often constitutes the crucial dilemma for decision-makers. Coverage can also be widened to include other types of impacts only very partially covered to date. Distributional impacts would fall into this category. Lichfield and others are seeking to counter this problem (see Lichfield 1996).

1.6.2 The nature of methods of assessment

As noted in Section 1.2, some of the main steps in the EIA process (e.g. the consideration of alternatives, monitoring) may be missing from many studies. There may also be problems with the steps that are included. The prediction of impacts raises various conceptual and technical problems. The problem of establishing the environmental baseline position has already been noted. It may also be difficult to establish the dimensions and development stages of a project clearly. Further conceptual problems include establishing what would have happened in the relevant environment without a project, clarifying the complexity of interactions of phenomena, and making trade-offs in an integrated way (i.e. assessing the trade-offs between economic apples, social oranges and physical bananas). Other technical problems are the general lack of data and the tendency to focus on the quantitative, and often single, indicators in some areas. There may also be delays and discontinuities between cause and effect, and projects and policies may discontinue. The lack of auditing of predictive techniques limits the feedback on the effectiveness of methods. Nevertheless, innovative methods are being developed to predict impacts, ranging from simple checklists and matrices to complex mathematical models. These methods are not neutral, in the sense that the more complex they are, the more difficult it becomes for the general public to participate in the EIA process.

1.6.3 The relative roles of participants in the process

The various "actors" in the EIA process—the developer, the affected parties, the general public and the regulators at various levels of government—have differential access to the process, and their influence on the outcome varies. Many would argue that in countries such as the UK the process is too developer-orientated. The developer or the developer's consultant carries out the EIA and prepares the EIS, and is unlikely to predict that the project will be an environmental disaster. Notwithstanding this, developers themselves are concerned about the potential delays associated with the requirement to submit an EIS. They are also concerned about cost. Details about costs are difficult to obtain. Clark (1984) estimates EIA costs of 0.5–2.0 per cent of a project's value. Hart (1984) and Wathern (1988) suggest figures of a similar order. Estimates by Coles et al. (1992) suggest a much wider range, from 0.000025 to 5 per cent, for EISs in the UK. The UK DETR (1997) suggested £35,000 as an appropriate median figure for the cost of undertaking an EIA under the new regulations.

Procedures for and the practice of public participation in the EIA process vary between, and sometimes within, countries, from the very comprehensive to the very partial and largely cosmetic. An important issue is the stages in the EIA process to which the public should have access. Government roles in the EIA process may be conditioned by caution at extending systems, by limited experience and expertise in this new and rapidly developing area, and by resource considerations. A central government may offer limited guidance on best practice, and make inconsistent decisions. A local government may find it difficult to handle the scope and complexity of the content of EISs.

1.6.4 The quality of assessments

Many EISs fail to meet even minimum standards. For example, a survey by Jones et al. (1991) of the EISs published under UK EIA regulations highlighted some shortcomings. They found that "one-third of the EISs did not appear to contain the required nontechnical summary, that, in a quarter of the cases, they were judged not to contain the data needed to assess the likely environmental effects of the development, and that in the great majority of cases, the more complex, interactive impacts were neglected". An update by Glasson et al. (DoE 1996) suggests that although there has been some learning from experience, many EISs in the UK are still unsatisfactory (see Chapter 8 for further discussion). Quality may vary between types of project. It may also vary between countries supposedly operating under the same legislative framework.

1.6.5 Beyond the decision

Many EISs are for one-off projects, and there is little incentive for developers to audit the quality of the assessment predictions and to monitor impacts as an input to a better assessment for the next project. EIA up to and no further than the decision on a project is a very partial linear process, with little opportunity for a cyclical learning process. In some areas of the world (e.g. California, Western Australia), the monitoring of impacts is mandatory, and monitoring procedures must be included in an EIS. The extension of such approaches constitutes another significant current issue in the largely project-based EIA process.

1.6.6 Beyond project assessment

As noted in Section 1.2, the SEA of PPPs represents a logical extension of project assessment. SEA can cope better with cumulative impacts, alternatives and mitigation measures than project assessment. SEA systems already exist in California and The Netherlands, and to a lesser extent in Canada, Germany and New Zealand. Following the Fifth Community Action Programme on the Environment which stated: "Given the goal of achieving sustainable development, it seems only logical, if not essential, to apply an assessment of the environmental implications of all relevant policies, plans and programmes" (CEC 1992), an EU SEA Directive is now in place, to be implemented from 2004 (see Therivel 2004, and Chapter 12).

1.7 An outline of subsequent parts and chapters

This book is in four parts. The first establishes the context of EIA in the growth of concern about environmental issues and in relevant legislation, with particular reference to the UK. Following from the first chapter, which provides an introduction to EIA and an overview of principles, Chapter 2 focuses on the origins of EIA under the US NEPA of 1969, on interim developments in the UK, and on the subsequent introduction of EC Directive 85/337 and subsequent amendments (CEC 97/11). The details of the UK legislative framework for EIA, under T&CP and other legislation, are discussed in Chapter 3.

Part 2 provides a rigorous step-by-step approach to the EIA process. This is the core of the text. Chapter 4 covers the early start-up stages, establishing a management framework, clarifying the type of developments for EIA, and outlining approaches to scoping, the consideration of alternatives, project description, establishing the baseline and identifying impacts. Chapter 5 explores the central issues of prediction, the assessment of significance and the mitigation of adverse impacts. The approach draws out broad principles affecting prediction exercises, exemplified with reference to particular cases. Chapter 6 provides coverage of an important issue identified above: participation in the EIA process. Communication in the EIA process, EIS presentation and EIA review are also covered in this chapter. Chapter 7 takes the process beyond the decision on a project and examines the importance of, and approaches to, monitoring and auditing in the EIA process.

Part 3 exemplifies the process in practice. Chapter 8 provides an overview of UK practice to date, including quantitative and qualitative analyses of the EISs prepared. Chapter 9 provides a review of EIA practice in several key sectors, including energy, transport, waste management and tourism. A feature of the chapter is the provision of a set of case studies of recent and topical EIA studies from the UK and overseas, illustrating particular features of and issues in the EIA process. Chapter 10 draws on comparative experience from a number of developed countries (The Netherlands, Canada and Australia) and from a number of countries from the developing and emerging economies (Peru, China, Benin and Poland)—presented to highlight some of the strengths and weaknesses of other systems in practice; the important role of international agencies in EIA practice—such as the UN and the World Bank—is also discussed in this chapter.

Part 4 looks to the future. It illuminates many of the issues noted in Section 1.5. Chapter 11 focuses on improving the effectiveness of the current system of project assessment. Particular emphasis is given to the development of environmental auditing to provide better baseline data, to various procedural developments and to achieving compatibility for EIA systems in Europe. Chapter 12 discusses the extension of assessment to PPPs, concluding full circle with a further consideration of EIA, SEA and sustainable development.

A set of appendices provide details of legislation and practice not considered appropriate to the main text. A list of further reading is included there.

Note

1. A comprehensive up-to-date overview of the state of the environment in Europe is provided in European Environment Agency, 2003. *Europe's environment: the third assessment.* Copenhagen: EEA.

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INTRODUCTION TO ENVIRONMENTAL IMPACT ASSESSMENT

3RD EDITION

JOHN GLASSON, RIKI THERIVEL AND ANDREW CHADWI