EVALUATING SUSTAINABLE DEVELOPMENT

IN THE BUILT ENVIRONMENT

Peter S. Brandon & Patrizia Lombardi

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Preface

This book is just a beginning. It seeks to address the issues related to the evaluation of sustainable development within the built environment and to provide a way forward. It is about how we can recognise, structure and assess all those factors that affect whether a development is sustainable in the medium to long term. It is also about how we try to balance these factors and how this contributes to our understanding of sustainability. It is not exhaustive as the authors believe there is still much to learn and to develop but it is hoped that it will provide another step towards a better approach to the subject.

It is designed for practitioners and students who are interested in the subject and wish to evaluate the impact of a development within the built environment in terms of its sustainability. At the time of writing there is considerable activity related to sustainability from a wide variety of sources. There are world congresses, lists of sustainability indicators, government policies and funding programmes, all trying to address the issue. Many of these are limited and only seem to address part of the problem. The interaction between people and the built environment, the contribution of human decision-making in its widest sense and the interdependence between all the various factors that make up a sustainable development are not always present.

This book will focus on two main issues. These are, firstly, how do we create a structure of knowledge and thinking which will allow us to develop a vocabulary which all participants in sustainable development can own and to which they will feel able to contribute and, secondly, how do we assess progress in sustainable development? The first is important because it enables a dialogue to take place between all the stakeholders in such a way that the complexity of the problem can be exposed, structured and communicated in order to gain confidence from all the parties. The second is important because unless we can

evaluate what contributes to sustainability it will be very difficult to know whether a sustainable environment has been created.

These are fundamental and important issues. Implied in the structuring is not only a recognition that many people are engaged but also that they come from a variety of backgrounds, disciplines and levels of commitment which all provide a different 'filter' for the individual or group to view the problem or issue through. For them to come to agreement requires a structure which they can all understand and to which they can contribute their particular view. It also requires mutual respect and a desire to come to a solution that may involve compromise. It involves education because all need to understand the position of the others and it needs a language, which is not exclusive, but which includes all participants wherever possible. In terms of technique it requires a confidence that the techniques for evaluation are fair and transparent so that the inputs and outputs are not favouring one particular view or, if they are, that all parties are aware of this limitation. There are very few, if any, techniques that are completely neutral in their advice.

This book, therefore, is an exploration of some of these complex issues and it attempts to provide an approach that can be built on and evolve over the ensuing years. The term 'sustainable development' is relatively new in terms of its current meaning and its definition, and its tools and techniques will develop over time. Our understanding of what we mean by the term, and how it should be viewed, will change, but this book attempts to provide a structure which will endure these processes and provide a platform which will allow the subject to grow and develop in a consistent way.

Peter S. Brandon and *Patrizia Lombardi*

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1 Setting the Context for Evaluating Sustainable Development

The environmental perspective

The subject of sustainable development is one of the key research and policy issues as we enter the early years of the twenty-first century. At the Rio Conference in 1992, 100 heads of states attended representing 179 governments that committed themselves to an agenda for addressing the perceived problem. In 2002, 109 governments were represented at the Rio + 10 Conference in Johannesburg and vowed to continue the focus on what they consider to be this important area. Over the past five years the European Union has committed a substantial proportion of its research and development monies to sustainability issues and the majority of governments that have a national research programme have also committed funds to the cause. So why the interest and why is it at, or near, the top of global policy for research and development?

With all new ideas, there is a long gestation period before they are taken up as policy or identified as a key issue for researchers to address. There is little doubt that the current interest in sustainable development has come from the pressure groups and particularly those associated with the green movement who saw the depletion of non-renewable resources (and particularly energy stocks), the pollution of the air and water and the breakdown of social conscience through globalisation, as leading to the demise of mankind and the balance of nature (the eco-system) which presently sustains living creatures. They considered that there was a moral imperative to take the long-term view and to consider the impact of decisions taken now on generations that would follow. It is true to say that within this

general thrust there was, and probably will be, a variety of opinions on such matters as the extent of the damage being done to the environment, the responsibility for the current situation and the manner in which it can be remedied. There is, however, a growing consensus that something is wrong and that mankind has a duty to do something about it.

Knowing what to do is of course another matter and there is a spectrum of views (see Fig. 1.1). At one end of the spectrum are those who suggest that we should conserve at all costs, change the way we live and seek a reduction in economic growth as a means of reducing consumption. At the other end are those who believe that necessity is the mother of invention and that a 'technical fix' will be found which will remove the need for such drastic measures to be taken. They believe that the markets will drive up the price of non-renewable resources and that this in turn will encourage innovators to provide sensible alternatives. Against this argument others would say that in the time it takes for the markets to realise what is happening irreparable damage may have been done to the planet for which future generations may have to pay the full price.

Much of this debate is at the level of the planet. Saving spaceship earth is the clarion call and we must all be engaged in the earth's preservation and its delicate ecological systems. This attitude may also be debated, for many would point out that the earth has been in turmoil ever since its formation and species have come and gone, climatic changes far outweigh the actions of mankind in terms of their devas-

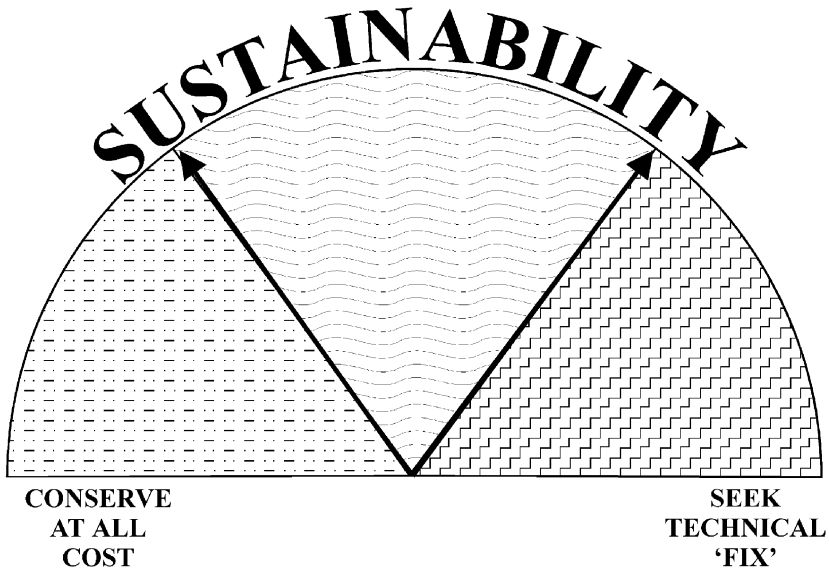

Figure 1.1 The spectrum of views on sustainability.

tation and in the very long term the earth itself will disappear and will probably be engulfed in a black hole or other stellar catastrophe. The response to this would be that we are the first species able to create its own downfall and the first to be able to at least extend its sojourn on earth, so why should we not rise to the challenge and try to extend the life of the species? The focus is on the environment and it is through this filter that human activity will be judged. This does not seem unreasonable as future generations will probably judge the activities of the current generation in the same way that we often judge the misdemeanours of the past: by the way they affect us now.

The question of time is a key one and the text will return to this in due course. Over what period should we view sustainable development? It is a critical issue for the systems and techniques we employ to measure progress. If we take the very long term, the planet is probably doomed anyway. If we take the short term, we can probably muddle through and overcome or manoeuvre around the problems that we have created. How far ahead can we look? Is it one, two, several or hundreds of generations? Most commentators would suggest that our ability to make interventions that would aid future populations is limited to two or three generations. Beyond this we would probably need to be prophets or exercise witchcraft to know what to do. Predictions made 200 years ago, extrapolating the knowledge of the time, seem naive and stupid with the benefit of hindsight. For example it was thought that London would be waist-deep in horse manure at the turn of the nineteenth/twentieth century because of the growth of horse-drawn transport!

There is perhaps one area where we can predict a potential problem and that is with the demise of non-renewable resources. Who knows of what value these resources will be to those who will follow? We do not know what benefits to health, to quality of life and to the supply of useful products these resources will bring because our knowledge of their potential is still limited. We do not understand how they may be used in different, complex combinations linked to other knowledge, for example of the nature of genes, to the benefit of our children and beyond. If some of these resources disappear, what legacy are we leaving? We tend to view these resources in terms of what they can provide *now* and not what their potential benefit could be in the *future*. Our outlooks are determined by their impact on us and the horizons that science and technology have set for us at this point in time. Often these are limited to the human lifespan.

Since the mid-1970s these debates have grown in intensity and have risen up the international agenda to the point where it is heads of government who find themselves gathered together to address the problem. Partly this is a recognition that it is a global problem. Most of the environmental problems are not confined within national boundaries. (A hole in the ozone layer or a leak from a nuclear energy plant does not respect the arbitrary limits of territory designated by human

beings.) Partly it is because this subject is recognised as being an issue of morality in which all must co-operate if action is to be taken that will change the course of environmental wellbeing. No one wants to be seen to show a lack of commitment to such a key issue. Partly it is because in each country there is a political imperative to address these issues because the nature of the problem has permeated the public conscience. It is unlikely that the subject will go away and indeed for some time to come it is likely to be a major item on the international agenda despite the fact that there are differences of opinion on how the matter should be tackled. For example, President George W. Bush of the United States of America refused to sign the Kyoto Agreement on greenhouse gas emissions in his first term of office.

The international policy debates

Table 1.1 shows some of the key events in the development of the world approach to addressing the problems of sustainable development. All have made their contribution since the 1970s and it is this groundswell of views at the very highest levels of global governance that has begun to change the actions of government and the investment in research into sustainable development. Many of the world conferences and the publications were about the context within which the discussion should take place. This context included the debates on the reduction in non-renewable resources and the apparent pollution of land, water and air. However, at the Rio Earth Summit in 1992 (United Nations Conference on Environment and Development, 1992) a significant change took place. An agenda for change was agreed and signed up to by 179 world governments. Not only did they sign up, but they also defined sustainability in a new way, extending its boundaries beyond just environmental issues.

The signatories embraced the notion that environmental issues often had their origins in the behaviour of the human race. When humans dump toxic chemicals or do not seek to conserve energy, or create social unrest leading to misuse or damage to existing resources, their behaviour has an impact on the environment. When the legal systems and regulations employed by governments make it difficult or even impossible to act in an environmentally friendly way, this aspect of human organisation has a detrimental impact on environmental issues. When the striving for economic growth results in poor use of the earth's resources, this human action and policy lead to more degradation of the environment. When there are big differentials between those who have and those who have not, unrest can follow and the damage can be substantial. The threat of terrorists gaining access to nuclear bombs is now spoken of quite openly and the terrorists gain much of their support from those who are economically or politically disadvantaged.

Table 1.1 Significant international conferences showing the growing importance of sustainable development.

Date	Action	Output
1972: 6–16 June	UN Conference on the Human Environment, Stockholm	Need for a common output to inspire and guide the people of the world in the preservation of the human environment: (a) Action plan for the human environment. (b) Educational, informational, social and cultural aspects of environmental issues have to be faced. (c) Construction of a framework for environmental action. (d) Recommendation for action at the international level. (e) Identification and control of pollution of broad international significance. (f) Declaration of the UN.
1992: 3–14 June	United Nations Rio de Janeiro Conference The Convention on Climate Change was adopted on 9 May 1992 and opened for signature a month later at the UN Conference on Environment and Development in Rio de Janeiro, Brazil.	Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity. As an output the subsequent follow-up mechanisms were created: Commission on Sustainable Development Inter-agency Committee on Sustainable Development High-level Advisory Board on Sustainable Development
1995: 7 April	Conference of the Parties to the UN Framework Convention on Climate Change 1 (COP 1), Berlin	The Berlin Mandate was adopted at the first Conference of the Parties (COP) on 7 April 1995. It acknowledged that the commitment of developed countries to take measures aimed at reducing their GHG emissions to 1990 levels by the year 2000 was not adequate to achieve the Convention's objective. The main objective of the Mandate was to strengthen the commitments for the developed-country Parties after the year 2000 without introducing any new commitments for developing countries, while reaffirming existing commitments of all Parties contained in Article 4.1 and continuing to advance their implementation.
1996: 3–14 June	United Nations International Conference on Human Settlements – Habitat II, Istanbul	This was the second conference organised for discussing the issue of habitation (Habitat I Conference was held in Vancouver in 1976). It specifically focussed on current built environmental problems in relation to major global changes (e.g. population growth, migration towards urban areas, tourism, urban regeneration).

Continues

Table 1.1 *Contd.*

Date	Action	Output
1997: 8–19 July	Conference of the Parties to the UN Framework Convention on Climate Change 2 (COP 2), Geneva	At the second COP, a large number of ministers agreed on the Geneva Ministerial Declaration, which provided political impetus to the Berlin Mandate process.
1997: 1–10 December	Conference of the Parties to the UN Framework Convention on Climate Change 3 (COP 3), Kyoto Protocol, Japan	Targets to reduce greenhouse gas emissions.
1998: 2–14 November	Conference of the Parties to the UN Framework Convention on Climate Change 4 (COP 4), Buenos Aires	At COP 4 (Buenos Aires, November 1998), Parties adopted the so-called 'Buenos Aires Plan of Action', www.unfccc.int/resource/docs/cop4/16a01.pdf, setting out a programme of work both to advance the implementation of the Convention and to flesh out the operational details of the Kyoto Protocol. This programme of work was conducted in the subsidiary bodies and at COP 5 (Bonn, October/November 1999), with a deadline of COP 6 (The Hague, November 2000). However, Parties were unable to reach agreement on a package of decisions on all issues under the Buenos Aires Plan of Action at that session. Nevertheless, they decided to meet again in a resumed session of COP 6 to try once more to resolve their differences.
1999: 25 October to 5 November	Conference of the Parties to the UN Framework Convention on Climate Change 5 (COP 5), Bonn	Ministers and officials from 166 governments agreed on a timetable for completing the outstanding details of the 1997 Kyoto Protocol by November 2000 in order to intensify the negotiating process on all issues before the sixth COP.
2000: 13–24 November, The Hague; 16–27 July 2001, Bonn	Conference of the Parties to the UN Framework Convention on Climate Change 6 (COP 6), The Hague and Bonn	Pledge to contribute €450 million per year by 2005 to help developing countries manage emissions and adapt to climate change. The Convention on Climate Change has been ratified by 37 countries.
2001: 29 October–9 November	Conference of the Parties to the UN Framework Convention on Climate Change 7 (COP 7), Marrakesh	Parties finally succeeded in adopting the Bonn Agreements on the Implementation of the Buenos Aires Plan of Action, www.unfccc.int/resource/docs/cop6secpart//05.pdf, registering political agreement on key issues under the Buenos Aires Plan of Action. The final Kyoto rulebook has been set. Countries must cut 80% emissions of gas. The Marrakesh Ministerial Declaration emphasises the contribution that action on climate change can make to sustainable development, calling for capacity building, technology, innovation and co-operation with the biodiversity and desertification conventions. Up to Marrakesh, 40 countries have ratified the Kyoto Protocol.

2002: 26 August–4 September	United Nations World Summit on Sustainable Development, Johannesburg	Key objectives to reach: (a) A revitalised and integrated UN system for sustainable development. (b) A new deal on finance – enabling a deal on SD. (c) An integration of trade and SD. (d) A clearer understanding of how governments should move forward nationally in implementing Agenda 21. (e) A new charter which could lay the foundations for countries to frame their sustainable development policies. (f) A review of the work of the present set of Rio conventions – looking at the overlaps, gaps and obstacles. (g) A set of new regional or even global conventions. (h) A set of policy recommendations for the environmental security issues that face us. (i) A clear set of commitments to implement agreed action by the UN, governments and major groups.
2002: 34 October–1 November	Conference of the Parties to the UN Framework Convention on Climate Change 8 (COP 8), New Delhi	The usual division between developed and developing country positions on many issues was in evidence at COP 8. Parties convened in negotiating groups on a number of issues previously left off the agenda due to the pressing negotiations under the Buenos Aires Plan of Action. The Delhi Declaration reaffirms development and poverty eradication as overriding priorities in developing countries and implementation of UNFCCC commitments according to Parties' common but differentiated responsibilities, development priorities and circumstances, but it does not call for a dialogue on broadening commitments.
2003: 1–12 December	Conference of the Parties to the UN Framework Convention on Climate Change 9 (COP 9), Milan	According to the way the Kyoto Protocol (KP) was written, it will go into effect only if 55 of the signatories ratify. These signatories must account for 55% of the CO_2 emissions at the then specified date – 1990. There is no problem with the first condition, as 121 countries have ratified the KP. But thanks to the position of the USA (the country at the forefront of greenhouse gas emissions), this is not going to represent the required minimum of 55% of emissions without a Russian ratification of the KP.

A tangled web of issues leads to actions that eventually have an impact on the environment. The way we live affects the world on a global scale when we piece the whole of the jigsaw together. In the words of John Donne, 'no man is an island entire of itself' (Donne, 1623). The environment at one level is fairly robust, taking care of the events that occur over time in a very practical way which is often not apparent to a single generation. At another level it can be presented as a very sensitive entity in which it is easy, through the interactions of man, to destabilise the whole superstructure and the interrelationships which provide the balance and allow the life forms that exist today to survive and prosper. It is the survival of what we have today, the bio-diversity, the climatic conditions, the level of water supply and so forth that provides the basis for the argument for sustainability. No one seems to be arguing for natural evolution which could see the demise of the human race in favour of some other life form.

Therefore there is an element of conservation that features strongly in the debate – the maintenance of the status quo. However, a recognition that the world is constantly changing is also there and must be accommodated. Evolution is thought to underpin much of this change but it is of course enhanced or aggravated by the activities of humans, not only in science and technology but also in the culture that they adopt and the growth of populations. It is the pace of change that has altered and our impact grows greater by the day. The obligation to the needs of future generations weighs heavily within the argument.

The report of the Rio Summit (United Nations Conference on Environment and Development, 1992) recognised these issues and identified some major themes. Mitchell, *et al*. (1995) have distilled from the literature of Rio and other reports four principles which underlie the guidance and advice is being given and take us beyond the pure environmental agenda, or at least to a better understanding of *why* environmental conditions change.

These principles are:

- *Equity:* the concern for today's poor and disadvantaged.
- *Futurity:* the concern for future generations.
- *Environment:* the concern for the integrity of eco-systems.
- *Public participation:* the concern that individuals should have the opportunity to participate in decisions that affect them.

Only one of these themes is directly concerned with the environment. The others are moral imperatives or cultural endorsements or mechanisms by which change can be effected through common ownership of the problem. However, they all impinge on the environment and their selection as major themes has come from the environment debate. They arise from a collective view of 'what is best' for the world both now and in the future. They represent our current stance on these issues but it is not necessarily true that these

principles will hold in the future even though most of us would subscribe to them today.

Extension of the debate

The scope or focus of the debate has therefore been extended into new realms concerned with social, legal, economic, political and technical aspects of how we live (commonly known under the acronym SLEPT). The shift has introduced a much wider debate about the values we place on various aspects of our lives, how we treat others and what level of intervention it is appropriate for a state or organisation to adopt to address these issues. Hence the move to an agenda with a different focus, known as sustainability. Since the word 'sustainability' has come into frequent use, many commentators have queried whether it has any meaning – even though they acknowledge that the term has created an important agenda. It is rather strange that a term which has favourable connotations and is used as the basis of some major research funding and government and industry initiatives is still considered rather vague by many individuals. Sometimes the concepts underlying the term get dismissed because the term itself is not sufficiently defined for these people to 'buy' into it. For some, the term 'sustainable development' is more meaningful as it suggests that it is concerned with interventions by humankind into the environment that can be analysed to see whether they have a positive or negative impact on the environmental issues of concern.

It may be helpful to look at the root words in sustainable development. To *sustain* means to continue without lessening, to nourish, to allow to flourish. To *develop* means to improve or bring to a more advanced state. Sustainable development is therefore about facilitating improvement without jeopardising what exists already. Sustainable does not mean that nothing ever changes, nor does it mean Utopia where nothing bad happens. It is not about maintaining the status quo or reaching perfection. Development does not mean continually getting bigger but is about qualitative improvement. In addition, sustainability does not mean sustained growth. At some point a community stops getting larger but it continues to improve the quality of life of its inhabitants.

This book has used sustainable development in its title for the above reasons. The book is largely concerned with the built environment which by definition is concerned with humankind's activity in creating shelter and accommodation for itself, an act which inevitably changes the environment in some way. In particular the development of cities, and the underlying social cohesion and culture which is created through cities, has a big impact on the use of resources, the way people behave, their interaction with nature and the waste products that ensue from this type of living.

The impact of the built environment

Unfortunately most of the interventions created by building accommodation in which to reside or to work have a negative effect on the environment. For example, the UK government has suggested (DETR, 1998) that consumption associated with the built environment is as follows:

- Consumption of each person in the UK averages 6 tonnes of material per year broken down into 1.5 tonnes for new infrastructure (roads, railways, etc.), 1.5 tonnes for new buildings and 3 tonnes for repair and maintenance.
- Of the 300 million tonnes of quarried aggregates per annum only 10% to 15% is recycled.
- Over 70 million tonnes of construction waste is created per annum which represents 17% of the total UK waste.
- Around 70% of energy use can be directly or indirectly attributed to buildings and infrastructure.

These are frightening statistics and reveal how important the built environment is to any policy and evaluation of environmental sustainability.

So where does the built environment fit into the big picture? As Fig. 1.2 shows, there is a growing complexity as we move away from the actions of individuals towards the actions of groups and nations and their interaction with the global environment. The more people

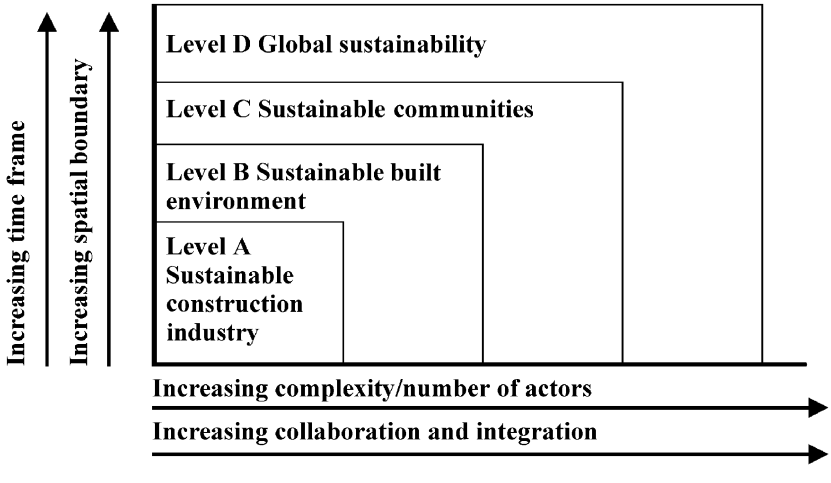

Figure 1.2 Levels of response to sustainable development. (*Source:* Construction Research and Innovation Panel Report: Sustainable Construction: Future R & I Requirements: Analysis of Current Position, 23 March 1999.)

involved, the more the interactions and the more decisions become driven by policy. These policies may not be co-ordinated and therefore may conflict with each other. If this is coupled with the normal vagaries of nature, a very complex set of interacting systems emerges. This is what makes the holistic study of the environment and sustainability such a difficult research issue.

The built environment is just one strand of development found in this complexity and there are many more. Nevertheless, the construction and use of buildings is an important factor in the overall game. Buildings and structures use raw materials, some of which are non-renewable. They use energy to extract these materials and to manufacture components and, once in the structure, these affect the heating and cooling requirements of the accommodation space. The manner in which people use the space could well affect the energy requirements too, for example if a family has a pet dog in the house it is likely that they will open the back door more frequently to let the dog out. This in turn will increase the energy loss, creating demands for the use of more fuel which may come from a non-renewable source.

Figure 1.2 attempts to show the relationship between different parts of the built environment including the communities that exist within it and the global environmental agenda. It starts with the construction industry and its suppliers, moves on to the built environment and the infrastructure required to sustain human activity, and then moves up to the communities themselves. This structure is quite useful for classifying the broad areas that need to be addressed for sustainability when viewed from the built environment perspective. It shows a continuum between the elements but gives focus for particular groups of decision-makers. Broadly, level 'A' would be addressed by building contractors, consultants and clients of individual structures, level 'B' would be primarily the decision-making area for the planners and local government and level 'C' would be the province of central government.

This series of statements is, of course, too simplistic. For example, as public participation is increased, so the representatives of citizens will need to be engaged. Ideally we would want a common structure that allowed information to flow freely from one level to another and a common language to allow full communication both across disciplines and between different levels.

This book will attempt to provide the starting point for such a language and structure and there will be more on this later in this chapter and beyond. There is of course an interdependence between all the issues. The environment determines our need for a certain type of accommodation, the built environment is largely determined by the communities that dwell there and the buildings reflect the needs of the individuals and groups, the culture and the location of the structures.

Sustainability: a definition

The discussion to date has centred around the transition from the general environmental debate to the wider discourse which includes those factors that influence the environment and therefore contribute to sustainability, and to the role that the built environment has to play in these matters.

It was the 1992 Earth Summit in Rio that provided a fresh understanding of the intimate link between the earth's environmental problems and such issues as economic conditions and social justice. It showed that the social, environmental and economic needs must be met in a balance with each other for sustainable outcomes in the long term. It showed that if people are poor, and national economies are weak, the environment suffers; if the environment is abused and resources are over-consumed, people suffer and economies decline. The conference also pointed out that the smallest local actions or decisions, good or bad, have potential worldwide repercussions. The Rio conference outlined the way that various social, economic and environmental factors are interdependent and change together. It identified the critical elements of change, showing that success in one area requires action in others in order to be sustainable over time.

A major achievement of the Rio conference was the development of what became known as *Agenda 21* – a thorough and broad-ranging program of actions demanding new ways of investing in our future to reach global sustainable development in the twenty-first century. Its recommendations ranged from new ways to educate to new ways to care for natural resources and new ways to participate in designing a sustainable economy. The ambition of Agenda 21 was extraordinary for its goal was to make a safe and just world in which all life has dignity and is celebrated (see http://www.johannesburgsummit.org).

As the basis for the programme, the conference took the definition of sustainable development provided by the World Commission on Environment and Development (WCED) and its 1987 report entitled *Our Common Future* (WCED, 1987). The Commission was Chaired by Gro Harlem Brundtland from Norway and the report is sometimes referred to as the *Brundtland Report*. The Rio conference took much of the argument in this report as the basis for its own recommendations. It is one of the most important documents in the field of sustainable development.

The definition is as follows:

> 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'
>
> (WCED, Brundtland Commission, 1987)

This simple statement has provided the basis for most of the debate and actions those engaged with sustainability have chosen to follow.

However Brundtland went on to say:

> 'In essence sustainable development is a *process of change* in which exploitation of resources, the direction of investments, the orientation of technological developments and institutional change are all *in harmony* and enhance current and future potential to meet human needs and aspirations.'(Note: author's italics.)

There are a number of points to be made from these statements for what follows in this book. Firstly, the definition itself has come under criticism because it is argued that it is difficult, even today, to determine people's needs. To try to forecast what they might be in the future is an impossible task. It is too difficult – let's all go home!

However, the further statement above does give a better picture of what can be done. It refers to sustainable development as a *process* and not an end goal or destination. It is therefore open to further learning and adaptation, and to evolution as knowledge progresses. It is about creating a learning environment in which all participants strive to improve the situation that exists for the needs of today and tomorrow. It acknowledges aspirations as well as needs and therefore engages the drive for improvement that is seen in all societies. It is not necessarily conservative and conservationist but it does recognise that a change of approach is needed in which the wider sustainable objectives are part of the agenda for change. In addition, it recognises that it is about *harmony* and balance between often conflicting aspirations and needs. It therefore requires, on occasions, compromise and negotiation rather than imposition. No doubt there are times when imposition is essential, for example when irreparable damage might be done to the environment if action is not taken quickly. However, on the softer issues related to social issues a local democratic approach, where consensus is sought, might provide an appropriate solution.

Seeking a shared set of values

If we are to engage in democracy, both in the imposition of laws regulating behaviour and in local debate and negotiation, there needs to be a set of shared values which allows discussion to take place. At one level it could be argued that the preservation of the human race and the planet to which we belong is a motivation we have in common. This is probably true, but there are some Eastern philosophies that might not consider the preservation of the human species as the pre-eminent driver for sustainable development. Nevertheless most human societies by implication would place it high on their agenda,

even if some would place a different emphasis on the balance between species. All would agree that the preservation of the planet and its ecosystems are of considerable importance.

The establishment of a set of values is important if we are to strive for harmony. Indeed one definition of a philosophy can be 'the system of values by which one lives'. The system is supported by logic and reasoning but underpinning the conclusions is this concept of value. The problem is, of course, that there are many shared value systems. Figure 1.3 is a typical landscape of a city and it can be seen that there are many systems at work.

Figure 1.3 Value systems at work in the city environment.

The photograph identifies many systems of which the following are just a few:

- *Religious system* centred around the church. In days gone by this might well have been the dominant set of values in the locality.
- *Community system* based on the interdependence between the activities taking place and the community that demands and/or uses them.
- *Transport system* which uses vehicles and cars and taxis to ferry people and products around the locality and beyond.
- *Biological system* which sustains human life but also maintains the landscape environment that people and other life forms enjoy.

- *Residential system* which allows people to have accommodation to meet their needs.
- *Business system* which provides wealth and economic activity in the region to support the local community and others.
- *Retail system* which allows the local community and those working in the area to purchase new items to develop their standard of living and sustain themselves.

It is not difficult to see that behind this list of systems there are also a multitude of different stakeholders. Stakeholders are those people who have an interest in the area either political, social, economic or legal. They will have different stakes but all contribute to the area's wellbeing and most will have an effect on its advancement or decline. They will include citizens, lawyers, developers, shop owners, priests, bus drivers, taxi owners, local authorities, politicians and many more. It is also not difficult to see that there is potential conflict between the systems identified as represented by their stakeholders. For example, the demand for business may squeeze out the residents from the area or create transport systems which are different from those desired by the citizens who live there or which have a detrimental effect on the health of both humans and plants. The noise level may increase to the point where the quality of life of the citizens is damaged and it may affect their ability to worship in the church. However, without the business centre it may be impossible to create the jobs people need to sustain themselves and the wealth which supports their life improvement. If the area is successful, the land costs rise and it may be that new forms of development take place which destroy the sense of community enjoyed by those living in the area and attract a different kind of person or activity which is hostile to the current environment.

There is a very complex interdependency between all these systems. Is it pie in the sky to expect that we can have harmony in such an environment? Many would say that it is, and yet our legal systems and governance attempt to create the framework in which, at the very least, minimal protection is given to many of these demands. In some cases the legal systems can work against each other and set in motion plans and activities which are not conducive to sustainable development. Another important factor is the timescale over which the decision will be considered. What seems right and appropriate now, may well seem entirely inappropriate in a generation or even less. Sometimes, and sometimes quite often, the changes that affect an area may come from adjacent areas over which the decision makers in the locality have little control. Indeed, sometimes they may be dictated by policy decisions at national or international level. The harmony we aspire to may be difficult to achieve and yet it is something for which we strive. What is clear is that, whatever we do, it is likely to be imperfect and whatever systems we set up to address these issues must have within them a

high degree of flexibility and be able to be altered and adapted within a variety of time frames.

Striving for a common framework and classification system

If we can accept that some degree of stakeholder engagement with decision making relating to the built environment is desirable, it is also important to consider within what framework or structure we need to have the dialogue. If the dialogue is to be helpful it needs to be at various levels, depending on the participants. For example, it is unlikely to be helpful to have a highly technical discussion with a citizen who may be unaware of the techniques being employed in the assessment. However, it is also the case that every contribution should be able to be pulled together within an understandable structure which identifies where the comment or report is targeted and how it helps the elements of sustainability. The field is littered with models and reports and opinions which are partial and unstructured. It is difficult for anyone to piece these together in a structured way in order to derive coherence from the diverse contributions and also to allow comparison with other assessments. It is rather like a group of people getting together and are trying to communicate when each only knows part of a language and each language is different. Confusion will reign and in the end it will be the dominant participant who knows slightly more than the rest who may get his or her own way either because this person is seen to be superior or because his or her ability to communicate is just a little better. 'In the country of the blind the one-eyed man is king!'

A major part of this book is the attempt to deal with this issue of structure and it will be returned to in Chapter 4. However, it is worth noting at this early stage that the following are required from such a classification:

- ❏ The framework should be common to whatever form of sustainable development is being considered.
- ❏ The framework should allow for the evolution of knowledge about sustainability as time progresses.
- ❏ The framework should not impose solutions but should facilitate thought and debate on the issue.
- ❏ The framework should be understood by all participants.
- ❏ The framework should allow different levels of knowledge to be brought together for common understanding.
- ❏ The framework should contribute to the wider question of global sustainability.
- ❏ The framework should have a theoretical base from which practical decision-making can be implemented.

- ❏ The framework should encourage a vocabulary and thought process that aids communication.
- ❏ The framework should allow the complex interrelationships within sustainable development to be made explicit when required, together with their interdependency.
- ❏ The framework should provide a mechanism by which knowledge gained can be transferred in a clear and understandable way, assisting in the overall education process of society and of the participants in particular.
- ❏ The framework should be holistic and encompass all issues likely to impact on sustainable development.

This is not a trivial list. Many of these issues are fundamental and can apply to a variety of complex problem-solving issues. Although the structure itself is likely to require refinement in the light of new knowledge it should be sufficiently robust for its own underlying principles to be kept intact.

The characteristics of assessment and measurement for sustainable development

Once a structure is agreed it should be possible to develop a method to establish whether progress has been made in sustainable development. This is difficult but is nevertheless vital to the field of study. If it is not possible to establish whether we have improved our performance in our move towards sustainable development it is difficult to justify any decision that might be made now or in the future. How do we monitor progress without some assessment? In addition, it is important to know whether this assessment, if it takes place, is confined by the techniques employed to assess. There is a danger that it might be restricted to those aspects that are easy to measure. This is not unlike the drunk being asked at night why he is searching under a lamp-post for a coin he has lost and replying 'This is where the light is!' Measures that are easy may not produce the right results.

It may be useful at this stage to distinguish between *measurement* and *assessment*. Measurement involves the identification of variables related to sustainable development and the utilisation of technically appropriate data collection and data analysis methods. Assessment involves the evaluation of performance against a criterion or a number of criteria. Both performance and criteria can only be defined by a value-based judgement; they are not empirically verifiable. Indeed the term *performance* must refer to a goal-orientated behaviour, i.e. a behaviour rendered meaningful by the existence of a criterion that specifies when a goal has been attained. So a publicly meaningful assessment can only be achieved if the value system underlying performance and criteria is

shared by both experts and public (Francescato, 1991). This latter statement reinforces the discussion in the previous section – there must be common language and structure to make it intelligible.

The methods employed in assessment are dealt with in Chapter 6, together with the appropriate application areas. There are considerable limitations to all evaluation methods (see Bentivegna, 1997) but these should be made as explicit as possible in order for all participants to engage properly within the process, otherwise the techniques can be misused to exact power.

Certain principles should underlie all assessments in sustainability if they are to be used for maximum benefit. They should be:

- ❏ *Holistic*: They should encompass all the key aspects needed to establish sustainable development.
- ❏ *Harmonious*: They should endeavour to balance or be used to balance the criteria upon which sustainable development should be judged.
- ❏ *Habit-forming*: They should be a natural tool to all concerned and encourage good habits.
- ❏ *Helpful*: They should assist in the process of evaluation and not confuse matters by further complexity or conflict.
- ❏ *Hassle-free*: They should be easy to use by a wide range of people and not require extensive training unless they are to be used by experts, and even then the results and their limitations should be simple to explain.
- ❏ *Hopeful*: They should point towards a possible solution and not leave the users in a state where there appears to be no answer.
- ❏ *Humane*: They should seek solutions which by their nature assist the development of human beings without pain, suffering or undue anxiety.

Again, this is a daunting list which may at this stage of our knowledge be impossible to achieve in its entirety. Nevertheless, it provides an aspiration which should be in the back of our minds as we develop systems for evaluation. It is a sounding board for our development of such techniques.

A review of the literature on assessment techniques will reveal a number of what are called *indicators* for sustainable development. In some ways this is a recognition that the subject does not always have absolute values which we can measure and present as fact. It may be possible to provide hard measures for physical entities such as carbon emissions and levels of radiation in the soil but it is not possible to be so precise with issues relating to social questions or human behaviour. In these areas we can use measures to indicate what is happening but we cannot necessarily measure the direct impact on the environment or sustainability. For example, the downward spiral of economic activity leading to inner city decay might suddenly change when an inner city

area suddenly becomes fashionable as people move into it from the centre of a city because the centre has become too expensive. It is not possible to be sure that this will happen but it may be possible to plot trends that suggest the probability that it might. This could then be an indicator of the regeneration of an urban environment and subsequent sustainability. On the other hand, if the city were to have no water supply this would be measurable and would lead to an unsustainable future, as has occurred in several cities around the world. These issues will be explored later in the book.

Another issue that is also relevant to this discussion is the categorisation of users or stakeholders of such information. There are bound to be different levels of knowledge among them and the techniques will have to be used where they are most appropriate. It would be easy to establish a very complex list of such people and this in turn would add to the complexity of addressing sustainable development. In fact, the French (ATEQUE, 1994) have suggested a comprehensive classification of participants in the built environment. The following list has been developed by the Intelcity Roadmap (EU-IST 2001-7373) from the ATEQUE classification of actors influencing the built environment (*Intelcity Roadmap* – version 4, June 2003).

Civic service providers: the pole of collective interest (ten actors):

- ❏ elected representatives
- ❏ city administrators
- ❏ government agencies
- ❏ regional authorities
- ❏ local authorities
- ❏ research institutions and technical centres
- ❏ vocational training institutions
- ❏ consumer associations
- ❏ non-government agencies for environmental protection and other relevant interests
- ❏ ICT standards organisations

Private service providers 1: the pole of operational decision-making (seven actors)

- ❏ property development companies
- ❏ non-managing building and infrastructure owners
- ❏ managing building and infrastructure owners
- ❏ banks and other financial backers
- ❏ ICT development companies
- ❏ non-managing ICT infrastructure, broadcasting and content owners
- ❏ managing ICT infrastructure, broadcasting and content owners

Private service providers 2: the pole of design (ten actors)

- ❏ designers – architects, engineers etc.
- ❏ property and construction technical consultants
- ❏ town planners
- ❏ landscape architects
- ❏ construction economists
- ❏ designers – software engineers
- ❏ ICT technical consultants

- ICT systems designers
- network developers
- IST/ICT economists

Private service providers 3: the pole of production (six actors)

- construction material producers and distributors
- construction contractors and managers
- development control officers
- ICT component producers and distributors
- network and ICT equipment manufacturers and managers
- network development control officers

Mixed public/private service providers: the pole of use (five actors)

- transport and utility service providers
- facilities managers
- insurers
- network and network service providers
- network and ICT facilities managers

Citizens: the pole of use (six actors)

- users of buildings
- users of public open space
- users of transport and utility services
- users of city ICT services
- users of ICTs
- users of network and network services

However, a much simpler grouping which might also define the nature of the techniques that might be employed could be as follows:

- *Citizens*: This general group would include all lay people engaged in the process who have no formal training in evaluation but nevertheless should be engaged with the decision-making process.
- *Clients*: This group would be largely the people who directly commission development within the built environment. They are interested in the impact on their own or corporate objectives. In private development this can either be for the client's own accommodation or speculatively for tenants and users. In the public sector their interest will be to establish value for the community.
- *Consultants*: This group would include the specialists and experts employed to create change and see through the procurement process. Their main objective will be to provide for a reasonable fee a service that satisfies the demands of their client base, as defined by themselves or the people who pay them.

Each may require a different set of techniques but within a standard structure and with consistency in the messages that derive from the

techniques (See Fig. 1.4). This approach is still in its infancy but will be addressed further in Chapter 4. The key issue is whether the techniques employed encourage debate within the stakeholder group and whether they direct the decision-makers to a more sustainable development and/or one that has the flexibility to adapt to new circumstances relating to sustainability over time.

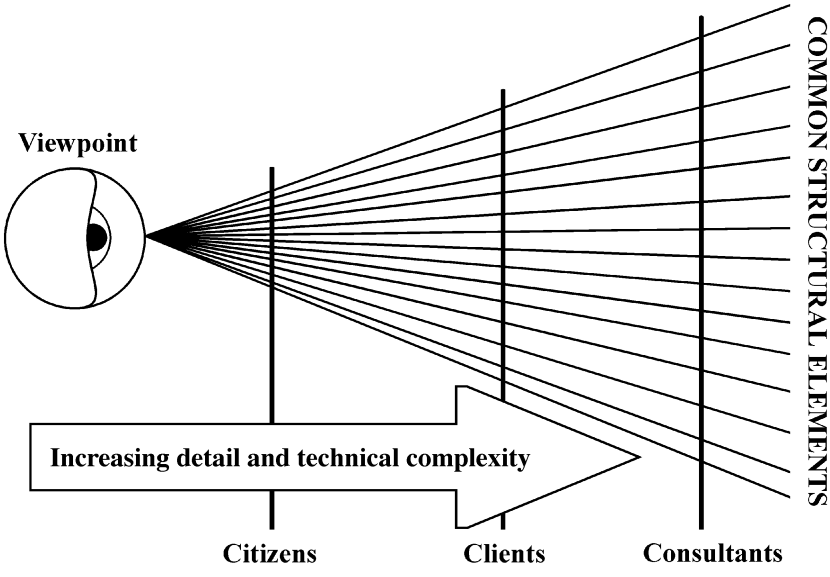

Figure 1.4 A consistent and integrated view for all parties to the sustainable development process.

Management and intervention for sustainable development

The discussion so far has focussed on the underlying issues related to sustainability and our understanding of the term itself. The concept of evaluation has been brought in and some of the issues related to measurement and assessment have been addressed. But for what purpose are these structures and measures? They are of little value on their own unless we can use them to do something which will alter events. To do this it is implied that human beings must intervene to ensure that something positive results. There is an irony here because it is often human intervention in the past that has created the severe problems we have today. Now we have a different set of assumptions from the past based on our improving knowledge of the earth and its eco-systems but we also recognise that even today our knowledge is far from complete. We also recognise the complexity of the systems we are

dealing with. This must mean that we have to tread carefully when putting forward ideas for change and we must allow for flexibility so as to be able to respond to the better understanding we may have in the future.

The discipline charged with the task of controlling and implementing change is that of management. Managers are thought to possess the skills which allow change to occur efficiently and effectively. However, what is the responsibility of management? Webster's Dictionary defines the role of management as 'to bring about or contrive' or 'to direct or conduct the affairs of something' . This raises a whole series of questions. It is not clear, in the case of sustainable development, what 'management' is to 'bring about'. We have argued previously that it is a *process* rather than a *destination* and the end goal in terms of what the sustainable world might look like is changing and unstable.

The timescales and complexity of the issues that contribute to sustainability are also major factors. In sustainable development we are talking about long-term issues and a whole variety of things that act together with a complex network of interdependent issues which may well be changing as time progresses. No one manager has control over the whole series of factors and in addition the timescales mean that, even if he or she did have such control, it is almost certain that the management would change over time. This raises the question of who would hold the blueprint for sustainable development that we might design right now. In reality it is likely to be held by a large number of organisations and people who may well be going through several transformations over relatively short periods of time. Who will feel the ownership and responsibility to see the process through?

Part of the role of management must be to bring the stakeholders together and strive for a degree of harmony between them. It must also be about timing and determining the process and trying to get the optimum balance between all the factors making up a sustainable development. But optimum for whom? Each stakeholder will have a different view, no doubt! The manager will also be responsible for the interactions between people and organisations, and for when they should be consulted and when they should act. It is obviously a very complex problem which cannot be viewed in the normal management sense. Indeed, it seems to be more about changing a culture within a community and then establishing a learning environment responsive to that culture which is constantly reviewing its previous decisions as time goes on.

Managers have an important role to play in the process and new management systems are required to deal with such a long-term and complex issue. It is not goal orientated in quite the same way as conventional management operations, at least not at the strategic level. At a tactical level decisions have to be made and they would follow normal management practice except that the complexity of relationships

and ownership of the problem could still be very diverse indeed. The choice of system is critical to what follows. There is a tendency for some prescriptive systems to control in a way that is counterproductive for the learning environment required for continuous improvement. It is when managers have the insight to see that systems cause their own behaviour that these issues can be tackled effectively. These matters will be explored further in Chapter 8.

Implementing management decisions

At some stage in any process that is going to change events someone will have to make a decision. This statement is not as naive as it sounds. We can define the problem of sustainable development for ever and a day; we can bring out statistics that make clear the degradation of the environment; we can develop systems that are meant to provide a framework in which we can work; but if we do not get to the point where we can make a decision, all will have been in vain. To be able to do this we need to be clear about what decisions need to be made and who will make them. The question is 'Can this be left to chance or does some order need to be brought to the process?'

If it is left to chance there is every likelihood that something will get missed. If we make the process too prescriptive, either the balance between issues will get distorted or we will be led in a specific direction dictated by the system we are following. Neither of these approaches is desirable. We need to create a flexible decision-making environment where all factors are considered and where a structured approach can be taken which has order without regimentation. We need to know we have covered everything, and that all parties are aware of progress and the critical points for 'go' or 'no go' so that we can work in harmony together.

This would suggest that a protocol of some kind is required to achieve such an end within the process of planning, designing and building, and perhaps one of the most valuable approaches is that developed by Cooper for a process protocol (see Chapter 7) in terms of the development process for construction (Cooper, *et al.*, 1998). A protocol is any rule, code of behaviour or etiquette used to achieve or perform an action. It can therefore be formal or informal but in the majority of cases would contain some clearly agreed approach or standard. In Cooper's Process Protocol there are a number of hard and soft 'gates' in the process through which the decision-makers pass. The 'soft gates' allow progress to be made without all decisions being firm while the 'hard gates' are points in the process where the process itself cannot continue unless a firm decision is made by those engaged at that point in time. It has been suggested that this procedure might be applicable to sustainable development, and the Cooper research team

have considered working on a protocol for sustainable construction which can be superimposed upon the overall protocol as already developed and integrated within it.

There is certainly a case to be made for a generic model that will provide a template for evaluating and implementing sustainable development at all levels in the sustainable development process. In a complex arrangement with a vast array of potential stakeholders, some form of standardisation is essential if all are to know how, and when, they can participate. It would provide a level of transparency which would aid participation and allow all participants to understand the process and the techniques being employed. The danger would be if this became too bureaucratic and slowed down processes just because of the weight of the management overhead involved. It is a balance between getting as close as we can to the right solution and the time and effort required to get there.

Summary

This chapter has attempted to provide a context for the subject of sustainable development within the built environment. It has introduced some of the arguments and has set the scene for what will follow. Sustainable development has been presented as a process that is emerging and evolving to reflect the knowledge that is emerging and evolving at the same time. It has argued for six requirements in the development of models and processes to be considered to address the evaluation of sustainability:

- *Working definition*: Here it has been suggested that the WCED definition might be appropriate even though it has inadequacies.
- *Shared value system*: We need a consensus around a set of values in order that all stakeholders can participate.
- *Robust classification system*: This is needed to provide a structure for discussion within which knowledge-building can take place.
- *A set of assessment/measurement tools*: These are required to assess whether progress has been made.
- *Management framework*: If humans are to intervene in the process they must operate within a system that they understand, and because of the timescales involved they must develop such systems to be flexible and to provide an active learning environment with a culture of self-improvement.
- *Process Protocol*: This is required to ensure that all knowledge with regard to sustainable development is addressed at the right time and with the right technique or approach, otherwise some stakeholders will be disadvantaged.

One further issue needs to be explored and that is the question of the time horizon up to which any decision-making is intended to apply. This is a big subject but it is critical to our understanding of process and what can be achieved by any group of decision-makers. This requirement is fundamental to the whole of the evaluation process. Much modern planning can be considered to be short term and without consideration for future generations. It is often dictated by economic criteria prevailing at the time whereas truly sustainable development requires the long-term view. We will return to this in Chapter 3.

2 Approaches to Evaluation

Chapter 1 provided an outline of the issues related to sustainable development and suggested that certain needs must be met. It is the intention of this book to put forward a structure that can address some of these issues although it is recognised that there is much work to be done in creating the tools which will allow the complete set to be implemented. For some time it has been recognised that unless some evaluation can take place it will be impossible to judge whether progress has been made. But progress towards what?

In the previous discussion it was recognised that sustainable development is a *process* and not a destination. It is something ongoing which is at the same time a learning activity whereby behaviour is modified as we learn from our actions and the growth of knowledge. It follows, therefore, that it is likely to be imprecise in terms of measurement and evolving in terms of content. This would suggest that it might be useful to concentrate on the structure by which knowledge is gained and classified in order that new knowledge can be identified and placed within an appropriate framework. This will allow relationships to be expressed that will address the complexity of the multi-criteria and multi-dimensional nature of the problem. Sustainable development rests on the *harmony* between the needs of stakeholders, and they require a framework within which they can address the issues that affect them.

Underpinning the framework must be an understanding of what we are trying to achieve and what we need to do to get there. The driving force is often the environmental agenda and therefore it is the value systems pertaining to this agenda that provide the foundation for the approaches taken by many researchers and practitioners in the field. There are a large number of these and most are partial in terms of the total sustainable agenda. For example, some just address the energy

issues, others the issues of pollution or contamination, and some just focus on conservation or historical development. These are not *wrong* in any sense but it must be recognised that they fulfil only part of the agenda for a sustainable development. There are also some which are more fundamental and provide a generic approach. It is worth looking at a few of these to see how they might impact on our future proposals in the book.

The Natural Step

The Natural Step approach was originated by Dr Karl-Henrick Robert in Norway in the 1980s and in 1991 he attempted to describe the basic environmental laws that would form the basis of a sustainable society. These arose from a scientific consensus of what was required to maintain the earth's systems. This consensus focussed on what were called 'system conditions' and these became the primary focus of the Natural Step creators. The Natural Step emphasises that the only long-term sustainable approach in which business and society can operate is within the earth's natural cycles. It accepts that answers to the wide and complex environmental problems facing society are not clear so it returns to basic science as the foundation of a consensus view (Robert, 2002).

The scientific principles are:

- Matter and energy cannot be destroyed (first law of thermodynamics and the principle of the conservation of matter).
- Matter and energy tend to disperse (second law of thermodynamics) so that sooner or later all matter introduced by man will be released into the natural system.
- Material quality can be characterised by the concentration and structure of matter – we never consume energy, only its exergy (i.e. we decrease its order, purity and structure).
- Net increases in material quality on earth can be produced by sun-driven processes. Disorder increases in all closed systems (second law of thermodynamics), therefore an exergy flow from outside the eco-sphere is needed to increase order.

In this frame of reference 'quality' represents the value of a resource. Higher quality means a material is more useful, e.g. 'concentrated' iron is more valuable than iron ore, and so on. Throughout evolution, energy from the sun has driven natural processes which have provided a continual increase in quality, e.g. concentrated hydrocarbons. Current industrial society reverses this process with the loss of material quality being waste and pollution. Fortunately, nature constantly tries

to produce quality by reprocessing and reconcentrating waste into more valuable resources, in a cyclical process. Recent industrialisation has imposed a linear process in which quality is consumed faster than it is produced in nature (Stahel, 1996; Jackson, 1996).

From an understanding of nature's fundamental cyclic principles, the authors of the Natural Step believe that this can be accomplished through four basic sustainable conditions. These provide the framework within which assessment and monitoring can take place. The four conditions are:

(1) *Materials from the earth's crust must not be systematically increased in the atmosphere*. In practice this means the extraction of fossil fuels, metals and other minerals no faster than their redisposition into the earth's crust – in other words radically decreased mining and use of fossil fuels and minerals.
(2) *Materials produced by society must not systematically increase in the eco-sphere*. In practice this means the production of substances no faster than they can be broken down and reintegrated into the cycles of nature and the phasing out of persistant man-made substances not known in nature, e.g. CFCs.
(3) *The physical basis for the productivity and diversity of nature must not be systematically diminished*. In practice this means the harvesting and manipulation of eco-systems that preserve productive capacity and diversity in order to husband the capacity of nature to reconcentrate and reconstruct waste in a way that maintains the productivity of the land and sea.
(4) *There must be a fair and efficient use of resources with respect to meeting human needs*. In practice this means that society's values should allow sufficient stability to achieve the other three conditions by doing more with less through a much more resource-efficient lifestyle in the wealthy sections of society.

These are, of course, important guiding principles and they provide an effective sounding board for much of the discussion on sustainable development. They also provide a context within which business can judge its efforts and they have been used by a large number of organisations that are sensitive to the environment or see long-term business advantage in addressing sustainability issues. The Natural Step suggests that organisations are not expected to achieve long-term goals immediately. Firms are encouraged to move systematically towards the goals by making investments that will provide benefits in the short term while also retaining a long-term perspective. Organisations can use the Natural Step framework to map out a series of steps that will eventually lead to sustainability. It is often appropriate to start with the 'low-hanging fruit' and to take the steps that are easiest and that will achieve results that will help move the organisation towards its goals.

This pragmatic approach has been attractive to a large number of organisations.

Dr Robert's approach has been endorsed by over 50 of Sweden's leading scientists and has been backed by a number of large Swedish industrial concerns including Electrolux, Scandic, IKEA, OK Petroleum, Gripen, SJ (Swedish rail), Bilspedition and over 60 local municipalities.

In America The Interface Corporation, the world's largest manufacturer of commercial carpet tiles, was one of the first companies to embrace the concept. In just a few years it had revised its processes and products in line with this approach and had saved approximately $76 million. It has since been joined by a number of other American companies including Home Depot, Nike, Mitsubushi Electric (USA), Collins Pine (Forest products), Placon, IKEA and MacDonald.

In the UK the principles underlie 'Forum for the Future' led by Jonathan Porritt and worldwide the Natural Step organisation now includes over 10 000 professionals and nineteen networks from all disciplines.

These firms and organisations appear to recognise that viewing sustainability issues through a framework that has a strong environmentally friendly future perspective is good for their business and their relations with the community. They see the process as gradually moving in a strategic way towards a vision rather than solely trying to solve problems caused by the mistakes of the past. The method claims that the potential benefits of doing this include reduced expenses for resources and waste disposal, avoidance of future liability, enhanced innovation and improved internal morale and motivation.

In practice the approach has been of benefit to many, but it is not easy to know what would take priority for the shareholders if there were a conflict between short-term profit and long-term environmental payoff. It will depend on the commitment of the organisation to The Natural Step principles and how far they are prepared to examine their trading activities to meet these goals.

In particular, the last principle of meeting human need is difficult for any organisation to determine, let alone to action. At the national level the distribution of wealth is something that is debated continuously in most democratic countries but the evidence in most economies is that those who have get richer while those who have not get relatively poorer. Is this sustainable in the long term? In time this is likely to lead to a loss of social cohesion. A firm which might be trying to contribute to meeting the needs of all its stakeholders might find it difficult to address this issue in any meaningful way. This is true for any organisation irrespective of the structures and frameworks within which it chooses to work. It is, however, a fundamental aspect of the WCED definition of sustainability (i.e. meeting current and future needs) and the themes of the Rio World Congress.

The concept of community capital

Another way to look at sustainability is through the concept of 'capital'. This term is familiar to those engaged in financial markets and refers to the accumulated wealth, usually (but not exclusively) of a company. However, it can also be applied to other facets that contribute to a wider definition of wealth.

Maureen Hart, in her *Guide to Sustainable Community Indicators* (Hart, 1999), suggests the following as being contributors to what she calls *community capital*:

- *Built and financial capital*: manufactured goods, equipment, buildings, roads, water supply systems, jobs, information resources and the credit or debt of a community.
- *Human and social capital*: the people in society, their skills, education and health, and their ability to co-operate and work together.
- *Natural capital*: the natural environment, which includes natural resources (both renewable and non-renewable), the services that the eco-system provides and the life-enhancing qualities of nature.

All of these types of capital are necessary for communities to function. All three types of capital need to be managed by a community. All three types of capital need to be cared for, nurtured and improved over time. Hart (1999) goes on to suggest that this can be represented diagrammatically as a pyramid (Fig. 2.1).

The base of the pyramid is the *natural capital* which relates directly to The Natural Step systems but is extended to include those matters that a community finds attractive or beautiful. The second layer of the pyramid relates to human and social capital and has two blocks, people and connections. This begins to extend the concept of sustainability much further than the Natural Step. *Human capital* is each individual's personal skills and abilities, physical and mental health and education. Social capital is the connections in the community and the ways in which people interact and relate to each other. The simplest connections are connections to family, friends and neighbours and we can then proceed on to the larger scale where we form connections through community organisations, links to government and the ability to form commercial organisations to create goods and services to satisfy the needs of the community. Finally, the remaining level of the pyramid is *built capital* which provides the physical infrastructure and supplies the needs that allow the other levels to flourish. It includes roads, transport, factory buildings, houses and basic necessities such as food and clothing together with luxury goods such as dishwashers, cars, telephones and computers.

Money is not included as money is just a medium by which we

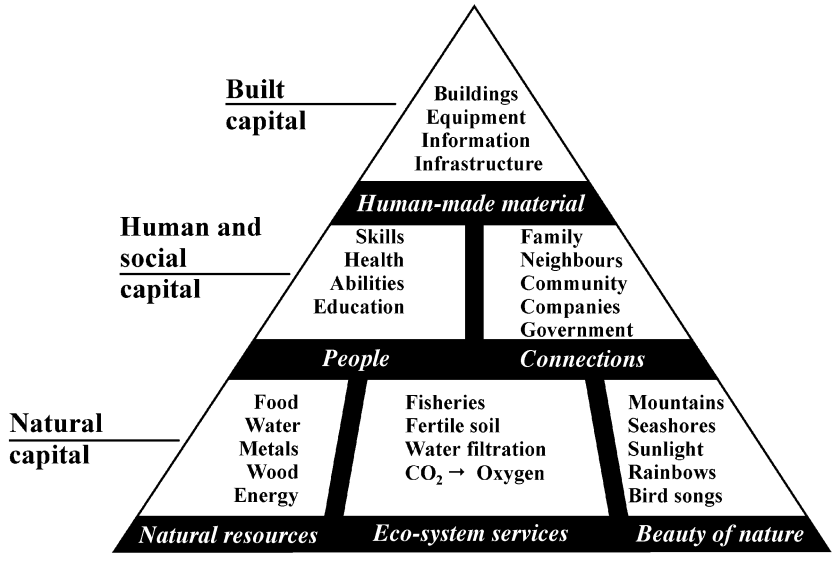

Figure 2.1 Sustainable community indicators. (Reproduced with permission from Hart, M. (1999) *Guide to Sustainable Community Indicators*, 2nd edn. Hart Environmental Data, North Andover, MA.)

exchange goods and services. We do not have to use money as we could exchange by barter, for example.

The three forms of capital are measured in different ways and this is what makes them difficult to compare when trying to make value judgements. A value can be given to a house or car or share of stock in monetary terms. It is much more difficult to place a monetary value on those items that appeal to the human senses or contribute to a sense of wellbeing. A mountain view, a clean beach, the ability to read, contentment in a child and an open and free government are all of value to the community but are difficult to capture in monetary terms, although some try to do this through techniques such as cost-benefit analysis. In trying to get harmony between stakeholders and even between the priorities you might hold as an individual, it is very difficult to know what weight to place on one feature rather than another.

Nevertheless the concept of capital would appear sensible. The driving force behind the sustainability debate has been the loss of natural capital through human intervention in the environment and the pollution created by this intervention. In our daily lives we try to live off the interest that we gain from investments rather than lessen the capital, which, when invested, earns that interest. If we eat into our capital we will have less interest to enjoy, and eventually we will find we have no capital from which to gain income. Extrapolations of what is happening to our planet as we use up the non-renewable resources are forecasts of what is likely to happen to our natural capital. It will

eventually disappear and we will be able to get no return. We are not always sure we can find an alternative that will give the same service or satisfaction.

The concept of *community capital* takes this a stage further. It recognises that people's quality of life also depends on other matters which are not just about food and shelter and our access to natural resources but about how we can assimilate, create, interact, celebrate, care for and enjoy ourselves. In turn these things have an impact on what we demand from the man-made environment and consequently what will be taken from natural capital to satisfy these wants. Where these things are in balance we do not use up our capital at a faster rate than we can replace it. Where they are out of balance it can lead to disaster or extreme difficulties. This book is largely about the built environment and its contribution to sustainable development. It is therefore largely addressing the top of the pyramid and how we create systems that allow us to monitor whether natural capital and the response to demand are in equilibrium. However, it must also take into account the communities that create the demand and how development is contributing to the satisfaction of these wants in a sustainable way. This raises another issue: it is possible to invest and to create more capital. Most communities will want to improve their position rather than stay where they are. The Brundtland definition of sustainability (see Chapter 1) recognises this and specifically mentions meeting the needs of future generations. The question is whether this improvement can be achieved without depletion of the capital base.

At the present time there are many examples throughout the world of communities giving up their natural capital and thus degrading their community capital. The obvious ones are the depletion of the rain forests in Brazil, the depletion of fish stocks in the North Sea, and the pollution of air, land and water in many places. It could also be argued that human capital is being degraded in some communities through poor health promotion (e.g. the spread of AIDS), insufficient and inadequate education, poor training for employment and so forth. In some cases the legal and financial infrastructure is not sufficiently robust to support the values of society or the need to conserve non-renewable stocks of resources. All these factors have a contribution to make to sustainable development.

At the level at which this book is considering sustainable development, i.e. at the largely urban level of the built environment, these larger matters of community capital are viewed from the local perspective. However, some of these issues are global in their nature, affecting other communities way outside the community that is making the decision to deplete the natural or other capital. Each local community will be making an impact on the world outside and cannot ignore the interdependence between itself and others.

The concept of community capital is one that is useful in any deliberation on sustainable development and it is important that any structure or evaluatory system attempts to preserve capital wherever possible. Again, it provides a conceptual framework which allows us to explore sustainable development in a useful way.

The ecological footprint

So far we have addressed approaches that build on the broad issues of the environment and the way in which an understanding of capital can be used to test judgement and explain the concept of sustainable development. These are compatible approaches where one extends the other. Another approach is to look at the impact that an individual or an individual development has on the environment and/or the community in which they live or are developed. This is sometimes referred to as the *ecological footprint.* A footprint is of course a measure of the amount of space that a person uses to stand upon the earth's surface. It follows therefore that an ecological footprint is a measure of the amount of space a person uses in the eco-system. To take a simple example, imagine yourself living in a glass dome that covers you and some land around you. If the dome is too small you will quickly run out of air to breathe, and if it were a little larger you might have enough air but might run out of water or food. If you include enough space to provide all your needs such as energy for heat, electricity and transportation, housing materials, food, clothing, etc. as well as enough land to assimilate all the waste that you generate and to convert all the carbon dioxide to oxygen, the result would be your ecological footprint.

The size of your footprint depends on the amount of resources you consume. Someone who travels by foot or by bicycle has a smaller footprint than someone who travels by car. It could be that someone who lives in a small well-insulated house has a smaller footprint than someone who lives in a large, poorly insulated house although the ecological impact of the extraction processes for the insulation and quality of materials, known as their *embodied energy*, would have to be taken into account. In the developed world it is lifestyle issues that are playing an increasingly large part, including food menus requiring the transport of ingredients from across the world, leisure activities and methods of transport.

Some of the figures generated by this form of assessment are quite staggering. It is estimated that the average American's ecological footprint is over 13 acres. This compares with a world average of 4.68 while in India it is 1.04. Figure 2.2 shows this in diagrammatic form. However, even with the existing population and the amount of productive land, there is less than 4 acres available per person on the

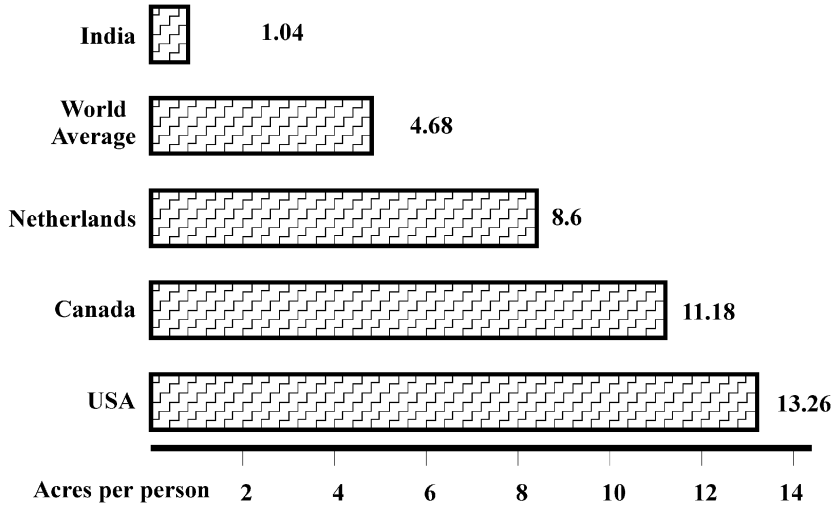

Figure 2.2 The ecological footprint of countries. (*Source:* Wackernagel & Rees, 1995.)

whole earth! If everyone consumed as much as the average American we would need two more earths. It is clear that this level of consumption would not be sustainable if every one on earth were acting in this way. It would require a major reduction in the earth's population just to allow this kind of behaviour to continue if the wealth and lifestyle aspirations of those in the developing and Third World are to be realised. Alternatively the developed world has to seek new ways of achieving its quality of life without endangering the planet on which the activity takes place. It would require a change in lifestyle that uses natural resources without degrading or destroying the ability of the eco-system to continue to provide those resources and services indefinitely (Wackernagel, *et al.*, 1993).

Imagine now looking not at the individual but at the impact of a new building or development. What would it take to bring the building or development into operational being and what would be the impact on the eco-system? This would include all the energy required for the extraction of materials, the transportation of materials and labour, the infrastructure for the construction process, the materials for the components, the communication links, the water supply and so on. Then you would have to consider the running and organisational costs of the building and all the activities and heating/cooling, etc., that were needed to meet the occupiers' demands. Finally, you would have to consider the issues related to demolition and disposal as well as the disposal of waste over the lifetime of the property. The ecological impact could be vast.

In construction and building the notion of footprint is well understood. This is the area of the planet's surface directly covered by a building's ground floor plan. However, its ecological footprint is not so well established. In one sense it could be argued that every building is an act against nature (Cooper & Curwell, 1998). A building directly makes some proportion of the earth's surface organically sterile by covering it over, rendering that area of soil incapable of producing those natural resources that require the interaction between soil, sun and water. As a result, in ecological terms the building is a parasite, what Rees (1992) describes as 'a mode of pure consumption' which calls on an extensive external resource base to sustain the life that it houses.

It follows that a building's footprint is very much larger than the physical footprint it occupies. It will require other activities to support it, many of which will be elsewhere and distant, and each of these will have its own ecological footprint. These may grow into economic or cultural dependencies which may develop instability or new power structures when acting together with other aspects of a global economy. These in turn may create social unrest and lead to conflict and more wastage and pollution. For a large building as for a city, the ecological footprint may extend across the planet, drawing in materials from developed, developing and Third World countries. This problem of boundaries and interdependence makes the development of an assessment tool based on the footprint very difficult.

For a city or building to be described as sustainable its ecological footprint should closely match or be smaller than its physical footprint. This is achievable only by using the minimum of resources, by obtaining them locally and by minimising the amount of resulting pollution and waste to a level that can be disposed of safely within the confines of the site or community. This is the concept behind the autonomous building or city. However, autonomy is too unsophisticated and restrictive to effectively define sustainable urban development in modern complex market economies. The idea of replacement or renewal is better. This accepts that resources are finite and, combined with man's ingenuity and technology, can supply a given maximum at any one time. Finite resources are being drawn upon too heavily so we must replace the natural capital that is used by any particular development. This idea is supported by the concept of total cost accounting, in which the external costs of environmental degradation of the production process are represented in the internal costing of products and services – which in turn is reflected in the 'polluter pays' principle (see Constanza, 1991). These ideas have the attraction that a number of traditional ways of assessing 'progress' such as money, energy, labour content, etc., can be used to assess sustainable development (Cooper & Curwell, 1998).

Discussion

These concepts are useful, particularly in terms of the environment. They provide us at a very strategic level with conceptual criteria which we can apply to a new or existing development to ascertain whether or not the development is going to be sustainable. In the case of the Natural Step and the ecological footprint, they are looking at the issue of sustainability through the filter of the environment and the reasons why people behave in a certain way to cause these things to happen are largely ignored. It is the end result that is the focus and not the processes leading to such an eventuality. Of course when these are used in practical decision-making they act more as checks and drivers on the processes and measures used to judge them. It is a little like assessing the result of a general election. The end result is clear but the reasons *why* people voted in a particular way need much further analysis and a great deal of knowledge of the factors that concerned people at the time. This in turn requires an understanding of their culture and the framework within which they live their lives. This framework includes the value systems that they hold dear and the legal and ethical framework that reflects these values. None of these issues is overtly reflected in the two systems although it could be argued that the concern for the environment and the preservation of the human species are strongly represented.

The concept of community capital takes the matter a stage further. It looks at a much wider range of issues which ultimately have an impact on the way human beings intervene within the environment. However, it looks at them as capital which in this context means the wealth and resource available to be used at any point in time. Is this resource being depleted or is it being enhanced? Will future generations be able to use this resource for their benefit or will it diminish or disappear and not be available to them? In the case of the natural capital this could be disastrous unless renewable alternatives are found or space freight travel occurs and we can mine other planets. Since both of these are unknowns, we can assume that in our timescale for decision-making space travel, at least, is not part of the equation. We cannot easily predict how technology will develop to create alternatives so it may not be sensible to build any strategy for sustainability on this expectation. We could have damaged our planet beyond repair before the alternative is produced to satisfy our needs.

Nevertheless, the introduction of community capital is very helpful since it begins to address the *processes* by taking us into the realm of human behaviour, values and judgement – the very things that decision-makers have to deal with when making practical decisions. However, there are still limitations. It is still monitoring the end result and not the interrelationships which take us to the point where capital is created or diminished. The processes are implicit in the system but

not explicit. It is a little like looking at the value of your house and not considering the multitude of processes, decisions and external factors that act together to reach the finite sum we call house value. The concept of the value of the house is largely an economic one but it derives from supply and demand. Demand will reflect society's values in terms of accommodation requirements (bathrooms, kitchens, etc.) and also location, perhaps the most important variable for most house prices. The supply side will provide what society demands, whether that is brick external walls, two bathrooms, a level of heating or cooling to provide comfort, gold plated taps or whatever. Society, on the other hand, may wish to control some of these issues so it produces planning laws or gives powers to local authorities or introduces anti-pollution legislation which limits what can be done.

The strength of the relationships between this mass of variables and the way they interact is important. In addition, the concept of capital gives little indication of what affects what and by how much. Obviously these are major issues which any structure is going to find difficult to address. However, perhaps we should be striving for something which keeps all these concepts intact but takes them still further in providing an understanding of relationships and how they impact on sustainability. It needs the widest possible terms of reference because practically anything that occurs in the world can be said to have some impact on the question of sustainability and sustainable development. In Chapter 4 we try to put forward another framework which attempts to provide further illumination of this question.

For the moment we will leave the matter of structure, process and interrelationships and will focus on the evaluations we may think are appropriate for assessing progress in sustainable development. Evaluation tools are critical for such monitoring but they are also important for setting targets for the future and for gauging the importance of the variables which contribute to the concept of sustainability. Without them it is hard to rank, prioritise, measure and act in a sensible and auditable way.

Why evaluate?

If people are going to adopt the principles of sustainable development they will need to adopt policies and possibly commit resources to achieving sustainable objectives. Sooner or later someone is going to ask whether this investment of resource or adoption of policy is working. To answer these questions requires evidence and this evidence must be acceptable to all the parties involved. In practice, for large developments, it is likely that what constitutes evidence will be agreed in advance and may well form the basis of the decision to go ahead. Evidence can come in many forms but in the vast majority of

cases will be reflected in some sort of quantitative measure. Even where the evidence is of a qualitative nature, for example the happiness of the community, a survey that provides statistics on the views of the population being studied will be required. The qualitative data is thus represented in a quantitative form.

If this is accepted as a requirement, the issue becomes one of 'what aspects of sustainable development do we evaluate and in what form?' This is not an easy question to answer and there are literally thousands of organisations across the globe attempting to establish sets of information that will address this issue. Of course there is massive overlap between the sets being developed but at the same time the communities to be evaluated often have their own particular issues which they want to address and these may not be applicable to others. In addition, and this is even more common, they will want to prioritise the criteria to suit their own particular circumstances. In a study of the suburbs of two cities, Salford and Turin, with similar profiles of workers, Salford residents placed the reduction of crime as their highest priority and Turin residents placed environmental quality as their highest requirement (Curwell & Lombardi 1999). To some extent this reflects the present state of affairs in the neighbourhoods and a previous lack of investment in certain areas of public life. The starting point is different for each case study under consideration. If these highly ranked issues are addressed in twenty years time they may be reversed for each city if adequate action is not taken to resolve the changes that may take place over this period.

There appears, therefore, to be a requirement for a high-level, strategic, questioning framework that is generic to all issues of sustainability. We also then need, for a particular scheme, a specific framework that operates within the generic framework but takes into account the local issues. This raises the questions of *what we measure* and to *what level of detail*. We also need to ask *what level of reliability* we would find acceptable.

Indicators and measures

If we are to evaluate sensibly we need enough information to enable us to make sensible and good decisions. It is possible to measure many things to several decimal places but the extra benefit obtained from measuring to this level of detail diminishes rapidly beyond a certain point. In fact in some cases it is counterproductive to have too much detailed information since it can confuse, can give a false impression of accuracy when the underlying data from which it is abstracted is not measured with precision, and can add to the computation problem. Imagine all the detailed information that goes into the calculation of ecological footprint outputs. We could present the accumulated data to

many decimal places but, firstly, many of the inputs would be fairly coarse measures; second, the data would probably be out of date now; and third the conversion to 'carrying capacity' is not a precise art. However, the output is not devalued by a broad approximation. It *indicates* the comparative values between societies and allows us to draw a reasonable conclusion.

To take another example from everyday life, we do not require a very precise measurement of the amount of gasoline or petrol left in the tank of our car when we are taking a journey. The purpose of the measure is to tell us when to fill up again to avoid running out of fuel. We know that when the tank gauge shows it is empty, with or without a warning light, we will have enough petrol to get to a reasonably close petrol station. When it is half-full we can gauge roughly when we will need to fill up again on a long journey. The indicator has to be timely to be useful. It would not be of much use if the petrol or gas indicator only showed the position at the start of the journey and did not keep the driver informed along the way. It also has to be understandable in that it must convey the information quickly and effectively. Petrol gauges can come in different forms such as a dial or an electronic presentation but they have the same purpose. These rough indicators, the measures used and the methods of presentation are sufficient for the purpose for which we use them. If, on the other hand, we wanted to undertake a test of the fuel efficiency of the car we might need to measure every drop of petrol used and the precise distance covered.

Indicators therefore are presentations of measurements to suit a particular need. They are pieces of information that summarise the characteristics of systems or highlight what is happening in a system. Indicators simplify complex phenomena and make it possible to gauge the general status of a system. An indicator helps you understand where you are, which direction you are going in, and how far you have to go. It both assesses the current situation and gives advice for the future. Indicators can alert you to a problem before it becomes critical and in some case can help the user recognise what needs to be done to resolve the problem. Sometimes it is useful to bring many indicators together to provide a composite assessment of what is happening and this is called an *index*. However, an index is an indicator in its own right, simplifying the complexity of the indicators that form its constituent parts.

The essentials of all good indicators are therefore as follows:

- ❏ They must be *relevant* and fit for the purpose for which they are intended.
- ❏ They must be *reliable* so that you can trust the information the indicator is providing.
- ❏ They must be *easy to understand* even by the people who are not experts in the field.

- They must be based on *accessible data* so that the information is available while there is still time to act.

Traditional versus sustainability indicators

The reader will be aware of the very large number of indicators that abound in the world today. All the developed nations have a long history of collecting information that could be useful to them in making strategic decisions and in particular for advising government on policy issues. The areas where these indicators proliferate most are in the economic fields where the economic performance of a government is critical to its survival in office and in advising the financial and trading markets on where to invest. These may be measures of, for example, trends in employment, inflation, level of investment or gross national product. Gradually these measures are being brought into line so that comparisons can be made across national boundaries.

Other sectors are also producing similar sets of measures that gauge how they are performing. For example, the health services may want to measure life expectancy or waiting lists at hospitals or cost efficiency per patient. The education services may want to measure the cost per pupil, the performance of school children in standard tests or the league tables on school performance in a particular area. The transport departments may want to examine the congestion in an area judged by the number of cars passing through a checkpoint or the number of passenger miles travelled on public transport. With increased accountability the number of indicators has grown enormously. It is important to realise that most of these indicators are derived from some kind of model which a group of people, usually designated as experts, have decided is the appropriate way to measure or evaluate a particular feature. There can be arguments for different measures depending on what end result is required.

Sustainability raises another set of issues which may not be reflected in these traditional measurements. For example, the economies of most nations are measured in terms of gross national product (GNP). This drives the agenda of most governments and is thought to be a gauge of prosperity. However, sustainability wants to look at the quality of life over the longer term. It is more concerned with long-term prosperity and the underlying issues that reflect this quality of life. Normal GNP measures may not reflect these issues. For example, a country that has a large number of car accidents may well see its GNP grow because these accidents place extra demand on the health services and extra demand for new cars or car repair services. These push up the GNP but it would be difficult to argue that this aids sustainability or adds to the quality of life. On the other hand, if a large number of citizens decided to walk to

work the population would be fitter and would place less demand on the health services, but the GNP would go down.

To take some other examples, a traditional indicator might use the cost of electricity as a measure for energy but to use this as a cost of consumption, without regard to the effects on the energy use, would not assist in indicating an improvement or otherwise of sustainability. If the cost is lowered it is likely to increase consumption which might not be desirable from a natural resources or air pollution perspective.

Another indicator might be the median income of a family, which is frequently used as an indicator of economic wellbeing. By definition, in any community half the people earn less than the median and half earn more. What this measure does not do is link the economic wellbeing of the community with the social or environmental wellbeing of that community. So if, for example, the median value rises by 5% but inflation rises by 10%, the economic wellbeing of the community has declined in comparison with other communities in terms of what is normally required to live at a certain standard. A better measure might be to see whether the median income allowed a person to survive at a certain level based on the average cost of basic needs of that community within its social context. Another problem might be that the rise of 5% is a result of using up non-renewable resources and is thus at the expense of the environment. Here, a measure which looks at the percentage of the population whose income comes from the non-sustainable use of resources might be a better one.

This brief introduction to the problem raises a number of issues of which two are key to further development. Firstly, where will we get the data for these new measures when the world has spent the last century or more developing and recording against a set of measures that are now thought to be inappropriate, at least to the sustainability agenda? Second, how many of these indicators do we need to use to be reassured that we are indicating in a reliable manner whether a development is sustainable or not?

The first point is easy to respond to, but less easy to implement. At some stage in the past our society was faced with just this issue when determining its current set of indicators. It managed over time to develop and add new ones so that we find ourselves with the range we have today. The same will happen with sustainability indicators provided there is the political will to ensure that sustainability becomes a key issue in all policy making. The real problem is that today we are less patient. We expect to have this kind of information quickly and for it to be easily accessible. It may be that the growth of the internet will allow both speed and accessibility. Certainly the ease with which data can be downloaded has greatly increased, and more and more is coming into the public domain. The question of data capture is less obvious but this will depend on the growth in integrated systems and tools such as remote sensing which may allow automatic capture of

information and analysis that can then be made widely available. There is no doubt that we are moving in this direction, sometimes with concern over the kind of information being captured and also the privacy of this information.

Technically many of the problems have been solved. Perhaps the main issue now is how far society is prepared to go in making transparent the way its citizens behave? Issues of privacy and individuality become important in this matter. However, there will still be a very large number of indicators, perhaps the majority, which relate to social and political issues that are difficult to capture by machine. In addition, if we do use measures we sometimes forego the richness of human culture and society and consequently lose something significant in terms of sustainable communities. Issues such as aesthetics and heritage can come into this category. How is it possible to measure these and capture their full meaning to a society? Not only that, but our perspective on these matters changes quite quickly and what is an appropriate view now will not necessarily be shared by future generations. You only have to look at how society values buildings over time. At one point it wants to pull them down to build a 'brand new modern' future, then shortly afterwards it wants to preserve them as part of its common heritage, signposts to the past and a sharing of its common roots. In addition, the public view of what is a beautiful building also changes as fashions come and go. To ascertain these factors in the sustainable development debate will require new methods and a totally different view on the data with which we work.

Generic and specific questions

Whatever approach we adopt, we have to recognise that it will never be complete nor will it capture every possible nuance that relates to whether something is sustainable or not. It will be a useful (we hope!) contribution or indicator but it will not be precise. There is also another important issue that we need to address: how many indicators do we need? If we have too many the systems fall into disuse because human beings cannot spend the time collecting and analysing them or they suffer from fatigue or they think it is economically not worthwhile. If we have too few we run the risk of missing a really important feature that goes to the very root of whether a particular development, in the case of the built environment, is going to be sustainable. There have been many attempts to provide a comprehensive list of indicators but there are severe problems. The UN Report on the State of the Indicators (2001) suggested that many people are designing many indicators without verifying them as there are no data collections related to the chosen indicators and consequently many of the indicators are not being used. (Appendix B, European Commission Structural Indicators,

shows the structural indicators for EU countries which provide an indication of the data collected recently. These indicators are, however, constantly under development.)

There appears to be no consistency in the choice of indicators among the various groups trying to evaluate sustainability, and no consensus as to what the indicators should contain and what should be the method of assessment. Of course something like this has happened in a wide variety of disciplines as each discipline has emerged. It is not possible to wave a magic wand so that suddenly everyone agrees and an instant structure and set of measures is created. There needs to be considerable dialogue and debate and a real wish to seek a common ground. Unfortunately it is human nature to hold on to the measures you have invested in and developed, even though something better might be preferred by others. At some stage a powerful authority needs to endorse a particular approach so that the others will follow and create such a strong critical mass that it is difficult not to change. In the case of sustainable development that authority is currently the United Nations, as we shall see later. However, it is by no means dominant and there are still hundreds of different systems being used throughout the world.

This does raise another question. At what level of detail is agreement to be sought? Surely there are generic questions to which we can all give our assent. We can then leave the second-order questions that follow to an evolutionary process of refinement and selection. For example, if one of the key questions for a sustainable development is 'What level of commitment and vision is there from all the stakeholders to the proposals being postulated?' we could leave the other questions that tease out the detail behind this generic question to the particular community undertaking the development and its own set of priorities. In the UK, for a new commercial scheme on a derelict brownfill site, we might ask about the political support, the planning authority support, the financial support and so forth. On the other hand, if we were evaluating the regeneration of a historic area as our development we might want to ask these questions but also to ask about the views of the community on the preservation of the area, the vision of the national historic commissions interested in this work and the Arts and other councils.

In fact because of the complexity and interdependence between factors and the external implications for most development, it would be impossible to devise a robust scheme at this second level which could be used by all. We would find that the list would get longer and longer as each proposal identified how it was different from others that preceded it and why it therefore should have a different set of questions and different evaluation criteria. These would then have to be added to the list. This probably paints too black a picture as in time there would be sufficient consensus around a set of issues, at least for a particular type of development. It does, however, illustrate the diffi-

culty. It also illustrates where we should be placing our effort at this time: on the big generic questions around which we should be able to gain a consensus. To do this we need a robust structure within which to frame these questions and this book tries to contribute to the debate with the proposals in Chapter 4.

International indicators

There has been a strong desire among all those addressing the issues of sustainability to provide a set of indicators that can form the basis of an agreed set of parameters for sustainable development. Given the preceding discussion it is clear that these indicators will need to be at a high strategic level, allowing more detailed work to take place at the next level down in tailoring the indicators to the needs of local and cultural circumstances. Of the many that have been developed there can be little doubt that those developed by the United Nations (UNCSD, 1996) are likely to have the most authority and to be implemented most widely as a result. Indeed the intention of such indices and indicators is to gain widespread support and use in order that the concept of sustainable development can be included in all national agendas, allowing for international comparison.

It would be true to say that there is still some debate about the indicators to be adopted and some of the developed nations of the world would argue that those currently listed are simplistic and do not reflect the complexity of the problem. They also believe there can be trade-offs between the indicators such as the planting of forests to compensate for CO_2 emissions. Nevertheless, the indicators identified by the United Nations have widespread acceptance and form the basis of many of the other indicator lists found across the world. They are grouped under a number of categories of sustainable development, i.e. social aspects, economic aspects, environmental aspects, and institutional aspects. These are listed in Table 2.1 (see http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm):

The model on which they are based is the Driving force-State-Response framework. *Driving force* indicators suggest human activities, processes and patterns that impact on sustainable development, *state* indicators suggest the state of sustainable development and *response* indicators indicate policy options and other responses to changes in the state of sustainable development. These are shown in Fig. 2.3.

The indicators in the Commission on Sustainable Development under the UN Sustainable Development Programme are described as a 'working list' which suggests that they are still under development. They are structured according to the chapter headings of Agenda 21. Agenda 21 was the 300-page plan for achieving sustainable development in the twenty-first century which arose from the United Nations

Table 2.1 Categories for UN indicators.

SOCIAL
(1) *Equity*: poverty, gender.
(2) *Health*: nutritional status, mortality, sanitation, drinking water, healthcare delivery.
(3) *Education*: education level, literacy.
(4) *Housing:* living conditions.
(5) *Security*: level of crime.
(6) *Population*: population change.

ENVIRONMENTAL

(1) *Atmosphere*: climate change, ozone layer depletion, air quality.
(2) *Land*: agriculture, forests, drought, urbanisation.
(3) *Oceans, coasts, seas*: coastal zone, fisheries.
(4) *Fresh water*: water quality, water quantity.
(5) *Bio-diversity*: eco-system, species.

ECONOMIC
(1) *Economic structure*: economic performance, trade, financial status.
(2) *Consumption and production patterns*: material consumption, energy use, waste generation and management, transportation.

INSTITUTIONAL
(1) *Institutional framework*: strategic implementation of sustainable development, international co-operation.
(2) *Institutional capacity*: information access, communication infrastructure, science and technology, disaster preparedness and response.

Conference on Environment and Development (UNCED) in 1992 and was endorsed by over 100 heads of state. The Commission on Sustainable Development (CSD) was created in 1992 to ensure effective follow-up of UNCED: to monitor and report (UNCSD, 1996) on implementation of the earth summit agreements at the local, national, regional and international levels. The CSD is a functional commission of the UN Economic and Social Council (ECOSOC) with 53 members. In June 1997 a special session of the General Assembly of the UN adopted a comprehensive document entitled Programme for the Further Implementation of Agenda 21, prepared by the CSD to take the issues still further. It continues to be the arm of the UN that ensures sustainable development issues have high visibility within the UN with a series of workshops and conferences around the world.

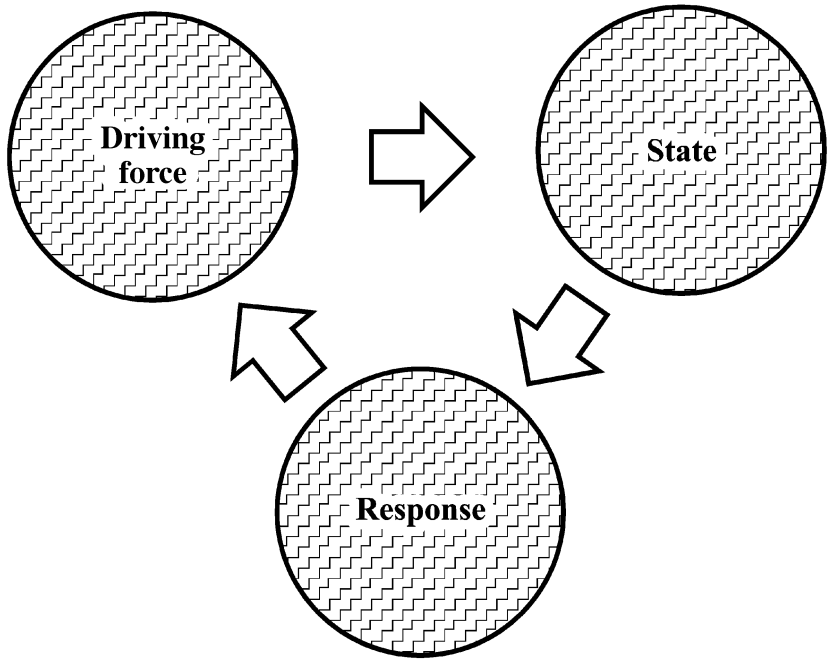

Figure 2.3 Driving force–state–response model.

Not surprisingly the 'environmental' category of Agenda 21 appears to be the most developed but it is likely that the others will be enhanced as time goes on. An example under the 'social' category is given in Table 2.2.

It is clear from Table 2.2 that these indicators work at a very high strategic level for the nation as a whole. Indeed since 1993 governments have been preparing national reports for submission to the CDS in order to help countries monitor their own progress and share experience and information with others, and to serve as an 'institutional memory' to track and record national actions undertaken to implement Agenda 21.

It would be possible to bring these indicators into the local understanding of sustainability but in most developed countries the local situation would mirror the national situation and it would be difficult to know where to draw the boundaries for data capture. Political boundaries for local authorities are useful but may reflect a rather arbitrary historical precedent. For a new development within the built environment a whole series of other measures might be more appropriate such as the number of vacancies in local schools at different age levels, the number of pupils going on to university education, the age profile of the local population and so forth. This illustrates the point that while we might be able to accept the generic heading we will

Table 2.2 Example: Social indicators suggested under CSD working list.

Chapter of Agenda 21	Driving force indicators	State indicators	Response indicators
	Category: social		
Chapter 36: promoting education, public awareness and training	❑ Rate of change of school-age population ❑ Primary school enrolment ratio (gross and net) ❑ Secondary school enrolment ratio (gross and net) ❑ Adult literacy rate	❑ Children reaching grade 5 of primary education ❑ School life expectancy ❑ Difference between male and female school enrolment ratios ❑ Women per hundred men in the labour force	❑ GDP spent on education

almost certainly have to develop more sensitive local indicators for a particular situation in a particular locality.

The UN has been aware of this, of course, and has attempted to provide urban indicators which are linked to the above but reflect the urban situation. Of the 130 indicators identified in the Driving force-State-Response model they have expanded 23 indicators and nine lists of quantitative data related to the 20 key indicators on which the human settlement unit has been working. Indicators in the case of the urban context are supposed to measure urban trends and the progress of the implementation of the Habitat Agenda (UNCHS, 1996). Examples of these are included in the following lists which are still under development (see Table 2.3 for a list of indicators corresponding to the 20 Habitat Agenda key areas of commitment http://www.unhabitat.org/programmes/guo/guo_guide.asp).

Shelter

This indicator provides an overview of the share of different tenure status among urban dwellers and the indices for shelter. It assumes that among the safest tenures are ownership, purchasing, and tenancy in social housing and, where rental regulations are protective enough, private tenancy can also offer a fairly safe tenure to households. The most common precarious tenures are considered to be those of the homeless and squatters. It is suggested that any indicators should

Table 2.3 List of indicators corresponding to the 20 Habitat Agenda key areas of commitment. (*Source:* http://www.unhabitat.org/programmes/guo/guo_guide.asp)

Chapter 1: Shelter (1) Provide security of tenure *indicator 1:* tenure types *indicator 2:* evictions (2) Promote the right to adequate housing *qualitative data 1:* housing rights *indicator 3:* housing price-to-income ratio (3) Provide equal access to land *indicator 4:* land price-to-income ratio (4) Promote equal access to credit *indicator 5:* mortgage and non-mortgage (5) Promote access to basic services *indicator 6:* access to water *indicator 7:* household connections	**Chapter 4: Economic development** (15) Strengthen small and micro-enterprises, particularly those developed by women *indicator 20:* informal employment (16) Encourage public–private sector partnership and stimulate productive employment opportunities *qualitative data 5:* public–private partnerships *indicator 21:* city product *indicator 22:* unemployment
Chapter 2: Social development and eradication of poverty (6) Provide equal opportunities for a safe and healthy life *indicator 8:* under-five mortality *indicator 9:* crime rates *qualitative data 2:* urban violence (7) Promote social integration and support disadvantaged groups *indicator 10:* 'poor' households (8) Promote gender equality in human settlements development *indicator 11:* female–male gaps	**Chapter 5: Governance** (17) Promote decentralisation and strengthen local authorities *qualitative data 6:* level of decentralisation (18) Encourage and support participation and civic engagement *qualitative data 7:* citizen involvement in major planning decisions (19) Ensure transparent, accountable and efficient governance of towns, cities and metropolitan areas *qualitative data 8:* transparency and accountability *indicator 23:* local government revenue and expenditures

Chapter 3: Environmental management	**Chapter 6: International co-operation**
(9) Promote geographically balanced settlement structures *indicator 12:* urban population growth (10) Manage supply and demand for water in an effective manner *indicator 13:* water consumption *indicator 14:* price of water (11) Reduce urban pollution *indicator 15:* air pollution *indicator 16:* waste water treated *indicator 17:* solid waste disposal (12) Prevent disasters and rebuild settlements *qualitative data 3:* disaster prevention and mitigation instruments (13) Promote effective and environmentally sound transportation system *indicator 18:* travel time *indicator 19:* transport modes (14) Support mechanisms to prepare and implement local environmental plans and local Agenda 21 initiatives *qualitative data:* local environmental plans	(20) Enhance international co-operation and partnerships *qualitative data 9:* engagement in international co-operation

present the percentage of man- and woman-headed households in the following categories:

- ❑ Owned.
- ❑ Purchasing.
- ❑ Private central.
- ❑ Social housing.
- ❑ Sub-tenancy.
- ❑ Rent free.
- ❑ Squatter, no rent paid.
- ❑ Squatter, rent paid.
- ❑ Homeless.
- ❑ Other.

With regard to shelter in general they suggest that the following indicators are appropriate:

(1) Tenure type.
(2) Evictions.
(3) Housing price-to-income ratio.
(4) Land price-to-income ratio.
(5) Mortgage and non-mortgage facilities.
(6) Access to water.
(7) Household connections.

Social development and eradication of poverty

Here the aim is to assess the social development of the city, the eradication of poverty and equal opportunity for a safe and healthy life. The indicators suggested are:

(8) Mortality rate indicator.
(9) Crime rate.
(10) Level of 'poor' households.
(11) Female–male gaps.

Environmental management

To promote environmental management this theme attempts to stimulate geographically based settlement structures through the following indicators:

(12) Urban population growth.
(13) Water consumption.
(14) Price of water.

(15) Air pollution.
(16) Waste water treated.
(17) Solid waste disposal.
(18) Travel time indicator.
(19) Transport modes.

Economic development

To stimulate economic development of small and micro-enterprises, and particularly those developed by women.

(20) Informal employment.
(21) City product.
(22) Unemployment.

Urban indicators are regularly collected in a sample of cities worldwide in order to report on progress in the twenty key areas of the Habitat Agenda at the city level. Data collection is conducted through local and national urban observatories as well as through selected regional institutions. The Global Urban Indicators Database 2 (GUID2) contains policy-orientated indicators for more than 200 cities worldwide. Its results have been analysed and incorporated in the State of the World's Cities Report 2001 (UNCHS, 2001).

Progress on UN Habitat indicators

Five years after Habitat II, the Special General Assembly (so-called Istanbul + 5) held in New York on 6 to 8 June 2001 made a first interim assessment to verify the degree of implementation of the Habitat Agenda.

National Reports and Global Reports from almost all 130 states present in New York were laid out on the occasion of the Special General Assembly, so that an interesting variety of views on how the Habitat Agenda has been implemented in the Member States of the United Nations were given. The majority of reports are available to be downloaded from the website of the General Assembly (www.un.org/ga/habitat).

A joint publication of the EU Member States (*Implementing the Habitat Agenda: The European Union Experience*), based on the National Reports of both the EU Member States and the non-EU Member States, illustrates comprehensively the European activities undertaken to implement the Habitat Agenda. (See Wakely & You, 2001.)

The United Nations Centre for Human Settlements (UNCHS) has presented a report of experts which documents the progress of

worldwide implementation of the Habitat Agenda (*Cities in a Globalizing World: Global Report on Human Settlements 2001*). The report focusses on the significance of settlements for a sustainable social and economic development in a globalising world and provides strategies for implementing the Habitat Agenda (UNCHS, 2001).

Around 80 eminent scientists from all over the world have actively contributed to this report. Furthermore, UNCHS has published its own report (*The State of the World's Cities Report*) which presents a series of analyses based on UNCHS databases (*Urban Indicators and Best Practices Databases*) and takes into account core fields of action of the Habitat Agenda. Both reports offer useful working tools to all those dealing with urban research, urban development and urban policy (source: http://www.planum.net/topics/main/m-hab-documents-bbr.htm).

Note: A further UN Habitat initiative is the *Guide to Monitoring Target 11: Improving the lives of 100 million slum dwellers* May 2003 where seven indicators are proposed for eliminating slums and poverty (the pdf file can be download from http://www.unchs.org/programmes/guo/).

Summary

The indicators shown above and in Table 2.3 are just those being proposed by United Nations initiatives. There are literally hundreds of lists of indicators being developed by a very large number of organisations for a variety of different purposes. Some of their websites are identified at the end of the References section at the back of this book. However, these web addresses may change over time.

As you would expect, there is a large amount of overlap at the strategic level as identified above. It is when more detailed indicators are brought in that they become specific to the development or the sector or region under consideration and some divergence in the sorts of indicators needed becomes apparent. In broad terms the categories identified by the UN do provide a baseline from which to work. However, while the UN indicators provide an indication of the positive and negative impacts of human interactions on sustainable development it could be argued that they are not integrated with each other. Each indicator has an influence on another and there is therefore a problem associated with a lack of discrete measurement which may mean that too much or too little emphasis is given to one measure. For example, the economic indicators have an impact throughout the system. If unemployment is low and incomes are high, many of the indicators for poverty will have little impact. However, the economic wellbeing of a community will also have an impact on what shelter can be provided and what tenure will be expected. It will also affect what can be done to tackle the environmental issues (as many of them

require substantial investment) and even perhaps the institutional frameworks within which the total system can operate. This interdependency can create problems in weighting various indicators when deciding what actions to take to improve matters. It may be clear that the economic activities are of such overriding importance that if these are dealt with all other aspects will follow. On the other hand, a rise in economic levels can lead to a major rise in consumption which in turn can have an impact on waste, pollution and all those other downside issues. There will be more cars, more packaging, more travelling and so forth. This is why we need to be careful with the indicators that are chosen.

The danger is that we use the measures that already exist but find them inadequate in assessing sustainable development issues. They are attractive because of the fact that they exist already but they can send the wrong signals and distort the behaviour patterns of the decision-makers. In these early years of establishing a new way of looking at development it is inevitable that there will be a period of transition from the old to the new. The speed at which new indicators are accepted and used and the data collected to make them meaningful will depend on the political will of each nation and of the world community.

The United Nations has started on this process and some countries are endorsing the indicators wholeheartedly. Others are more reticent but it is likely that they will fall in line as time goes on, mainly as a result of international pressure. At this stage it is important that we learn the limitations of indicators and make sure that we interpret them correctly. Meanwhile, governments have a role to play in ensuring that agreement is reached on which indicators are really appropriate and that resources are placed at the disposal of those who need to collect the statistics.

3 Time and Sustainability

At the heart of sustainable development are some assumptions about how long a development is expected to be sustainable for. Over what period are we considering the issue? One answer might be 'forever', another might be 'over a human lifetime' and another might be 'until something comes along which is better or changes the reason for trying to sustain the development'. Underlying all the assessments and evaluations of sustainable development must be some consideration of the time period over which we are making the assessment. Some might argue that as sustainable development is thought to be a *process* it is not necessary to pay too much attention to this matter. It is part of getting all the stakeholders to think in a certain way about the future to avoid leaving future generations in a worse position than we have today. It is therefore as much about culture and the creation of a learning environment as it is about calculation and prediction.

However true this might be, at some stage decisions have to be made about what to build, how to build and how to use the built environment. Finance houses, clients, local authorities and all the other participants who have some power or require accountability in the process will want to know over what time period these assessments have been made. Every decision is made within the context of an assumed time period. It influences the choice of material, the speed at which development occurs, the response to market forces, the design and layout and a whole host of other factors that make up the complexity of the built environment. While our horizon might be the long-term future, we have to make decisions in the here and now.

Strangely, it appears not to be something that is a major issue in the literature on the subject. It is hidden from view but is an implicit assumption in many of the techniques employed. A quick review of some text books on sustainable development in the built environment

has revealed that only a few have a reference to 'time' in their index. This may be a reflection of the nature and youth of the subject. It may reflect the imprecision in the definitions of the term sustainable development or it may be that the lack of structure underpinning the subject prevents us from getting to this level of detail in general discussion. After all, the time period over which the stakeholders will view a decision will vary from one to another. For example:

- Political support for development in an area may be limited to the term of office of an elected politician or party.
- Finance houses may view the development over the time required to get a pay-back on their investment.
- Retail clients may view the development over the number of years they believe they have left before the market moves on elsewhere or the market has grown to the point where they need a new store or a major extension.
- A group of citizens may be interested in the development over their lifetime or the lifetime of their children.
- Planners may see the development within the lifetime of their 'master plan' or other such strategic document.
- Developers may view the development from a financial point of view but also in terms of what is happening in adjacent sites, regions and even other countries and therefore as a response to market conditions (in the markets in which they work) over the time it takes to create the development.
- Experts in demography will be interested in the changing age patterns around the development over a specified period related, perhaps, to government horizons.
- Lawyers may at one level be interested in the development for the time it takes to sign off a contract, and/or at another level the length of time new legal business will exist, and at another level the implications of changes in the law over a much longer time period.
- Valuation surveyors may be interested in the time taken to create an increase in property and land values.
- Architects will be interested over the lifetime of their commission but also in the long-term impact of their design as expressed in the building.

It can be seen from even this short list of potential stakeholders that there are a variety of views of the time dimension. If the aim is to create a harmony of view among all the participants, these different levels of interest over different time periods should be recognised as an essential aspect of the sustainable development process. This raises many questions, of course, such as:

- Whose view should take priority in the case of a dispute? Is it the

person or organisation who has the longest time interest in the development?

- ❑ Should the financiers, who take the major financial risk, be considered pre-eminent in the decision-making process? If they are not, will the finance become available to undertake any development?
- ❑ Should market forces be challenged as, in time, the markets will adjust to the new situation that faces them? However, the time-lag may be too great to avoid irreparable destruction to the environment: is this acceptable?
- ❑ Is it the aim of sustainable development to avoid negative influences on the environment or is it to provide positive influences towards what is believed to be a better way of living?
- ❑ Are our techniques for evaluation sufficiently sensitive to the way society views sustainable development?
- ❑ Would it be more sensible to identify potential critical failure points, rather than critical success factors, in the quest for sustainable development?

Each of these questions contains the essence of a research question which at this stage of the topic has yet to be answered. It is not the intention of this chapter to answer them but to explore their nature and provide some context for the techniques and structures that follow.

Innovation and stability

Stewart Brand in the stimulating book *The Clock of the Long Now* (Brand, 2000) has proposed six significant levels of pace and size in the working structure of a robust and adaptable civilisation. From fast to slow, the layers are as identified in Fig. 3.1 with fashion, technical innovation and other quick-change items stimulating change and the lower levels of culture and nature providing a balancing force. In a healthy society, he argues, each level is allowed to operate at its own pace, safely sustained by the slower levels below and kept invigorated by the livelier levels above.

To quote an example, if commerce is allowed to advance unfettered and unsupported by watchful governance and culture, it easily becomes crime, as in some nations and republics after the fall of communism. Likewise, commerce may instruct but must not control the levels below it because commerce is too shortsighted. Brady goes on to say:

> 'One of the stresses of our time is the way commerce is being accelerated by global markets and the digital and network revolutions. The proper role of commerce is to both exploit and absorb

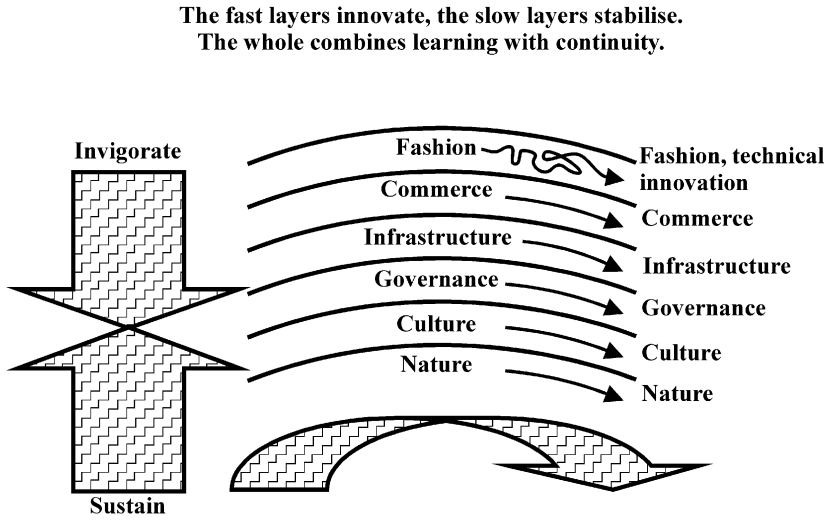

Figure 3.1 The order of civilisation. (Reproduced with permission from Brand, S. (2000) *The Clock of the Long Now: Time and Responsibility: The Ideas Behind the World's Slowest Computer*. Basic Books, New York.)

these shocks, passing some of the velocity and wealth on to the development of infrastructure, at the same time respecting the deeper rhythms of governance and culture.'

He debates the roles of each of the layers in a similar manner.

For our purposes in this book, this useful metaphor provides an indication of the timescales within which civilisations change and work, and their innovative drivers and stabilising forces. When these are not in harmony tensions and breakdowns occur. Nature is seen as the major stabilising force but it is this layer that is under threat because the other facets are imposing themselves upon it in a negative way. It may be a case of *Future Shock* (Toffler, 1985) where the future is coming so fast that the natural evolutionary processes cannot keep up.

The built environment plays a major part in infrastructure and commerce and its impact on those below can be significant. It identifies the physical position of governance, expresses the culture that has created it and imposes itself on the natural world in many different ways.

Perceptions of sustainable development

There is within the human psyche a latent model of the world and the future which understands that within a closed system such as the universe, as time progresses, less energy becomes available to be used

and the system falls into decay. Entropy seems to be the fate of all closed systems. This model pervades our thinking and we think in terms of something being created, existing for a finite time and during that period of existence probably increasing in energy before reaching a peak and then moving into decline. Figure 3.2 shows this in graphic form.

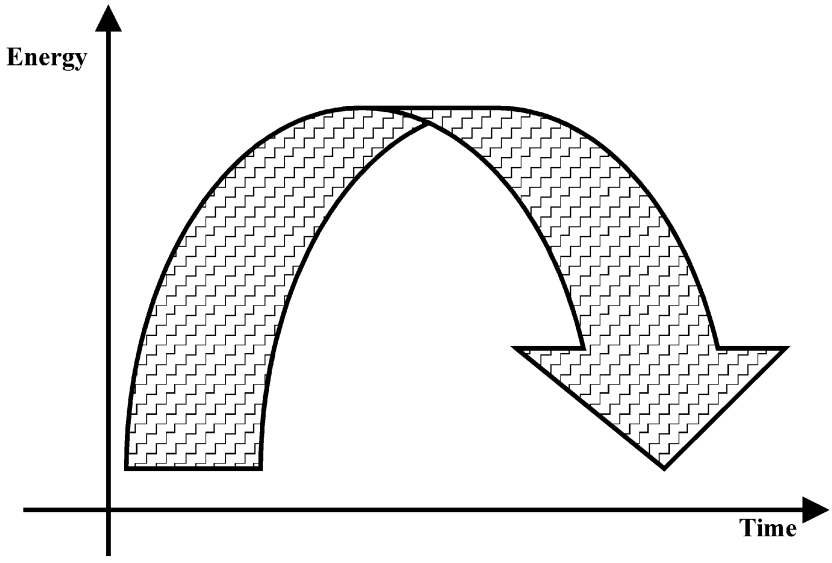

Figure 3.2 Entropy in closed systems – is our mental model like this for sustainable development?

The conventional wisdom within sustainable development seems to have this model behind it. A development is created, there is growth in that development in both physical and social terms, and then it reaches a peak. For a further period of time it remains at this level and then it begins to decline for a wide variety of reasons until eventually it disappears as a recognisable development. This process may take thousands of years or it may be measured in tens of years or even shorter time spans if a major catastrophe should befall the development. The purpose of sustainable development is to halt the downward decline and, if possible, increase the availability of energy represented by social cohesion, physical wellbeing, biodiversity, appreciation of the habitat and so forth that go to make up a sustainable community which in turn creates the sustainable physical environment in which the community lives.

Evidence for this pattern of events can be seen in a large number of the cities we see around us. They start as small settlements, grow into larger conurbations with a strong social activity and then decline, often

as the result of a downturn in economic wellbeing of the country or context in which they find themselves. Often this pattern is repeated at the sub-city level with certain suburbs going into decline as crime and poverty begin to establish themselves. Others become fashionable and continue to rise, sometimes creating barriers beyond the financial to entry from unwelcome influences that exist in the poorer suburbs. In time, two societies exist side by side with tension between them, and in some cases this tension is so great that it creates a complete social breakdown which can lead to the demise of both. These events are almost unpredictable until they are well into the decline phase of the graph. The potential for breakdown can be articulated but it is much more difficult to know exactly *when* this might occur.

If we are to address the Brundtland definition (see Chapter 1) of sustainable development (WCED, 1987), we have an obligation to leave the environment in at least the same position, and if possible a better position, for future generations. We should not compromise their ability to make decisions about their future even if it means some short-term sacrifice in the way we behave now. The problem is that it is difficult to get people to accept the concept of self-sacrifice when they are not the beneficiaries. Even in the short term we know that this is true because governments that tax to provide something better a few years ahead, or to aid the redistribution of wealth, often find themselves unpopular and voted out of office. This is where education and public participation have a major part to play. Education is required to develop a different culture with a set of values that reflect sustainable development, and public participation is needed to enable as many stakeholders as possible to be informed and engaged in the planning process that adopts these values.

In many situations there is considerable inertia. Plans are made, budgets are set, political mandates are established and, together with the desire of many for certainty and routine, there is a reluctance to alter the status quo. It is not until a real breakdown of social cohesion or security or quality of environment occurs that we see a willingness to alter direction or to make substantial investments. The danger here is that the breakdown may be irreversible and significant damage may have been done which may destroy the community, and the stakeholders may well not be interested in doing anything about it. In the wider dimension of the earth's natural resources, for those resources that cannot be replaced (i.e. they are non-renewable) it will be impossible within any time frame to do anything about it. In other instances, such as the destruction of rainforests and other habitat, it may be possible to reverse the trend but there must be the political will. In the built environment it is difficult to envisage a total loss of the urban infrastructure as it can rise again as it has done for centuries – often one on top of another! Its nature may be forced to change because of the scarcity of the non-renewable resources that make up its physical

presence but its ability to emerge again always remains. What will be lost are some of the less physical aspects of the built environment such as its historical and cultural value, its use as a social integrator, its role as a focal point of religious significance, for example. The pattern of sustainable development in the urban context is represented in Fig. 3.3.

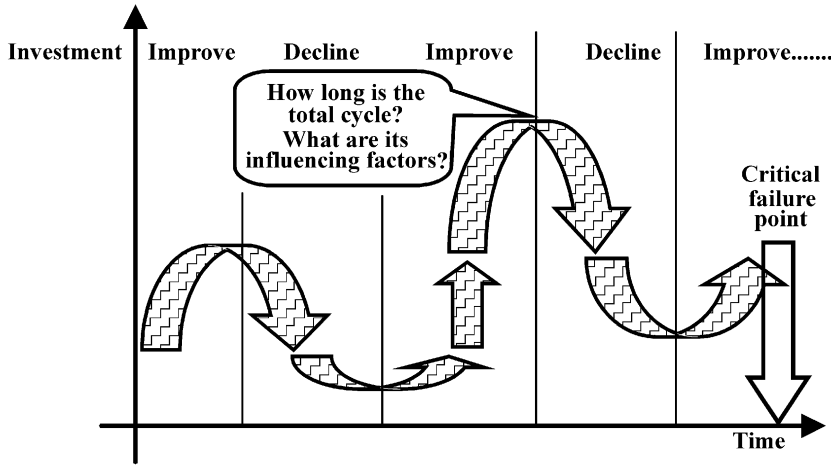

Figure 3.3 Hypothetical cyclical pattern of investment in the built environment over time.

Of course the investment is not necessarily so abrupt or the decline so rapid as envisaged above, but nevertheless the pattern is recognisable and can even be seen in our personal investment in our homes. We do not usually invest in a new washing machine when the original is still serviceable. Then, later, we may decide to buy a better one if our finances allow it or the decision is forced upon us because the original has completely broken down and is not worth repairing.

In cities the decisions are similar but of course much more complex and bigger in their impact. The decline of docklands in many parts of the world because of a change to container traffic and other forms of transport (a change in the technology) has resulted in considerable expanses of blighted urban landscape. More recently these landholdings adjacent to the docks have been seen by developers as an opportunity and have been rapidly developed as new conurbations, revitalising a derelict area. The London Docklands, Salford Quays in Manchester and the Albert Dock in Liverpool are all prime examples in the UK. In Bilbao it has been the Guggenheim museum that has revitalised the whole city and in Sydney, Australia, the opera house has transformed the image of the whole country. These transformations are almost always the result of a political will to get things done. In the early days of Salford Quays, which was originally the old Manchester

docks, the local authority tried to sell the site without success. No developer would invest and in fact the developers who were approached were asking for money to take it off the authorities' hands. It was not until a new vision was created by a small number of like-minded individuals with influence, and the government changed its planning policies and began to invest in urban infrastructure, that a new and successful life was given to the area. Now it is a prime development site and has wonderful new cultural buildings, with each new development reinforcing the others success (see Fig. 3.4).

The question for all these developments is how long they will last before they move into decline. In fact, of course, nobody knows. A serious downturn in the economy creating a lack of tenants, followed by a lack of maintenance and security, could quickly see the beginning of a demise. If war should break out on a large scale, it is again difficult to predict what might happen. Sustainable development can only survive while all the external factors that bear upon the development are in harmony together. A failure in any of the major factors could well bring the whole development into crisis. The aim of sustainable development seems to be to ensure that the overall pattern of investment into an area continues in an upward direction even if we have to accept that there will be fluctuations in the upward graph caused by normal investment cycles. It is worth noting here that investment in this context is being used in its widest sense to include any input of resources, whether it be labour, finance, infrastructure, arts, social welfare or whatever is required to sustain or improve the built environment.

Critical failure points

In the majority of decision-making strategies relating to the built environment, the people making the decision are driven by the 'critical success factors' (CSFs). They look for the returns and the key ingredients that will make the development successful. This is the basis for some of the sustainability indicators that are used. In sustainable development these positive attributes still hold good but at the same time it may be important to give equal attention to the critical failure points. These are the factors which, if they fail or do not exist, could lead to a rapid decline in the sustainability of development in general and possibly the demise of the whole scheme or area. The type of issues that may be of this nature include:

- *The loss of a key resource* such as water. In India the city of Fatapur Sikri near the Taj Mahal lasted only fifteen years because the water supply dried up.

Figure 3.4 The regenerated Salford Quays, Salford, UK.

- *The loss of the major employer* in a region can destroy the local economy and the ability of the community and its infrastructure to survive. Examples of this include some of the towns built around coal mines that closed, or steel works that became part of a concentration of production elsewhere.
- *Pollution of air, land or water*, if on a long timescale, can mean that an area becomes uninhabitable. Examples are toxic chemicals in the land, pollution of sea water depriving the fishermen in an area of their livelihoods, or acid rain destroying forests.
- *A breakdown in law and order* which can mean that property values fall and residents become trapped in a cycle of decline; or, if they are financially able, they may move to other places but no one wishes to take the place they have vacated.
- *A breakdown in the commitment of a community* due to a challenge to the faith that has been practiced there. Towns in what used to be Yugoslavia identified as Muslim or Christian or towns built around a religious order find themselves vulnerable if the basis of the community is challenged.

It can be seen from the above that most of these issues are related to well-being and the quality of life. Some of them, such as pollution or loss of a key resource, are secondary to the need for a quality of life, however that is defined, although ultimately these issues impinge on the enjoyment of life anyway. It should be possible to overcome these matters but it requires substantial resources or a level of technical competence that the community might not have. It is therefore better for the community to move elsewhere and thus avoid the problem. By moving, their quality of life is expected to improve. In the context of the discussion of 'time' in sustainable development, these factors complicate the issue. We do not know when these movements might occur and in many cases we will not know with certainty the underlying causes. It is therefore difficult in developing a model of sustainable development to prejudge when we can expect a critical failure point to manifest itself. All that we can do is ensure that, as far as our knowledge exists today, the circumstances that might lead to such an eventuality are avoided or mitigated through the process of development. This leads us on to the approaches used in 'risk management'.

The majority of 'failures' are not critical in this respect. They do not result in sudden collapse. In general there appears to be a spiral of decline, a vicious cycle, where a lack of investment, a period of disinterest by the current and potential stakeholders or a lack of economic wellbeing, in particular, can result in gradual decline. Eventually the possibility is that it is no longer feasible to create a virtuous spiral that will build the community again and result in a sustainable solution. Again, the timescale for this is unknown. We cannot predict with certainty how long this will take and we often

do not know when the stage of non-renewal has been reached. So here we have a strong psychological urge to ensure that we create something sustainable, yet we cannot predict the events that will create the environment in which this demise will take place nor can we predict the timescale over which it is likely to happen. The two are of course related.

Kohler (see Fig. 3.5) has shown this diagrammatically in his work on life cycle analysis in the case of cities (Kohler, 2003). He suggests that there might be a corridor of solutions that need to be examined and evaluated over time which any decision-maker should be aware of and keep within. It is possible to overshoot as much as undershoot and the job of the decision-maker is to keep in balance all the contributing factors. Critical success and critical failure are therefore built within this framework. Of course, even with dereliction there is usually the opportunity to build again but the economic, social and other costs are that much larger.

Another view of this problem concerns the changing timescales for renewal within the process of an emerging and evolving city. These complicate the time when decisions *can* be made and in a complex organism such as a city they make the task of addressing the sustainability problem that much more difficult.

Figure 3.6 shows some assumed cycles for physical and other assets in the built environment. In some ways these are similar to the upper layers of the invigorating and sustaining aspects of the order of civilisation in Fig. 3.1.

These differing transformations suggest that we have to address 'time' in some other way, not as a measure but as a continuum within which we learn and improve. This is not unlike the arguments being put forward by those advocating the concept of the learning organisation within business. Senge (1990) describes 'learning organisations' as:

> 'organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together.'

It appears that the act of learning and sharing the results of learning can lead to a corporate view of the problem and a solution that allows for more creative ideas and a positive attitude to the aims of the organisation. Senge goes on to say that

> '. . . learning disabilities are tragic in children, but they are often fatal in organisations. Because of them, few corporations live even half as long as a person – most die before they reach the age of forty'.

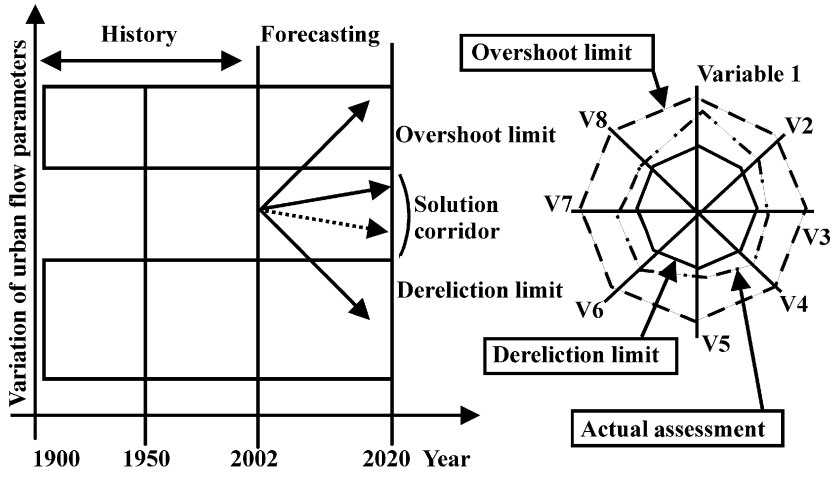

Figure 3.5 Solution corridor within urban regeneration. (Reproduced with the kind permission of Niklaus Kohler from his 2003 Presentation: Cycles of Transformation for the City and its Culture. Intelcity Workshop, Siena (under the auspices of the University of Salford).)

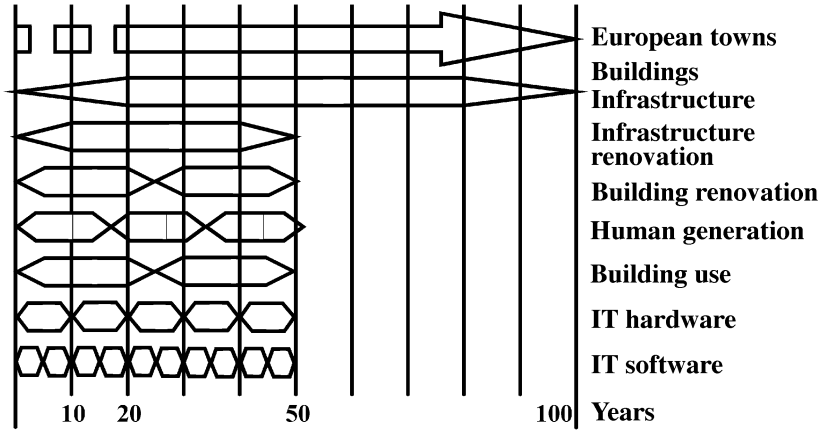

Figure 3.6 Cycles of transformation for the city and its culture. (Reproduced with the kind permission of Niklaus Kohler from his 2003 Presentation: Cycles of Transformation for the City and its Culture. Intelcity Workshop, Siena (under the auspices of the University of Salford).)

Perhaps this is also true with regard to corporate action for sustainable development.

This approach requires a move to systems thinking which we shall address later. For now, it is worth noting that a focus on working and

learning together is thought to be beneficial to organisations and, as the built environment is an organisation of a sort, there may well be lessons to be learnt for achieving a sustainable development. If we do not do this the cycles described are likely to continue and we can expect failure on a regular basis.

Time in evaluation

Even with a learning organisation approach and the focus on the process, it will not be possible to ignore the effect of time in our evaluation and assessments. As we have said earlier, most of those authorities with financial or political power will want to have proposals justified in order to persuade committees or shareholders or boards or whatever group they are accountable to. This inevitably means that some form of risk assessment has to be made, and this is a recognition that we cannot predict or control all future events.

In economic evaluation the concept of discounting is used to take account of the effect of time on the view of the investor at the present day. In simple terms the view is held that the value of a payment or receipt in the future is worth less now because, in the case of a payment, a smaller sum of money could be set aside now that could grow over time to meet the needs of that payment at the time specified. In the case of a receipt the value to the recipient now is worth less because a smaller sum invested now will accrue at compound interest to the amount to be received in the future. This is shown diagrammatically in the Fig. 3.7.

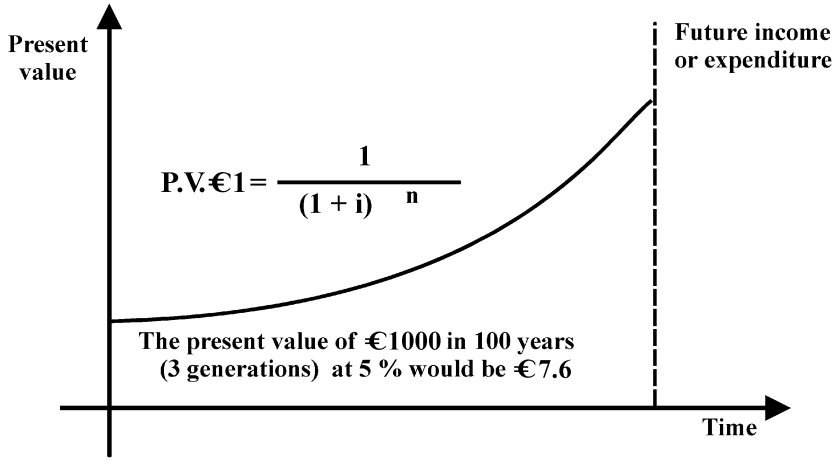

Figure 3.7 The present value of an amount to be paid or received in the future.

What this graph indicates is that if you are set to receive €100 in 25 years time its value to you now is €29.5 if you expect your investments to produce a return of 5% and €9.2 if you expect a return of 10%. In other words, if you invested €9.2 now in a bank or other financial concern and a return of 10% was guaranteed, it would accrue, with interest added, to €100 in 25 years' time. Notice that the higher the interest rate, the lower the value to you now or the smaller the amount that needs to be invested now to accrue to the same figure. The time remains the same but the effect on the supposed value is quite different, depending on the interest rate. It follows that if we were to use a higher rate of interest in our calculations we would be discounting the effect of future transactions more than if we used a lower rate. If in sustainability we want to take a long-term view and encourage this within our calculations, we would use a low rate of interest because this would make future activities appear more important in financial terms.

The choice of interest rate is therefore critical and is more complex than it at first appears. No account has been taken of inflation and this might have a substantial impact on the calculation. It might, for example, eat away at the real benefit from the investment over time. Some would argue that the 'real' rate of interest that should be used is the assumed rate less the inflation rate. Others would argue that inflation can be ignored as it affects both income and expenditure equally. This may or may not be true as differential inflation is quite common. It is also quite clear that long-term periods of stable interest rates and inflation are almost non-existent within the timescales of the built environment.

The time element is also a major consideration. The formula for computing the present value is based on the compound interest formula and is presented as follows:

$$\text{present value } €1 = \frac{1}{(1+\text{i})^{\text{n}}}$$

Where i = interest rate divided by 100 and n = number of years.

It follows that there is an exponential curve which rapidly discounts future values as time increases. The result is a model of the world, upon which decisions are made, based upon a view that suggests the future is something to be discounted and is of considerably less value than the present. It is mechanistic and uses few variables in its operation. Nevertheless, much of financial investment is based upon

it. It has replaced some of the other models such as 'pay back', where the length of time required to pay off the original investment is the criterion, because it is thought to more accurately reflect the logic of the financial markets. However, even on this assumption it may not reflect the real values that investors adopt within their decision-making processes.

Future aversion

It could be argued that when time enters a calculation most people are likely to prefer present over future gains (this could be termed 'future aversion' – we want to limit the risk on future gain) and future losses over present losses (this could be termed 'future seeking' – we are prepared to take a greater risk to minimise losses). However, there is unlikely to be symmetry between the two, which is plausible on the intuitive grounds that a postponed loss is less aversive than a postponed gain of a similar amount is attractive (Kahnemann & Tuersky, 1984). This is illustrated diagrammatically in Fig. 3.8. In sustainable development, where the emphasis is on reducing future losses, this asymmetry could be important in reflecting the psychology of the decision-maker within the technique.

If there is such a view at work in the minds of the decision-makers, it has relevance to sustainable development and affects the way in which those who are encouraging sustainable development are prepared to argue for different models that allow a longer-term perspective to be addressed. It would suggest a move away from the conventional economic models to the adoption of a moral imperative which will demand that future values are given significant weight. This could be done in some cases by legislation and regulation that requires minimum standards to be kept – say the reduction in major pollutants, or it could be that business advantage is achieved by taking the long-term view.

There are already instances in banking where banks that take an ethical stance in their investments have managed to increase their performance substantially. However, this may be the absorption of the niche market of those investors sensitive to these issues. Nevertheless, it is a start and with further education in these issues it may be that the minority niche market becomes the mainstream. Directives such as those contained in the Agenda 21 documents and adopted by many authorities throughout the world will hasten the take-up of a longer-term assessment. There is little doubt that it will

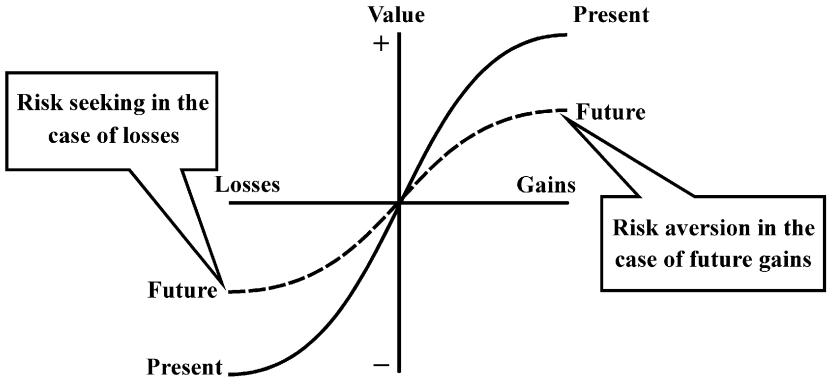

Figure 3.8 Risk aversion related to the future.

require a variety of approaches to ensure that the concepts of sustainable development are included as the norm in addressing decisions in the built environment.

Clever or wise?

Patricia Fortini Brown, in *Venice and Antiquity* (Brown, 1996) draws our attention to the fact that the ancient Greeks distinguished two kinds of time: *kairos*, meaning opportunity or the propitious moment; and *chronos*, meaning eternal or ongoing time. 'While the first … offers hope, the second extends a warning'. *Kairos* is the time of cleverness, *chronos* the time of wisdom. Our dead and our unborn reside in the realm of *chronos,* murmuring warnings to us presumably if we would ever look up from our opportunistic, *kairotic* seizures of the day. Today we live in the golden age of *kairos*, where opportunity is all, the cult of the individual is paramount and the corporate sense that will allow us to engage with time is hard to come by. This has its zenith in economic evaluation where the views of shareholders in corporations often seems to dictate a short-term perspective in policy matters and where the evaluation methods heavily discount the value to future generations.

Practical assessment of 'time'

This discussion has revealed some of the issues relating to 'time' within decision making. It has not, however, put forward a proposal that can be used on a day to day basis to address the matter. This is because no one method exists. In fact when the situation is analysed fully it is realised that it is difficult to obtain a universal view of timescales for something as varied and complex as the built environment. Boulding (1978) diagnosed the problem of our times as 'temporal exhaustion': 'If one is mentally out of breath all the time from dealing with the present, there is no energy left for dealing with the future.' She proposed a simple solution: expand our idea of the present to 200 years – 100 years forward and 100 years back. A personally experienceable, generations-based period of time, this reaches from grandparents to grandchildren – people for whom we feel responsible – thus allowing human nature to support the longer-term perspective. From our grandparents and parents we distil our values and through our children and grandchildren we connect with the future. This is shown diagrammatically in Fig. 3.9.

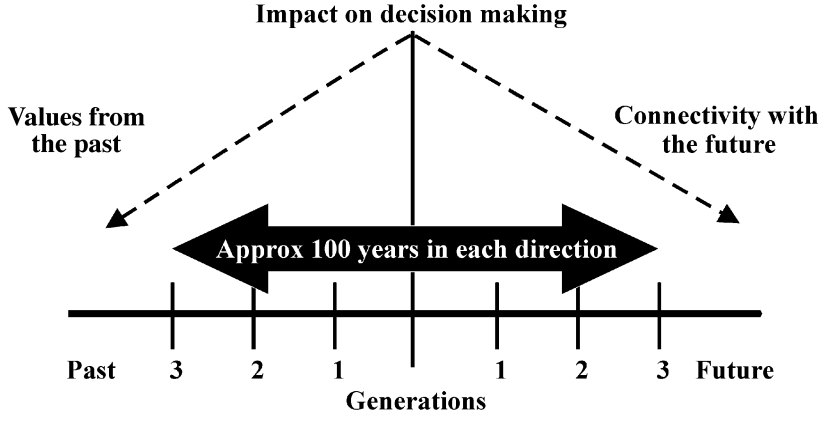

Figure 3.9 Impact of generations on decision-making.

Whatever scale we choose, it would seem that a philosophy is more appropriate than a range of techniques. It is more about behaving within a framework in a way that is conducive to the objective to be achieved. One of the attempts to outline a philosophy such as this in a simple way, that all could understand, was Alex Gordon's '3 Ls' concept: 'Long life, Loose fit, Low energy' when designing buildings (Gordon, 1974). It had no quantitative measures but provided a frame of reference within which it was possible to begin to collect quantitative evidence and then seek improvement. It enters the realm of the

learning organisation where the call for improvement becomes the watchword of the organisation – in this case society. The questions asked are then:

- ❑ 'Will this building development last a long time or longer than previous developments?'
- ❑ 'Will it be easily adaptable to change in the future to avoid using up non-renewable resources either in extraction or in use?'
- ❑ 'Will it use less energy in extraction, manufacture and operation than similar types of building?'

Once we get into this frame of thinking we begin to devise the techniques and measures appropriate to this view of the world. It provides a belief system which those who adhere to this belief can respond to and justify their behaviour. If it becomes the mantra of the many, it becomes politically unacceptable to follow a different path and it is adopted within the culture. In the '3 Ls' concept, two of the drivers have time as a key feature and so it begins to permeate the thinking of the many. What seems appropriate for a building soon becomes the view of the planners and the local authorities and begins to have significance for the district and then the city. A virtuous circle has begun.

Perhaps the closest to a view about how to approach the question of 'time' is the methodology employed in the study referred to in Chapter 8. This was a competition to set out a plan for a sustainable city for 100 years time and was won by the City of Vancouver. Those undertaking the study had to address the question of time in a very positive way. Targets for the future were set by the team and then it was necessary to discover a process by which these could be achieved including milestones relating to time for the whole of the 100-year period. As such, they had to address many of the issues raised in this chapter in a very practical way. The encouraging aspect of the exercise was that as the stakeholders began to look beyond the immediate future they began to leave the 'baggage' of the present behind and were able to think more freely. If this is the case it could be argued that we need more of this type of study because it encourages improvement without the constraints of the future and allows a wider group to gain consensus around the problems faced by an urban environment in achieving sustainable development.

The luxury of the 'time' horizon

The discussion in this chapter has argued the case for a longer time period in which to consider sustainable development than presently seems to exist in the developed world. Short-term financing and

meeting the needs of stakeholders are often quoted as the reason why we can't extend our horizons. Financiers and investors want quick returns and sustainable development needs time to establish itself. Even if we could persuade people to think long term and consider the needs of future generations in the developed world, and there are signs that this is happening, the Third World might consider this a luxury of the rich.

If someone is living at subsistence level and the question is one of whether he or she will survive, then considering the needs of future generations appears absolutely irrelevant because it may well be that the present generation will not survive. Long term thinking becomes a luxury which only the wealthy can contemplate.

Various figures suggested for South Africa, a very mixed group of First and Third world peoples, forecast that by 2010 deaths from AIDS will leave two million children as orphans. If this is true the repercussions for the country are enormous. Not only is there the problem of assisting these poor children but there is also the social impact of large numbers of children, many of them living on the streets, who to stay alive may turn to other activities that may be antisocial. In addition, it means by implication that a vast swathe of those who work and provide the economic wealth of the country (the parents of these children) will be dead or incapacitated. It is thought that around 17% of the population of South Africa is HIV positive. The impact on the economy and its ability to provide social services for the orphans will be devastating. This problem will impact within a decade, not within a generation. The timescale over which decisions have to be made is extremely short and taking the long-term view, which may still be a good thing to do, is almost impossible. Survival becomes the order of the day.

This is in a country where many communities have been able to live sustainably for scores of generations. However, the integration of outside cultures, and the wealth within those cultures, has led to aspirations that go beyond rural living and that often create an unsustainable society as the mistakes of the western economies are repeated, within much shorter periods, in the Third World environment.

These aspirations for wealth can lead to the repetition of First World mistakes at a time when the First World is coming to terms with those mistakes and attempting to take action. Does the First World turn back and retreat into a more primitive but nevertheless sustainable way of living and meet the developing nations half-way, or is there some other way in which the aspirations, already realised by western economies, can be achieved by the developing nations? It is a critical issue and a visit to some of the nations with high economic growth will show that the mistakes are often being repeated.

When the West points a finger, the developing nations cry hypocrisy.

It is often seen as a way of penalising the developing world when the West has reaped the benefit of exploitation in the past. For the Third World it can appear to be a restraint on their growth and a means by which the West can avoid competition – economic power is being used to exploit them still further.

4 A Proposed Framework for Evaluating Sustainable Development

Chapters 1, 2 and 3 have provided a basis for viewing sustainable development and have tried to establish some guiding principles. They have also looked in outline at some of the approaches that are being taken by others, and their success or otherwise.

One of the major requirements identified in Chapter 1 was the need for structure. This is not a new problem for an emerging discipline. Every new avenue for study has to go through the process of giving the subject form. This allows the subject to progress and encourages the building blocks of knowledge to be developed in a coherent and systematic way so that the full meaning and extent of the subject can be discussed and shared by those working in the field, and subsequently by those who will use and be the beneficiaries of the system. If there is not a commonly agreed structure the following problems can arise:

- ❏ The topic loses coherence and understanding is difficult.
- ❏ It is difficult to share knowledge in a meaningful way.
- ❏ Vocabulary can be too diverse. The same topic can be described in different ways and meanings are not shared.
- ❏ It is difficult to build knowledge in a systematic way.
- ❏ Viewed by those who are outside the system (as well as those inside), the subject appears to be ill-formed and it may even be dismissed as unimportant or irrelevant or insufficiently thought through.
- ❏ Collection of data becomes problematic as standardisation is difficult because of the different competing structures all trying to do the same thing.
- ❏ There is little theoretical underpinning for the subject as a whole. It

rests on a collection of apparently unrelated topics that cannot be linked together.
- ❑ A reductionist view prevails and this can mean that the holistic approach is lost.

Sustainable development at the present time suffers from many of the above problems and therefore can often be seen by sceptics as having little substance. A framework or structure does help enormously in people's understanding of what is included in a topic and this in turn can give it more substance than a series of ad hoc studies. This chapter attempts to provide such a structure from what the authors believe to be a useful theoretical base.

The need for a holistic and integrated framework

Decision-making for sustainable development in the built environment requires new approaches that are able to integrate and synthesise all the dimensions of an urban system (or a building) and different point of views, in a holistic manner (Mitchell, 1999; Deakin, *et al*., 2001).

Much of the early work on sustainable development in the built environment was focussed on the ecological dimension of the problem, as reflected in the policy agendas of various local authorities. On the other hand, the softer and more 'fuzzy' dimensions of sustainable urban development (e.g. political, social, cultural, aesthetic, and so forth) are still poorly addressed in decision-making, while contemporary analytical tools do not handle them adequately.

Recent surveys of environmental assessment (Deakin, *et al*., 2001, Deakin, *et al*. 2002a; Deakin, *et al*. 2002b) have examined how the methods are currently being used. Only in 'life-cycle assessment' is there evidence to suggest that the assessments augment environmental capacity to include equity, public participation and futurity within the sustainable development issues of the economic and social structures in question (i.e. the economic and social structures underlying the city of tomorrow and its cultural heritage). Even with this group of methods, there is clear evidence to show that the methods experience noticeable difficulties in dealing with the complexity of institutional structures and the range of stakeholder interests that this introduces into any such assessment (Lombardi, 2001; Nath, *et al*., 1996).

At present, there is a need for greater integration at the level of local decision-making. This is often emphasised in the literature through the concept of what is sometimes called 'co-evolutionary interdependence' between the physical environment and the human environment (Faucheux, *et al*., 1996; O'Conner, 1998; Faucheux and O'Conner, 1998, Capello, *et al*., 1999). This approach suggests that the development of the environmental, economic and social dimensions are all com-

plementary. There is a serious lack of understanding regarding the complex dynamic interactions and feedback effects of socio-economic-technological activities and the earth's ability to sustain itself. For example, the impact of social organisation on the built environment and subsequently on its sustainability is not well understood.

A further problem is that experts use a specialised and codified vocabulary that is not common to all the disciplines and stakeholders involved in the planning process. Each discipline brings its own agenda, its own classification system and its own techniques to the problem. Often the disciplines are unwilling (or unable) to consider the views represented by others because there is not a common language or a systematic methodology that will allow a fruitful dialogue to take place (Lombardi & Brandon, 1997). Consequently, there is still a need to incorporate sustainable development principles and criteria in current decision-making processes.

Devising strategies for the sustainable development of cities is difficult, not just because the nature of a city is complex, but also because the concept is ambiguous, multi-dimensional and generally not easy to understand outside the single issue of environmental protection. Mitchell (1996) suggests that effective urban sustainable development strategies and sustainable development plans can best be identified by ensuring that decision-makers and developers are adequately briefed on sustainable development issues, local characteristics and community needs. This process requires the application of a suitable operational framework, and an evaluation method or approach that is able to guide developers through the decision-making. However, at the moment, such a structure for organising the information required in decision-making is not yet available or agreed on among the different disciplines and fields of activities.

The lack of an agreed structure that can help decision-making processes achieve greater sustainability is a major problem. This chapter suggests an integrating mechanism or framework which could bring together the diversity of interests necessary to assess the impact of the built environment and urban design on urban sustainable development. This framework could be used by all stakeholders in the development process including political and technical decision-makers, public local control officers, planners and designers, citizens, lawyers and financial advisers, enabling them to check a design or a plan in the context of sustainable development and to learn from it. It should be able to assist the process of devising sustainable planning strategies, ensuring that all sustainable development aspects and quality of life issues are included and nested into each other. It also provides a structure that can be used at different levels of detail, thus providing a vehicle that all stakeholders can engage in but contribute to at different levels of complexity.

The basis for this framework is the work of the Dutch philosopher

Herman Dooyeweerd (1894–1975) who developed what he called a 'Theory of the Cosmonomic Idea of Reality' (Dooyeweerd, 1955). This theory attempts to integrate all of the aspects of the universe in a meaningful form to help explain structure and relationships in a holistic way. At the very least it provides a checklist of things to examine in order to establish whether a development is sustainable. At best it provides a means of explaining the interdependence between aspects of the urban environment and can be linked to the wider sustainable development agenda. Its holism allows an integrated view of the issue and also assists in explaining what is meant by, and what contributes to, sustainable development (see Appendix A).

As stated earlier, there is the added advantage that this approach is simple in concept and can be used effectively by all stakeholders at different levels of understanding (see Fig. 4.1). The underpinning philosophy, however, is complex and is based on a Christian view of the world not unlike the value systems adopted by the western democracies. However, in informal conversations with people from other cultures and faiths it has proved to be acceptable as a way forward since it recognises all issues in which human beings are engaged with the universe. The interpretation of content may differ but the structure remains the same.

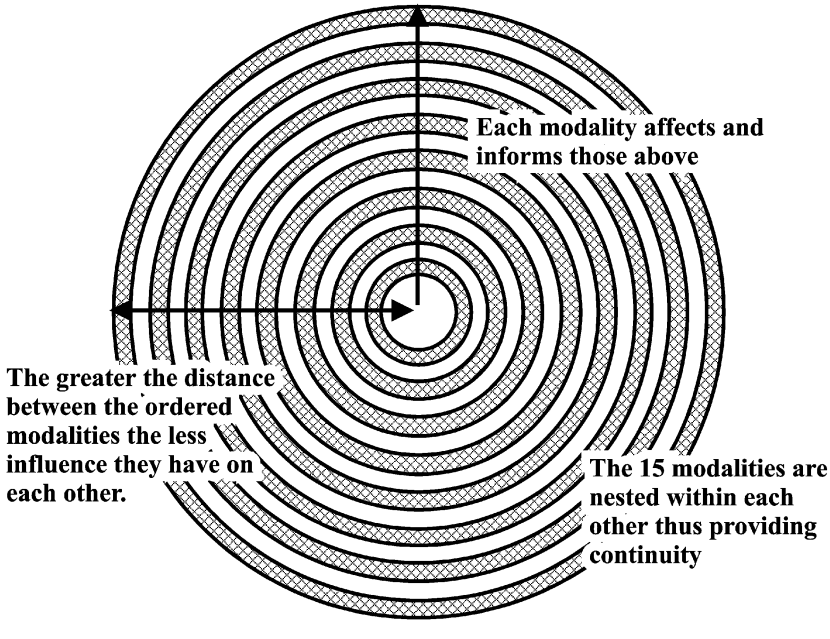

Figure 4.1 Features of the framework.

The theoretical underpinning of the framework

The challenge for political and technical actors (planners, designers and urban authorities) is to devise strategies and policies, urban plans and projects that can guide cities and other aspects of the built environment along a more sustainable development path. At present, there is a lack of a decision support framework, system or tool, which is both comprehensive and holistic, to harmonise the different aspects of sustainable development in planning and design. This section introduces a possible approach to this problem.

As stated earlier, the framework is supported by Dooyeweerd's theory of the 'Cosmonomic Idea of Reality' (Dooyeweerd, 1968, 1979). This has recently been postulated in a number of studies related to cybernetics, information systems and organisation learning, mainly because it offers an extremely useful checklist to guide systems development and usage, ensuring that not only one but all aspects of human life, from the quantitative to the highest-level value system, are present in the design. In addition, it has been studied and developed by other contemporary authors such as Hart (1984), Clouser (1991), Kalsbeek (1975), de Raadt (1991, 1994, 1997), Griffioen (1995) and Basden (1994, 1996), who have illustrated some of its benefits for understanding and explaining how social systems and institutions work.

A particular feature of the theory is its ability to explain complexity without falling into reductionism and/or subjectivism. This feature suggested that the theory would be useful in structuring sustainable development in the built environment, overcoming one of the problems of current tools (see Chapter 2).

The theory is complex, but broadly the 'Cosmonomic Idea of Reality' proposes a list of dimensions of reality, named *modalities*, which can be useful for understanding the 'functioning' of a complex system or entity such as the built environment or a local community. The list of modalities identified by Dooyeweerd and their meanings is provided in Table 4.1. The third column of the Table illustrates the meaning of each modality in the context of sustainable development. Both the original name of the modalities and the proposed definition are used in Table 4.1.

In simple terms, a *modality* can be defined as an irreducible area of the functioning of a system or entity. It is characterised by a nucleus of meaning and it has its own law, or set of laws, which not only guides but enables entities (people, animals, trees, houses, etc.) to function in a variety of ways. For example, the laws of physics provide the functioning of materials while the laws of biology regulate the functioning of trees. More complex entities, such as local communities, are guided by several other modalities whose laws are less determinative and more normative since their fulfilment is contingent on people's inclination to follow these laws, e.g. the law of justice or the law of ethics.

Table 4.1 The list of modalities and their meaning.

Modality	Meaning	Proposed definition in the context of sustainable development
Numerical	Quantity	Numerical accounting
Spatial	Continuous extension	Spaces, shape and extension
Kinematics	Movement	Transport and mobility
Physical	Energy, mass	Physical environment, mass and energy
Biological	Life function	Health, biodiversity, eco-protection
Sensitive	Senses, feelings	People's perceptions towards the environment
Analytic	Discerment of entities	Analysis and formal knowledge
Historical	Formative power	Creativity and cultural development
Communicative	Information	Communications and the media
Social	Social intercourse	Social climate and social cohesion
Economic	Frugality	Efficiency and economic appraisal
Aesthetic	Harmony, beauty	Visual appeal and architectural style
Juridical	Retribution, fairness	Rights and responsibilities
Ethical	Love, morality	Ethical issues
Credal	Faith, trustworthiness	Commitment, interest and vision

The philosophy of the 'Cosmonomic Idea of Reality' has not placed the fifteen modalities in an arbitrary order: the earlier modalities serve as a foundation for the later (Dooyeweerd calls this 'the cosmic order of time') (Kalsbeek, 1975). For instance, the economic modality is dependent on the social, the social on the lingual, the lingual on the historical, and so on. In other words, the fifteen modalities are nested inside one another and each modality affects and informs those above.

This interrelation between the modalities (*dependency relation*) defines their position in the list. The consequence of this order is also felt in terms of the influence they are able to exert on each other. For instance, we often use the laws of mathematics (numeric modality) to understand economical processes (guided by the economic modality) but the results are much more effective if we use a modality closer on the list such as the social one. In other words, the greater the distance between the ordered modalities, the less influence they have on each other. Figure 4.1 graphically illustrates these concepts. A more detailed description of the theory is provided in Appendix A.

The modalities can be better illustrated by an example related to the built environment.

The built environment explained by the modalities

The built environment represents a meaningful sub-set of the whole topic of sustainable development (Brandon, 1998). It is part of the physical system and is intrinsically linked to both the environmental (physical) and the human (social and economic) systems. For example, urban density, mobility and lifestyles are usually reflected in the demand for space and the flow of resources (Breheny, 1992).

Literature on sustainable urban development emphasises the need to have the three systems – environmental, social and economic – functioning in an integrated and coherent manner. This is important if we are aiming to achieve a stable or improving level of wellbeing in the local community in the long term (quality of life) and a reduction of negative effects, such as pollution in the biosphere (environmental quality).

As a physical entity, the built environment has spatial extension, mass and energy. It is subject to the laws of thermodynamics (energy) and others, such as the law of gravity, the laws of physics and the rules of geometry. Its fundamental characteristics include building materials and components, layout and form of the building and the structure of the ground on which it is built. In the 'Cosmonomic Idea of Reality' these are all issues of the spatial and physical modalities whose laws regulate and guide the functioning of buildings, materials and components.

The built environment represents the physical context in which individuals spend their time living, dwelling, working and recreating. Unlike other manufactured products, it is unequivocally linked to the land. This makes a building unique, and therefore an object of economical and juridical interest. In addition, it has social and cultural properties since it is useful in satisfying a number of human needs, both material and immaterial. In terms of the 'Cosmonomic Idea of Reality', the built environment, as a system or entity, is qualified by the physical modality. This is the specific aspect that guides and regulates the internal organisation or development of the system.

Although the built environment is characterised by the physical modality, it functions in all the other modal aspects, maintaining different relationships with them. For example, an urban district is usually formed by a number of houses, offices, banks, schools, roads and so forth (numerical modality), placed according to a particular layout (spatial modality). Within an urban district there is usually a constant movement of people, cars, bicycle, animals and goods (kinematics modality) which need energy in order to function (physical modality). People and other living creatures also need food, water, air to breath, houses for shelter and hospitals for health (biological modality). They display emotions and feelings in their relationships

within a group (sensitive modality). Furthermore, people have an intrinsic logical dimension resulting in the discerning of entities (analytic modality). They build their houses on the basis of past experience and technological knowledge (historical modality) and they communicate with each other and with the outside environment through media (communicative modality). They have social intercourse (social modality) and often find their employment there (economic modality). The built environment can be beautiful and attractive both for the people who live in it and for tourists (aesthetic modality). A group of laws regulate the use of land and property (juridical modality) and often there is discussion on topics such as the environmental pollution caused by modern city life (ethical modality), but, in the end, there is usually a strong belief in science and technology as the solution to modern society's ecological problems (credal modality).

Table 4.2 classifies a number of issues related to the built environment according to the modalities. This list of issues can only be indicative. It cannot be exhaustive because of the complexity and richness of the urban environment.

Table 4.2 Examples of sustainable development aspects within each modality for the built environment.

Modalities	Issues of the built environment
Numerical	Population (human), amount of various resources available, number of species and their population levels, census statistical office, information.
Spatial	Layout, shape, building footprint, location, proximity, terrain shape – flat, mountainous, etc., neighbourhood area, urban area, district area, etc.
Kinematics	Infrastructures, roads, motorway, railways, cycling roads, pedestrian streets, car parking, transport and mobility, wildlife movement, mobility, accessibility.
Physical	Energy for human activity, energy for biotic activity, physical environment, structure of ground on which to build, building materials, components, buildings, districts, settlements.
Biological	Food, shelter, housing, air and air quality, water and water quality, hygiene, green areas, pollution, soil quality, biodiversity, habitat diversity and quality, resilience of eco-system (ability to recover from imbalances), health and health services, hospitals, gyms.
Sensitive	Feelings engendered by living there, feeling of wellbeing, comfort, fitness, noise, security, safety, privacy, provision of peaceful surroundings, e.g. motorway noise that makes bird song inaudible, counselling services, asylums, housing for domestic animals.

Contd.

Table 4.2 *Contd.*

Modalities	Issues of the built environment
Analytical	Clarity with which issues are aired in the community, letting people clearly know facts and issues, quality of analysis for planning and evaluation, diversity, functional mix, knowledge, tendency to understand rather than react to issues, schools, universities, education services, research.
Historical	Encouraging creativity in the community, innovation, heritage, history of the community and area, technology employed, museums, archives, built heritage.
Communicative	Ease of communication in the community, quality of communication (e.g. truthfulness), lingual networking, symbols, information provision, monuments, signs, advertising, the media.
Social	Social relationships and interaction, recreational places, social climate, cohesion, plurality, competitiveness, collaboration, authority structure, social register, clubs and societies.
Economic	Use of land, use and replacement of renewable resources, use of non-renewable resources, recycling schemes, attitude to finance, efficiency, financial institutions, offices, banks, stock markets, industrial plants, employment.
Aesthetic	Beauty, visual amenity and landscape, architecture and design, architectural style decoration, social harmony, ecological harmony and balance, art galleries, theatres.
Juridical	Laws and law-making with regard to property, ownership, regulation and other policy instruments, contracts for building, rights, responsibilities, inequities, property-market interests, democracy, participation, tribunals, administrative offices, legal institutions, political structure.
Ethical	General demeanour of people towards each others, goodwill, neighbourliness, solidarity, sharing, equity, morality, health of the family, voluntary centres.
Credal	Loyalty to the community, general level of morale, shared vision of what we are, (e.g. 'I shop, therefore I am', 'I am responsible to God'), aspirations (e.g. to car ownership), shared vision of the way to go (e.g. 'science–technology–economics will solve our problems'), religious institutions, churches, synagogues.

The above description has made use of the fifteen modalities of Dooyoweerd's theory for revealing the complexity of an urban environment as a system and its multi-dimensional meaning. However, if we want to understand the modal aspects more fully we need to isolate each aspect in our mind so that we can get at its individual natures and distinguish each aspect, making it irreducible to the others (Kalsbeek, 1975).

The fifteen modalities for understanding sustainable development in the built environment

In this section, all the fifteen modal aspects are outlined with specific attention to the 'role' that each of them plays within the context of sustainable development in the built environment. It should be emphasised that the modal order provides a particular position for each aspect. The modal aspects are so constituted that the earlier aspects serve as a foundation for the later. This order is not reversible within the 'Cosmonomic Idea of Reality'.

This order of fifteen modal aspects is suggested as an approach that provides decision makers with a framework with which to classify relevant sustainable development issues in an urban design or planning situation. The names of the modalities given below relate to Table 4.1.

The numerical modality: numerical accounting

The numerical modality means a discrete quantity, awareness of how much there is of things, and it precedes all the following modalities. In fact it provides all the required quantification for an urban development. Some well-known examples in construction are: the number of hectares of ground on which a building is placed (spatial), the amount of resources required for the construction (physical) and the number of living creatures (sensitive) who occupy a building.

The spatial modality: spaces, shape and extension

The spatial modality refers to 'continuous extension'. It is one of the most fundamental modalities for this study since it qualifies spatial differentiation and all the following issues: building shape and layout, terrain shape, location, geographical position, proximity, area topology and form. It is the basis for the development of all the later aspects. For example, the accessibility to a site or to a building, which is recognised as a crucial factor for the quality of living, is characterised by the spatial modality but it is also qualified by the kinematics aspect (such as movement to a place or a site).

The kinematics modality: transport and mobility

The meaning of the kinematics aspect is movement. It characterises the movement of people and goods within an open or closed space, a city or a building. It qualifies mobility in towns and regions. Transport and mobility are crucial factors for the sustainable development of an urban context, both for their environmental ecological impacts and for their utility and quality of life features.

The physical modality: physical environment, mass and energy

The physical modality has its meaning in energy and mass. It qualifies different elements of our living environment, dealing *inter alia* with energy, water, air, soil, and natural materials and resources. Its core meaning qualifies physical (natural) elements, such as building materials and the ground on which to build, and also those natural barriers to the spatial development of regions, such as mountains and lakes, the oceans and so on. Artificial or man-made barriers, such as walls, bridges and other built infrastructures, are also qualified by the physical modality. Finally, the physical modality characterises all built (urban) environments, which are recognised as systems with a finite carrying capacity (Rees, 1992).

The biological modality: health, biodiversity and eco-protection

The biological modality has its core meaning in organic life. In terms of the built environment, it has been recognised that buildings have a major impact on the eco-system as they are produced, consumed and continue to exist within the cycle of nature. This can be expressed by the concept of the *ecological footprint* (see Chapter 2) which is defined as the area of land required to produce biologically all the resources consumed by a community, and to assimilate its waste, indefinitely (Rees, 1992). It expresses the impact of construction on the natural environment, in biological terms. These can be associated within recurring impacts over the building's life, producing a remarkably large footprint. Unfortunately, an understanding and assessment of all the life-cycle impacts of a building is not an easy task. There is a need to know the types of information available and the problems that arise in assessing the existing situation, analysing past trends and projecting future ones.

Case studies and examples of sustainable development in planning have shown that both health and eco-protection or biodiversity are relevant issues in the development of an area. The consequences of building and construction activities influence the quality of air, the quality of water and the quality of the soil over a long time period, particularly in the case of an industrial plant. Biodiversity is not encouraged but penalised by the construction sector which has always removed land from the natural environment and from agricultural use for material extraction and the expansion of cities. Again, the waste derived from construction activities and other uses of land (industrial use or housing) can condition the biological functioning of the site and the urban complex. On the other hand, biological issues can provide direction, for example, in the importance of a 'green' design. A shape

and form of building sensitive to environmental issues, as well as a good location in terms of reducing the pollution produced by a building, are key issues in sustainable development at the building level.

The sensitive modality: people's perceptions towards the environment

The biological modality anticipates a number of later modalities. For example, the presence of pollution and the lack of biodiversity of a site are able to influence the perception that people have towards the environment. The latter is an issue of the sensitive modality and it is crucial for sustainable development processes. The sensitive has its root in feeling, which is a quality belonging to everyday experience. Because feeling is irreducible, defining it is as difficult as defining the other meanings.

The feelings of comfort, safety and privacy or, say, the noise level all play a large role in the quality of living for human beings. If we did not feel safe in a place we would certainly not stay there long and would prefer to change our living environment. However, the feelings of privacy, security and comfort and the pleasure engendered by living there can make our lives more satisfactory and of higher quality.

Not only the biological issues but also the spatial and the physical characteristics of the built environment, such as the layout, shape and location of the building, also contribute to the quality of living. This means that the sensitive modality is able to encapsulate all the modalities preceding it.

The analytical modality: analysis and formal knowledge

Human feelings and perceptions are the basis for the logical process of analysis and discernment of the parts constituting a building. The sensitive is the base for developing analytical aspects.

The meaning of the analytical modality is logic and distinction. In planning and design, the analytical modality refers to analysis and formal knowledge. This usually helps decision-makers to recognise a good construction from a bad one and the quality of analysis used in the building design. In some cases the building can be viewed as a good example of design and it can act as an educational tool. Again, the shape, layout and form of the building play a strong role in providing information for this analytical function. This explains why the spatial and physical modalities are placed before the analytical in the modal order. But the latter is able to anticipate and provide information for other aspects, such as the historical modality. Education and the ability to rationalise and discriminate between elements are the foundation

for developing a knowledge and a cultural background in construction. These are issues related to the historical modality whose core meaning is *formative power*.

The historical modality: creativity and cultural development

The historical modality qualifies creativity in design and the technology employed in construction. The expertise in construction usually comes from learning from good practice. Innovation in technology is made possible through research activities that make use of analysis. The relation between the historical modality and the analytical modality is particularly important here.

The historical modality represents the cultural and technological progress of human beings in achieving a better quality of living. The production of the built environment entails the use of natural materials and the consumption of energy, and impacts on local habitats. This modality governs the processes of modelling the physical materials and of assembling the components of a building and all the operations required for developing the construction plan. Therefore it includes the spatial, kinematical, physical and analytical modalities. In planning and design for a human community this is reflected in creativity and cultural development, and it also refers to conservation strategies for the built heritage.

The communicative modality: communications and the media

The historical modality anticipates a number of modalities, and firstly the communicative. For instance, a new building (or renewal) can be regarded as an example of good practice or a laboratory for innovative technologies. In both cases it represents a way forward in scientific and cultural development. It represents a modification of the present environment that has been put in place in order to satisfy some community needs. It communicates symbols and messages to the community. This is an issue of the communicative modality whose significance is to provide information and meaning.

A building is usually able to inform people about the functions held within it. We can easily recognise a hospital as different from a station or from a bridge just by its external form and layout. Therefore the communicative anticipates both the spatial and the physical but also the historical.

Often, a building such as a monument or a built cultural heritage or an example of modern architecture is able to communicate particular values to a community (credal) from an aesthetical viewpoint (aesthetic). In these examples, the communicative is the foundation for the

higher modalities. Communication and the media are relevant factors in linking people together, facilitating participation in planning and the achievement of a common vision of sustainable development in the built environment. The communicative modality directly anticipates the meaning-nucleus of the social modality: a house or a site may provide a welcome message to its visitors. The building is usually a gathering place for people, such as a meeting point for friends in a bar or a club, but may also be an office or other building that encourages relationships with colleagues or other people.

The social modality: social climate and social cohesion

Social intercourse is the meaning-nucleus of the social modality. The size and form of the building, the biological quality of the internal and external environment, the accessibility of the building, the feeling of comfort, its design, the technology used and the messages provided by it – all these elements play a pertinent role in human attitudes towards social interaction and thereby condition it. The spatial, physical, sensitive, historical, analytical and communicative modalities precede the social modality in the framework and support it.

The economic modality: efficiency and economic appraisal

The use that a community makes of a building is connected to its economic value in the real-estate market. The social modality anticipates the economic modality. The link between the two modalities is very strong, as is also recognised by the utility theory of value for buildings (Forte & De Rossi, 1996).

A number of economic issues relate to construction activity and a number of decisions are taken with regard to the initial, limited amount of resources available to developers and builders for construction. Form, shape, layout, and location are fundamental issues that determine the cost of a building. Physical and spatial resources also influence future economic decisions, as the life-cycle cost of a building demonstrates (Ferry, Brandon & Ferry, 1999). The economic modality asks planners and designers to consider future costs for the design and development of buildings as it very often refers to an economic appraisal over the building life cycle.

The spatial, physical, sensitive, analytical and all the other earlier modalities are anticipated by the economic modality. Many economic decisions relating to buildings are determined by the environmental conditions of the site, the perception that people (e.g. developers, users, economic decision-makers) have of it, the analyses made for developing the building design, the technology available at the time, the information owned by the actors and finally the use made of the building.

In the literature, an existing interdependence that also encompasses social and cultural values is recognised between the economy and the environment (Costanza, 1991; 1993). On one hand, environmental quality influences economic performance (e.g. a higher environmental quality could be reflected in a higher market value of buildings) and, on the other hand, the economy affects the environment (e.g. an industrial plant may provide pollution and stress the eco-system). This influence is visible for both its positive effects, such as the improvement and regeneration of the built environment, and its negative effects, such as the damage that urban activities have caused, for example to natural landscapes, to sites of historical, architectural or cultural interest and to local traditions and customs.

The economic modality precedes the softer modalities and reflects a key issue for sustainable development in the built environment. For example, the use that people make of a building has an impact on the harmony (aesthetic) of the urban complex. If the users of the building are functioning poorly in the economic aspect, by squandering physical resources or by inefficient handling of their domestic waste or by not caring about their gardens and their neighbourhood, the harmony of the whole urban area might be threatened and sustainability is low.

The aesthetic modality: visual appeal and architectural style

The concept of harmony between elements of a settlement or parts of the same building is the meaning-nucleus of the aesthetic modality. A number of factors occur to determine the harmony of a built system, such as the form, layout, location and distribution of the buildings, the quality of design, the use made of the built environment by the community, the cost paid and other economic choices that occur during planning, design and building. The aesthetic modality comes before all the more quantitative aspects in the modal order.

The particular architectural style and the decoration of a building possess an aesthetic meaning. The beauty of a building can be recognised not only by its inhabitants but also by neighbours and tourists. For example, a qualitatively high image of an urban area not only meets the requirements of the citizens but also attracts new investors, drawing in firms that intend to re-locate and becoming a 'model' to be followed by other local administrations. Many effects of wellbeing are expressed only indirectly and may bear little relation to an increase in productivity or cost savings, such as the relationship of inhabitants to the urban context, the degree of social integration, safety, the presence of green areas and people's contribution to education and training.

The juridical modality: rights and responsibilities

The building can be in harmony with its surrounding or, alternatively, can be in contrast. These relationships between a building and its surrounding are usually regulated by technical and planning legislation. The latter is an issue of the juridical modality, which precedes the aesthetic aspect, specifically in the case of standards, codes of practice or norms regulating the development of the building in terms of architectural style, the colour of the facade and similar matters.

The meaning of the juridical modality is well explained through the concepts of rights and responsibilities. From a juridical point of view, a building belongs to a public or private owner within an administrative space, under the regulation of a local authority. The local administration governs and regulates the functioning of an urban complex through a complex body of laws. Regulations can also be found at different planning levels – local regional and national. In the UK, for instance, the main planning legislation is the Town and Country Planning Act 1990 (amended and revised in 1991) and, in contrast to other Member States of the European Union, there are fewer provisions for planning at the national and regional level. Spatial planning is largely the responsibility of local authorities, although central government retains considerable influence and control.

There are also several repercussions in terms of properties and use of land. In designing a building, urban and technical standards need to be taken into account. On the other hand, a new building can provide a modification to the actual property structure, and sellers and buyers are required to be formally registered.

The juridical modality follows and encapsulates not only the aesthetic modality but also the economic, social, sensitive and all the earlier aspects in the list. In particular, the relationships between the juridical and the biological modalities need to be emphasised in terms of sustainable urban development, for example the environmental pollution caused by a building such as a factory or a waste disposal plant. In the juridical modality, the producers of pollution (the users or owners of the building) are responsible, in legal terms, for the negative service provided to the community. Consequently, in some countries they are required to pay a price or a particular tax for this pollution, according to the principle that 'pollutant (or user) pays' (Pearce & Turner, 1991). Unfortunately, it is not always easy to define the exact boundaries of a pollution source. The effects of pollution can often be felt very far away from the place or origin and this provides an obstacle to the application of the principle. Often the administrative boundaries (juridical) do not correspond to the natural (spatial and physical) ones.

The ethical modality: ethical issues

In its role of anticipating and supporting the ethical aspect, the juridical modality provides a fundamental contribution to our understanding of sustainable development in the built environment. The ethical modality refers to a particular attitude towards other entities, both living creatures and inanimate ones, which is governed by love and morality. In the context of this study, it specifically suggests that citizens (particularly building and land owners) go beyond mere duty in exercising ownership and responsibility and that those who live nearby should look beyond the traditional NIMBY ('not in my back yard') defensiveness.

The ethical modality precedes and encapsulates the meaning of all the earlier modalities. For example, we can think of the social conflicts arising from the decision to locate a waste disposal plant, an airport or a railway nearby. The spatial modality (in terms of location) and the biological modality are foundation dimensions of this modal aspect. However, other examples can be found in our everyday experience with regard to the wide repercussions that a legislative act (juridical) may have on the morale of a community.

Finally, the concept of equity – which is fundamental in a study of sustainable development – is an ethical issue, although the concept also holds an economic and juridical meaning when it is defined as a 'fair distribution of resources between members of the same community' (Voogd, 1995). It is based on humanitarian love for one's neighbour, love of nature and so forth or, in the words of the Brundtland Report (WCED, 1987): 'a respect for the needs of future generations'.

The credal modality: commitment, interest and vision

The ethical certainly anticipates the credal modality. It can often be observed that when the morale of a community is low for some reason, such as a political decision, an economic decline derived from an inefficient use of resources or a social problem (e.g. the presence of crime), people have no commitment towards their environment and no development is possible.

The meaning of the credal aspect is specifically faith. This is an essential part of the structure of human beings and not just a characteristic peculiar to Christian or other religions. The contents and the directions of faith differ among different people. For example, belief can be directed towards God or towards an idol or towards any other philosophy of life whether it be communism or materialism.

The built environment is, finally, a reflection of what we think it has to be. Urban form, the shape and layout of buildings and infrastructures, the design and the planning, the social attitude towards the environment, all the economic choices made and the aesthetical and

ethical characteristics of our built environment are just a reflection of a simple but fundamental credal issue*: who we are and where we aim to go as individuals or as a community* (Lombardi & Basden, 1997).

Development of the multi-modal framework for decision-making

The development of the scientific procedure underpinning the framework is supported by the theory of Dooyeweerd described above. The fifteen descriptions are suggested to provide decision-makers with a qualification system for classifying sustainable development issues in urban planning and design. A number of scientific criteria and specifications, followed by questions for examining sustainability, will guide the user in handling the evaluation of a planning or design proposal.

The limitations encountered in existing frameworks for decision-making (see Chapter 2) have suggested that the structure should be flexible and able to take into account various situations and planning and design problems. The structure should include criteria that are relevant to decision-making and at the same time are easily checked by users, providing information about the sustainability of an urban development.

This framework should be able to facilitate collaboration among stakeholders, aiding consultation and communication between the formal decision-makers (planners, designers and urban authorities who devise strategies and policies for the cities), and any members of the general public who may participate in this decision-making process (stakeholders and concerned citizens). In other words, it should possess a user-friendly terminology.

To illustrate the use of the framework, some example questions have been developed for an urban district that is being redeveloped. These questions will help decision-makers (planners or stakeholders) to examine each sustainable development aspect and to provide evidence that the aspect has been addressed in a planning situation.

This cannot be an exhaustive list of questions because of the complexity of the subject but they provide a prompt which may support and guide evaluation in planning. It is also worth noting again that the evaluation is not limited to technical factors but also includes non-technical aspects as it follows the checklist illustrated in Table 4.1. Each of them will represent a level of information that may be relevant for the stakeholders.

A final point is that the evaluation perspective adopted in the development of these questions is related to the so-called *ex ante* evaluation of potential alternatives. In this evaluation perspective, the aim

of the framework is to aid choice by decision-takers and stakeholders in the decision-making process. Clearly this example may be one in a series. By changing questions and assessment techniques, the checklist of modalities remains the same and can be assumed as the basis for an *ex post* (retrospective) evaluation or a *monitoring*. In *ex post* and *monitoring*, both of which imply a different view of the planning and management process, the framework may be a useful guide for understanding the changes produced by a policy or a programme and for judging the degree of achievement of a planning process. The flexibility of the framework will be further discussed in Chapter 5.

The following provides a short illustration of the questions which will allow us to examine sustainable development, encompassing all the issues that might lead to a harmonic environment.

Key questions for examining sustainable development within each modality

As sustainable development is a process that includes also non-technical aspects, such as socio-economic and cultural factors (see Chapter 1), the process can only be assessed by a robust theoretical framework able to provide structure and support for this complex evaluation exercise. The authors have adopted the modal order based upon the philosophy of Dooyeweerd and illustrated in the early part of this chapter.

Starting from the top of the modal order, the following are potentially key questions related to each modality redefined in the context of sustainable development, as introduced in Table 4.1. These example questions are indicative of the issues that need to be addressed and aid the person making the assessment to consider all the key issues (and the moral imperatives).

Credal modality: commitment, interest and vision

- ❑ Is the political situation stable?
- ❑ Does the scheme meet the requirements of regional–national plans?
- ❑ Will finance be available for environmental protection and for how long?
- ❑ What commitment has each stakeholder made to the scheme?

Ethical modality: ethical issues

- ❑ Does the development scheme provide the same opportunities or improvements for people in the future as in the present?
- ❑ Does the development scheme reduce social inequalities? Does it support the action of voluntary groups?

- ❑ Does the scheme provide protection to the biosphere, eco-system and animal species?
- ❑ Have all the stakeholders been involved in the development of the scheme?

Juridical modality: rights and responsibilities

- ❑ Have the rights and the responsibilities of all developers, land and building owners and users been accounted for in the long term?
- ❑ Does the scheme identify those who benefit and those who pay for the development? Does it include some possibilities for the reimbursement of damage and payment for the rights received?
- ❑ To what degree can people change their environment either directly or through elected representatives?
- ❑ Has a strategic environmental assessment (SEA) been undertaken (see Chapter 6)? Is there compliance with the technical–planning standards related to the protection of the environment?
- ❑ What citizens groups are entitled to participate in the decision process?

Aesthetical modality: visual appeal and architectural style

- ❑ Does the development scheme improve the artistic character and significance of buildings and settlement in the short and long term?
- ❑ Does the condition of the built environment enhance the visual appeal?
- ❑ Are the planned interventions aesthetically satisfying to all the stakeholders?
- ❑ Is the development in harmony with the context, the surroundings and the eco-system? Does the scheme improve the visual appeal of natural settings?

Economical modality: efficiency and economic appraisal

- ❑ Has a long-term financial appraisal been undertaken?
- ❑ What is the financial distribution to the stakeholders?
- ❑ Has employment of the local labour force in construction been considered?
- ❑ Is there an efficient environmental management system? Are there exhaustive city-wide recycling programmes from which the development could benefit?
- ❑ How many of the stakeholders have committed themselves to the financial appraisal?

Social modality: social climate and social cohesion

- ❑ Does the plan enhance and sustain social interaction in the long term?
- ❑ Does it consider the impact of the development on the social climate in the long term?
- ❑ Does the plan favour co-operation and association between individuals and institutions? Does it improve the accessibility to social utilities for all the members of the community?
- ❑ Does the plan consider the impacts of tourism on the cultural and natural settings?
- ❑ Have social clubs, voluntary groups and cultural associations been involved in the development of the scheme?

Communicative modality: communications and the media

- ❑ Is a monitoring system for the area available?
- ❑ Will the communicative infrastructures be improved in the present and the future?
- ❑ Is a long-term programme for urban signs available?
- ❑ Does the plan improve the accessibility to communication facilities for all citizens, including the poor and disadvantaged?
- ❑ Does the plan include environmental audits? Is environmentally orientated advertising available for the area?
- ❑ Is information on the development scheme available to all stakeholders? Are all relevant citizen groups able to take part in the discussion, argument and evaluation in planning? Does everyone understand the language used?

Historical modality: creativity and cultural development

- ❑ Does the urban plan include a restoration programme to preserve the cultural heritage of the area?
- ❑ Is the innovation based on local practice?
- ❑ Does the plan improve the living standards of the poor and disadvantaged and their cultural aspirations?
- ❑ Are the technologies employed environmentally friendly?
- ❑ Does the city have a well-established consultation process? Has consultation been successfully undertaken in relation to the proposal?

Analytical modality: analysis and formal knowledge

- ❑ Has scientific analysis been applied to the problem including consideration of the long-term perspective? Does the funding provided support the proposed solution in the long term?

- ❑ Is an educational scheme available for citizens ?
- ❑ Is an educational programme relating to the environment available for the community?
- ❑ Has the developed analysis been accessed and agreed by most of the stakeholders?

Sensitive modality: people's perceptions towards the environment

- ❑ Is a long-term security scheme available for the area?
- ❑ Does the plan address the issues of crime and vandalism in the area and surroundings? Will every stakeholder feel comfort and confidence in the design for safety within the surroundings? Is the viewpoint of children taken into consideration?
- ❑ Does the plan solve the problems of noise in the area? Does it take into account the visual impact?
- ❑ Are the viewpoints of all stakeholders, including those who have no voice, taken into consideration? Have groups representing the rights of children been active in decision-making?

Biological modality: health, biodiversity and eco-protection

- ❑ What is the carrying capacity of the area? Does the development scheme for the area take into account the maintenance of available capital of non-renewable resources in the long term?
- ❑ Is every stakeholder able to enjoy an appropriate quality of air, water and land in the developing area? Do they feel happy with the presence of green areas, hygiene, health and health services, hospitals, gyms, etc.?
- ❑ Is there an environmental planning scheme available for the area? Does the plan improve air, water and soil quality in the area? Does it increase or improve health services?
- ❑ Are the community groups active on environmental issues? Have all stakeholders taken part in the development of the environmental planning scheme?

Physical modality: physical environment, mass and energy

- ❑ Is an energy saving scheme that takes into account the long-term perspective available?
- ❑ Is there an environmental planning scheme available for the area?
- ❑ Does the development scheme for the area take into account the maintenance of non-renewable resources in the long term?
- ❑ Have local environmental action groups been involved in the development of the scheme?

Kinematics modality: transport and mobility

- ❑ Does the development scheme for the area improve the mobility in and out of the area for the long-term future?
- ❑ Is every stakeholder able to move easily using public transport? Are transport facilities available to all stakeholders?
- ❑ Is the transport planning scheme environmentally friendly? Will it improve the air quality?
- ❑ Have all stakeholders taken part in the development of the transport planning scheme?

Spatial modality: space, shape and extension

- ❑ Is the development sufficiently flexible to take into account future development schemes for the area? Will the urban form be stable through time?
- ❑ Is the urban density appropriate for every stakeholder?
- ❑ Is the new urban density and form environmentally friendly?
- ❑ Have all stakeholders taken part in the development of shape and layout of buildings and settings?

Numerical modality: numerical accounting

- ❑ How long is the development process?
- ❑ How much redistribution of wealth is contained within the scheme?
- ❑ How much, in terms of natural and non-renewable resources, does the development cost?
- ❑ How many stakeholders have taken part in the decision-making?

It should be stressed again that these questions are merely examples and will vary from scheme to scheme. However, the basic framework remains the same. This provides the opportunity to 'think global' through the modalities, and yet to 'act local'. Even this limited list of questions illustrates the massive complexity in understanding and evaluating sustainable development.

Synthesis of results

A major problem faced in decision-making for sustainable development is the massive amount of information which can confuse decision-makers rather than help them to find a final solution. To overcome this problem, the fifteen modalities and planning aspects have been regrouped into two more aggregated sets of dimensions of sustainable development as illustrated in Table 4.3.

Table 4.3 The proposed framework for sustainable development decision-making.

Goal	First-level aspects	Second-level aspects	Multi-modal aspects	Built environment and planning aspects
Sustainable development	Physical environmental capital	Urban and infrastructural development	Numerical	Numerical accounting
			Spatial	Space, shape and extension (e.g. urban density)
			Kinematic	Transport and mobility (e.g. infrastructure level)
		Environmental and physical quality	Physical	Physical environment (e.g. environmental quality level)
			Biological	Health and ecological protection or biodiversity (e.g. greenery)
			Sensitive	Perceptions of people towards the environment
	Human cultural capital	Education and scientific development	Analytical	Analysis and formal knowledge (e.g. university reputation)
			Formative	Creativity and cultural development
			Communicative	Communication and the media (e.g. ICT level)
	Financial institutional capital	Social and economical development	Social	Social climate, social relationships and social cohesion
			Economic	Efficiency and economic appraisal (e.g. GNP)
			Aesthetical	Visual appeal and architectural style (e.g. cultural heritage)
		Governance	Juridical	Rights and responsibilities (e.g. legal framework)
			Ethical	Ethical issues (equity)
			Credal	Commitment, interest and vision

The first set of sustainable development dimensions corresponds to the three major clusters of sustainable development ('first-level aspects' in Table 4.3), also defined as three different types of 'capital' (see Chapter 2), which are related to the physical environment, the human environment and the institutional environment (as suggested by Lombardi & Nijkamp, 2000; Nijkamp, 2003), in accordance with the EU definition of sustainable urban development (see *EC Report,* February 2002).

The second set of issues are the five classes of urban policies ('second level aspects' in Table 4.3), i.e. urban and infrastructure development, environmental and physical quality, education and scientific development, social and economical development, and governance, which reflect the main strategic areas where interventions can be made in the urban environment (Stanghellini & Lombardi, 2002).

This structure is intended to provide a synthesis of the results obtained from an evaluation process by incrementally aggregating the numerous aspects and evaluation issues into a smaller class of well-known key sustainable development dimensions. These are illustrated further in the case studies in Chapter 5.

Summary

Decision-making for sustainable development, particularly in the field of planning or design, requires a framework that is able to structure the problem. This enables us to understand the implications that the (re)development may have for the existing context.

This chapter has shown a new conceptual framework for understanding sustainable development in urban planning and design for the built environment. The framework developed in this study is based on a simplified version of the philosophical theory of the 'Cosmonomic Idea of Reality'. This is useful, not only because it recognises different levels of information but also because it suggests an integration of the key aspects to provide a continuum for harmony and decision-making.

The proposed framework aims at guiding designers and planners, official public developers and decision-makers through the process of understanding and evaluating sustainable development in planning and design on the basis of a new holistic structure that acts as a prompt and a checklist.

The evaluation framework involves all of the following:

- A *technical assessment* of the construction under development with regard to dimension, space, functions, accessibility, etc.
- An ecologically orientated assessment of the project (a 'green design') illustrating the *environmental compatibility* of this development within the existing context.

- An understanding of the *historical and cultural significance* of the planning asset and of its *social desirability*.
- An analysis of the *financial and economic feasibility*.
- A check of the *visual appeal* of this new (re)development and of its *flexibility or adaptability* which may allow it to meet some future user needs.
- An assessment of the *institutional sustainability* of the project, based on an analysis of the juridical and procedural issues.
- An understanding of what *interest or concern* there is in the local agenda of the city and in its strategic plan.

Problems arise in decision-making for sustainable development: for example, the amount of information required for an evaluation is time-consuming and costly; the variety of vocabulary employed and required by each assessment method confuses the dialogue between stakeholders; the elements of uncertainty included in the available data make prediction difficult; and compromise is difficult because of the lack of an agreed structure.

The framework, as it has been developed, does not overcome all of these problems directly but it does provide new opportunities for collaboration between disciplines, experts and people; it adds new dimensions that were traditionally not covered in the evaluation (e.g. aesthetics); and it links all the knowledge and the special contributions of technique and science within the same structure, providing order, continuity and integration without falling into reductionism or lack of transparency. Thus it can also act as a learning tool, addressing current demands for higher education in the field of planning.

In Chapter 5, three case studies will provide an illustration of this structure at different planning levels, demonstrating the power of the framework as a tool for decision-making.

5 The Framework as a Structuring Tool: Case Studies

This chapter aims to show the robustness, relevance, comprehensiveness and flexibility of the proposed multi-modal framework for decision-making through some case study applications. Three real-world examples are provided which are related to various planning/design contexts and different operative levels. These are intended to demonstrate that this framework is able to make the key issues within a decision-making process explicit and transparent in the context of sustainable development and that it is able to cover a wide range of issues that are rarely addressed by current methods.

It is worth re-emphasising that technical information and scientific knowledge related to sustainability in the built environment are, at present, very limited. Moreover, experience in the field of sustainability in planning and the built environment is restricted to some good 'local' examples or case studies whose applicability cannot always be generalised (Selman, 1996; Cooper, 1999).

Research on sustainability is still experimental and still very fragmented since it requires joint effort, collaboration and continuous implementation and monitoring, involving many different disciplines and many different people working together over a long period of time. A further major constraint is the lack of a comprehensive data base on sustainable development, making it difficult to apply. Current debates on sustainable development tend to focus on statistical indicators and classification systems as a structure for organising the information required in decision-making but currently few of these are available or operational (Mitchell, 1996; Bentivegna, *et al*., 2002; Deakin, *et al*., 2002a).

It is in response to the above that this book has been undertaken. The book has adopted a new theoretical base to address the need, with the

support of the theory of the 'Cosmonomic Idea of Reality', suggesting a framework for the evaluation of sustainability in planning (see Chapter 4). This process has required understanding, investigation and information. It has also required testing and reviewing. However, the limited amount of information available at present on many of the issues in the framework means that future practical applications of the proposed multi-modal framework will be required to test it to the full. A continuous implementation and adaptation of the structure in each planning situation and decision-making process is necessary to encourage users to adopt it as a fully operative tool for the evaluation of sustainability.

As the information on which the proposed multi-modal structure relies is still in a state of change, it follows that applications can only focus on the theoretical structure underlying it. This structure encapsulates 15 modal aspects and the three clusters of sustainability aspects of physical environment, human environment and the institutional environment, illustrated in Table 4.3.

Wegener (1994) argues that an urban model should provide thoughts that 'open up' the field to new problems that were not evident previously. Recent studies (Deakin, *et al.*, 2001; Bentivegna *et al.*, 2002) suggest that not just one but a variety of methods are required to deal with sustainability in planning and decision-making.

In this chapter three case studies are provided, based around the comprehensiveness of the framework to aid the decision-making process for sustainable development. These case studies try to address the following key questions:

- Is the proposed structure *flexible* enough to be able to produce meaningful results in different planning situations?
- Is it *transparent* enough to produce clear advice for decision-making within each modality?
- Do the framework components *help decision-making*, leading to an improvement in understanding, monitoring and learning about sustainability?

The first example provides evidence for the comprehensiveness of the modalities for the long-term planning of a situation by applying the modality approach to a decision-making problem that has been tackled previously by a traditional provisional (*ex ante*) evaluation method. Thus it is possible to compare the new approach with the one undertaken previously in order to see whether there is an improvement. In this example, it is shown that the multi-modal structure is able to render all the factors underlying the decision-making explicit, pinpointing the limitations of the traditional method used in the case study. In turn, this helps to illustrate that the structure is comprehensive and able to address the identified problems sufficiently.

The second case study proposes a retrospective (*ex post*) analysis of a

decision-making process, adopting the multi-modal framework as a tool for detecting the stakeholders' views of the problem. The third deals with sustainability indicators, structuring the 'Social reporting' (or stakeholder reporting) of the City of Modena (Italy) by means of the suggested multi-modal framework. All three examples illustrate the relevance of the fifteen structure components.

All the three case studies are related to different planning situations in order to show the flexibility of the proposed structure to different contexts and its potential for generalisation, i.e. its replicability. As already stated, planning and design are multi-aspect activities and generally pose a variety of different problems that challenge decision makers. For the purposes of illustration, the following major current planning/management problems for sustainability (UNCHS, 1996) have been selected: management of technological systems at the infrastructure level, urban regeneration at the district level and strategic planning at the city level.

In the first case study, an example is used to show how multi-criteria methods (see Chapter 6) are able to tackle the problem of selecting a new waste treatment for the city of Turin, demonstrating that a number of aspects – which are important for true long-term sustainability – are left uncovered.

In the second case study, the multi-modal framework is used as a retrospective evaluation tool for prompting understanding and learning about sustainability. A multi-stakeholder decision-making problem that deals with the crucial sustainability problem of regenerating an ex-industrial area is illustrated (Curwell & Lombardi, 1999).

Finally, the third case study required rigorous field work and three stages of development relating to social reporting in a city. The first stage concerned a deep understanding of the problem involved. The second stage applied the framework to the context within the city and this implied a structured collection of information. The third stage is the analysis of the results.

All three case studies are based on previous applications of some traditional methodologies and are documented in Lombardi & Zorzi (1993), Lombardi & Marella (1997) and Comune di Modena (2004) respectively. Detailed background information can be found within these publications and it is not possible to replicate the detail here.

Case study 1: selection of a municipal waste treatment system

This example deals with a major ecological issue of concern for sustainable development: the problem of municipal waste. This generally consists of organic substances, paper, metals, textiles, glass, synthetic materials and small quantities of a large variety of toxic substances.

Municipal waste is generally collected in most European cities, although in deteriorating neighbourhoods removal systems do not always work adequately, because of a lack of public funding.

In Europe, between 150 kg and 600 kg of municipal waste are produced per person each year. On average, each European produces more than 500 kg of waste per annum or 1.5 kg of waste each day. Estimates provided by the OECD for western Europe indicate an increase in the production of municipal waste at the rate of 3% per annum between 1985 and 1990 (OECD, 1994; CER, 1996). In addition, a major shift is occurring in the composition of municipal waste, with an increase in plastics and packaging materials.

A large proportion of municipal waste from cities is taken to landfills. Tipping, which is the most common method of disposing of urban wastes in landfills in Europe, is not always controlled. An alternative system for disposing of municipal waste is an incinerator. In western Europe it is used, on average, for 20% of produced waste. Incineration of municipal waste causes a reduction of up to 30% in the weight of the initial quantities of treated waste and can be designed to recoup the energy content of the waste. At the same time, this can cause notorious problems of air pollution, and harmful and toxic waste products. In addition, it is very costly and extremely difficult to manage (Stanner & Bourdeau, 1995).

Efforts are now undertaken in many European cities to set an example of good practice by recycling, with the aim of reducing the unnecessary import of materials as well as the volume of waste that leaves the city (EEA, 1995).

The present case study concerns the problem of selecting a new municipality waste treatment system for the town of Turin. At the moment, a public company called AMIAT manages the municipal waste through a system of controlled burial. Although the system is still operational, the problem of finding new technical solutions for the future will remain after the closing of the current system.

The disposal of urban waste by means of a new landfill raises the problem of finding suitable new sites with suitable hydro-geological characteristics, so that this will not add to underground water or soil pollution. In addition, the landscape can be blighted by unsightly views and smells during the life cycle of the tip and a considerable increase in dust, rats, insects and fire hazards may occur. These problems are at the root of the social conflicts that are usually generated in decisions of this kind.

In the case study developed by Lombardi and Zorzi (1993), three main systems of municipal disposing – controlled burial, incineration and recovery/selection – were analysed (as alternative solutions) and an environmental impact analysis was developed for decision-making. In this application a number of environmental factors and social-economical issues were taken into consideration (as evaluation

criteria). These included: air, water, soil, landscape, public hygiene, technological risk, economic analysis, life cycle of the system and ease of operation.

The complete hierarchy used, with the goal at the top and the alternative solutions at the bottom, is illustrated in Fig. 5.1 and Table 5.1.

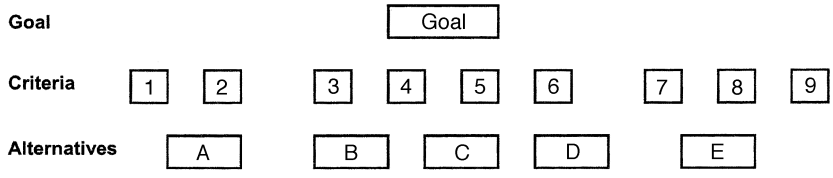

Figure 5.1 The hierarchical model structure.

Table 5.1 The goal, criteria and alternatives adopted in this evaluation.

Goal
Identification of a technical solution for waste disposal in Turin
Criteria
(1) *Safeguarding the atmosphere* (2) *Safeguarding the water supply* (3) *Safeguarding the soil* (4) *Protection of the landscape* (5) *Protection of public health (maximum hygiene)* (6) *Minimisation of danger (maximum safety)* (7) *Maximisation of cost/revenue ratio* (8) *Maximum life of plant* (9) *Ease of operation*
Alternatives
(A) Controlled burial (B) Incineration (C) Mixed recovery and controlled burial (D) Mixed recovery and incineration (E) Mixed recovery, incineration and controlled burial

An assessment of the significance of the impact of each alternative solution, in terms of reversibility and duration in time, was also developed by creating a nine-point measurement scale. This impact analysis formed the basis of the application of three different multi-criteria analysis methods (MCA), in order to devise a single preference index for each alternative system of disposing of urban waste (see Chapter 6).

The reason why Lombardi and Zorzi (1993) used three different

MCA methods (when one is generally considered sufficient for this problem) was to avoid the well-known problem of 'method uncertainty' (Voogd, 1983), which states that the results of an MCA application are fettered by the mathematical structure on which the method is based. Therefore, a comparison of the results obtained by different methods may be of advantage for the decision.

The application of the MCA methods devised a final ranking of alternative options which placed a mixed waste treatment system (mixed recovery and incineration) at the top, as best, and traditional systems (controlled burial and incineration) at the bottom.

This result is dependent upon both the subjective selection of the evaluation criteria used and their weighting vector (this has been identified as an additional 'uncertainty' of this method (Voogd, 1983)). The criteria and their weights were agreed on by experts within a consultative process that did not consider the views of non-experts and in fact only technical factors were considered in the analysis.

The MCA methods used in this application were the following: Concordance-Discordance Analysis – Electre II (Roy, 1985), Analytical Hierarchy Process (Saaty, 1980) and Regime Method (Hinloopen, *et al*., 1983). A short illustration of the multi-criteria analysis is given in Chapter 6.

An application of the multi-modal framework shows a number of problems in terms of threats to sustainable development, particularly with regard to the aspects not included in the above analysis. In particular, it shows the lack of commitment due to the absence of community non-expert participation in the evaluation (see Table 5.2).

Although some major environmental-technological and social-economical impacts have been taken into consideration in the assessment, the lack of elements related to users' perceptions and to social or ethical factors may have influenced the output, leading to a strictly 'expert-orientated' decision. For instance, the concern for non-renewable resources such as landscape, air quality, water quality and soil quality, and the attention paid to both public hygiene and hazardous materials (safety) are important in relation to the health of people and the value systems prevalent within a community. The chosen decision-making process did not consider these aspects.

In the literature, MCA methods are often considered useful tools for consultation with experts and the general public. However, practical examples of experience in this field are not easily accessible or available. In many contexts, only a few sporadic and mainly theoretical experiments are available and the results of these are not very satisfactory (Archibugi, 2002). MCA requires an explanation of the individual preferences of each decision-maker in an explicit manner. The decision-makers require *a priori* agreement on the criteria to be included and the weights to be assigned, avoiding interrelations

Table 5.2 Critique of the MCA application based on the proposed multi-modal framework.

Modalities	**Major concerns regarding sustainability**
Numerical accounting	A cardinal scale with decimal indices was used by experts to compare the alternatives with the criteria and assign the relative importance to the evaluation criteria. Reduction in the analysis is sometimes dangerous in analysing sustainable development processes.
Space, shape and extension	The assessment did not take into consideration spatial location of a waste treatment system. The only spatial concern was 'safeguarding the soil in terms of land occupation' as one of the evaluation criteria.
Transport and mobility	Not considered in the above decision-making.
Physical environment, mass and energy	Considered the landscape on one hand and the impacts on the human system from hazardous materials on the other.
Health, bio-diversity and ecological protection	A number of environmental criteria were used in this evaluation, such as: safeguarding the atmosphere, safeguarding both the surface and the underground water supply, protection of public health in terms of maximisation of hygiene.
Perceptions of people toward the environment	Not considered in the above decision-making.
Analysis and formal knowledge	The criterion used to compare the relative strengths of alternative waste treatment systems was related to the analytical level 'easy to operate'.
Creativity and cultural development	Two different criteria were used at this level, i.e. minimisation of danger (for technological risks) and maximum life of a plant. Both are important for the sustainability principle of futurity.
Communication and the media	Not considered in the above decision-making.
Social climate, social relationships and social cohesion	Not considered in the above decision-making.
Efficiency and economic appraisal	One evaluation criterion refers to the 'maximisation of cost/revenue ratio derived from economic analysis'.
Visual appeal of buildings and settings and architectural style	The visual impact of alternative waste treatment systems is not considered as such but in terms of protection of the landscape.
Rights and responsibilities	The regulatory framework considered was limited to technical issues and had no reference to political and legal structures.
Ethical issues	Not considered in the above decision-making.
Commitment, interest and vision	Not considered. In the above decision-making.

(Note: the proposed definitions of the modalities have been used here to aid clarity.)

between them (Zeppetella, 1997). This is not always possible or easy to carry out, and therefore discussions and negotiations cannot take place.

The suggested multi-modal framework illustrated in Table 4.3 is able to guide the decision-makers in the selection of the most suitable criteria for the evaluation. The new hierarchical structure of criteria and sub-criteria suggested for evaluating the five selected alternative solutions is illustrated in Table 5.3.

Compared with the original hierarchy of elements shown in Table 5.1, this list is more comprehensive as it incorporates all the relevant sustainable development issues for decision-making (including user's perception and social or ethical factors). It also places the previous criteria (*in italic*) inside each appropriate group of sustainable development modalities.

Case study 2: 'multi-stakeholder' urban regeneration decision-making

In decision-making processes related to public and private sectors, conflict often occurs when competing interests who value land in different ways, such as house-builders and amenity societies, seek to promote or prevent development of the same site. During the planning process many public and private interests have to be considered, e.g. healthy environmental conditions for living and working, social and cultural needs of the citizens, the demand for home-ownership and social equality, mobility and conservation.

In general, urban planning laws protect the individual corporation or citizen against disadvantages and encourage equal opportunities and competition in the real-estate market and urban development. However, in practice there are many problems, especially those of communication, between public and private decision-makers who often do not co-operate. There are often lengthy negotiations without any result. In particular, there are few shared values concerning the development of the urban area, nor is there agreement about measures to promote development (Kaib, 1994; Koster, 1994). If the preferences of certain groups are in conflict, it is usually necessary to know the comparative 'strengths' of the interests, generally expressed in terms of costs and benefits, in order to increase the information available to assist in the resolution of conflicts through the decision-making process (Lichfield, *et al.*, 1975; Lichfield, 1996).

In this case study, the multi-modal framework has been used as a guide for analysing the various stakeholder decision-making processes that took place in relation to the redevelopment of an ex-industrial area in Muggia (Trieste). The methodology involved a

Table 5.3 The new list of criteria and sub-criteria identified on the base of the multi-modal framework.

Goal	Modalities	Criteria	Specification of criteria and sub-criteria
Sustainable development	Numerical accounting	Urban and infrastructure development	Considers quantitative issues such as population density, the location and extension of the waste disposal and the issue of transportation.
	Space, shape and extension		
	Transport and mobility		
	Physical environment	Environmental and physical quality	Includes the following sub-criteria: ❏ *Safeguarding the atmosphere* ❏ *Safeguarding the water supply* ❏ *Safeguarding the soil* ❏ *Protection of the landscape* ❏ *Protection of public health (maximum hygiene)*
	Health and ecological protection or biodiversity		
	Perceptions of people towards the environment		
	Analysis and formal knowledge	Education and scientific development	Takes into account the technological development in this field and the issue of good communications for sustainable functioning of the waste disposal, including the sub-criterion: ❏ *Ease of operation*
	Creativity and cultural development		
	Communication and the media		
	Social climate, social relationships and social cohesion	Social and economical development	Includes the following sub-criteria: ❏ *Minimisation of danger (maximum safety)* ❏ *Maximisation of cost/revenue ratio* ❏ *Maximum life of plant* ❏ *Visual appeal of the site*
	Efficiency and economic appraisal (e.g. GNP)		
	Visual appeal and architectural style		
	Rights and responsibilities	Governance	Includes rights and responsibilities, the participation of people in decision-making, the ethical issues and the vision of a sustainable development.
	Ethical issues		
	Commitment, interest and vision		

study of the decision-making problems related to the area, an understanding of the objectives and strategies of the different actors and a detailed analysis of the project in spatial and economic terms. The analyses required investigation, collection of information and interviews with the key actors.

The case study refers to the long decision-making process involved in the regeneration of the area. This involved four different stakeholders:

- The local authority of Muggia.
- The private industrial owner of the area.
- The local authority of Aquilinia (a small village developed by the employers during the firm's year of activity, under the jurisdiction of Muggia).
- The local authority of Trieste, the biggest town adjacent to the area, which as regional capital holds territorial jurisdiction over Muggia.

The opportunity to understand a re-development of the area arose at the beginning of this decade thanks to the Italian law n.179/92 on urban regeneration (Ministry of Public Works, 1995) which facilitates public–private partnership by providing national funding to cover the cost of the reclaimed land (D.M.LL.PP, 1994).

The local authorities and an industrial firm started a number of time-consuming negotiations in order to reach an agreement. The main conflicts related to the new land uses to be included in the area. Muggia and Aquilinia sought residential and tourist areas, and Trieste aimed at developing its territorial influence by including public services for its harbour and fruit market; the private owner was interested in making the highest profit. Large differences in the interests of all these actors made it very difficult to achieve a solution. A simple financial appraisal had been applied but this method was not able to assist in the resolution of the conflict.

After years of discussion and a long process of design, it was possible to reconcile the interests of all the actors in a single project. This final project included residential and tourist areas, commercial areas and public services, providing a synthesis of the numerous negotiations undertaken by the actors.

A retrospective analysis of the above decision-making process was undertaken, using the multi-modal framework (Lombardi & Marella, 1997). This analysis was useful in that it recognised the major areas of integration between the actors, the nature of the conflicts and their dependence on the interests of each actor, and the relationships between the design factors and other factors that could have led to an earlier resolution of the above conflicts.

An outline of the differences is provided in Table 5.4. In particular,

Table 5.4 A retrospective analysis of the decision-making process on the basis of the modal aspects.

Aspects	**Decision-makers (stakeholders)**			
	Land owner	**Aquilinia**	**Muggia**	**Trieste**
Numerical accounting	516 000 volume	321 000 volume	321 000 volume	352 000 volume
Space, shape and extension	Building layout according to landscape	Building layout according to landscape	Building layout according to landscape	Building layout according to landscape
Transport and mobility	To improve accessibility: building a new motorway	To solve urban traffic: building a railway, a motorway and a pedestrian street	To improve connection with Trieste: building a new motorway	To improve connection with Muggia: building a new motorway
Physical environment	Not addressed	Reduce energy use of traffic	Reduce energy use of traffic	Recycling of building materials
Health, bio-diversity and ecological protection	Attention to reclaimed land	Attention to reclaimed land	Attention to reclaimed land and water quality	Attention to reclaimed land and water quality
Perceptions of people, welfare	Not addressed	To improve security	Not addressed	Not addressed
Analysis and formal knowledge	Suggested land uses from the analysis: shopping mall; business district; hotel; residence	Suggested land uses from the analysis: business district; residence	Suggested land uses from the analysis: business district; hotel; residence	Suggested land uses from the analysis: public services; harbour services; residence
Creativity and cultural development	Not addressed	To break with previous activity	Not addressed	To develop public services and residential areas
Communications and the media	To include signs and advertising for commercial activity	Not addressed	Not addressed	Not addressed

Social climate, social relations, social cohesion	Not addressed	To improve social interaction, e.g. design an urban square	Not addressed	Not addressed
Efficiency and economic appraisal	To use public funding, minimising private resources	Frugality in the use of the land	To use national funding for building local infrastructures	Recycling schemes for building harbour wharves
Visual appeal and architectural style	To improve visual impact and to harmonise landscape	Harmony within the landscape	To improve visual impact, to harmonise accessibility	Not addressed
Rights and responsibilities	To reduce own responsibilities in construction	To move property rights from private to public sector	To increase responsibilities of private owner in construction	Not addressed
Ethical issues	Not addressed	To improve health of families	Not addressed	Not addressed
Commitment, interest and vision	To increase own profit and improve 'image' for company marketing reasons	To improve wellbeing of its citizens and increase young population	To improve tourism, increasing areas for recreational activities	To expand its territorial influence and increase areas for new services

(*Source:* adapted from Lombardi & Marella, 1997)

the analysis showed that there are reasons of a different nature underlying the interests of each actor (see the credal modality: 'commitment, interest and vision'), but there are also strong integrations of interest among the actors (concerning the issues of 'transport and mobility', 'health, bio-diversity and ecological protection' and 'visual appeal of buildings and settings'). The major conflicts arose in dealing with issues related to the 'efficiency and economic appraisal' and 'rights and responsibilities' and these have led the stakeholders to end up with different results from the ones they wanted, both in the amount of construction and in their proposed design, particularly with regard to land-use and the allocation of resources (see 'numerical accounting' and 'analysis and formal knowledge'). For example, the purpose of the land owner was to use public resources (efficiency and economic appraisal) to improve his marketing image (commitment, interest and vision) and to reduce his responsibility in construction (rights and responsibilities). This would result in a design scheme with a greater amount of construction (numerical accounting) and a 'highest and best use' of the land identified in a shopping centre (analysis and formal knowledge). However, the same land owner agreed with the other stakeholders regarding accessibility of the site (transport and mobility), the land reclamation (health, bio-diversity and ecological protection) and the harmonisation of the re-development with the landscape (visual appeal of buildings and settings).

This retrospective analysis of the conflict in this 'typical' (at least for the Italian context) decision-making process suggested that the multimodal structure provides a useful theoretical foundation for the comprehension of a planning (and design) process in the context of the sustainability of our built environment. The analysis also suggests that the structure may assist in the resolution of conflicts between actors involved in a planning process. It makes a number of critical factors that underlie a decision-making process explicit, stimulating thought and 'opening up' the field to problems that were not previously evident.

An application of this structure at an early stage of decision-making (as a proactive evaluation tool) would have helped to explain the relationships between the actors, showing the aspects that qualify the interests of each stakeholder. This, in turn, would have revealed those aspects that are in opposition and this might have guided the stakeholders towards a different result in planning. Finally, it would have helped decision-makers to recognise the areas where negotiation was needed.

In planning, particularly at the strategic level, there is a great demand for, but also a lack of, systematic methods that are able to help (Bentivegna, 1997). It may be that the proposed framework can improve this situation.

Case study 3: social reporting of Modena City strategic plan

This case study deals with the sustainability reporting of Modena, which has recently been developed in the context of the strategic planning process of the city (Comune di Modena, 2004).

In planning, traditional tools have largely lost their original meaning in predicting the future assets of a town. There is a clear understanding that, on the one hand, local development takes into account a bigger spatial scale with many more stakeholders. On the other hand, globalisation and trans-national integration processes have increased the role of cities inside the socio-economical and territorial development of countries (Mazzola & Maggioni, 2001).

The role of strategic planning is to build incrementally a shared vision of the future development of a city through networking and multi-disciplinary effort (Archibugi, 2002). The main differences from traditional physical planning, e.g. the City Master Plan, are the inclusion of uncertainty and discontinuity in the decision-making process, the networking of actors and competitiveness, global vision and direction for future urban development (Ciciotti & Perulli , 1998).

According to Bryson (1998) the main steps of a strategic planning process are:

(1) Framing of the issues.
(2) Networking of the stakeholders.
(3) Evaluation of the actions undertaken.

The framing and networking activities aim at:

- ❏ Exploring the decision-making problem.
- ❏ Identifying the strategic issues for the development of the vision of the future.
- ❏ Analysing the relationships between the issues and the actors involved.
- ❏ Recognising the partnerships and strategies of the stakeholders.

Strategic planning implies taking a holistic view of the context in which the action is performed. It requires retrospective and monitoring evaluation approaches as learning tools for transparent, inclusive decision-making (Ciciotti, *et al*., 2001; Pugliese & Spaziante, 2003).

The model of *participatory democracy* postulates that policy-making takes place in continuous interaction with citizens and aims to build up the capacity of individuals to exercise greater control over decisions (Davidson, 1998; Davoudi, 1999). It originates from a generally accepted definition of strategic planning as 'the process which aims at building a shared vision of the future development of a community or

a town' (Bryson, 1988). The stakeholders in this shared vision are all individuals who have specific interests regarding the future development and who have the opportunity to influence decision-making and all those contributing to the building of value. It also includes all concerned citizens (Lichfield, 1999).

The 'social reporting' is a retrospective evaluation process based on a system of performance indicators of economical, social and environmental nature (thus the term 'triple bottom line approach'). The aim is to evaluate the actions (decisions, projects, investments, etc.) undertaken by a local authority in the past in order to improve future decisions and eventually correct current mistakes (Hinna, 2002).

Key issues of social reporting

- ❏ It is a marketing and managerial tool for local governance, derived from the private sector with an ethical underpinning (e.g. eco-audit).
- ❏ It has evolved from a 'one bottom line' to a 'triple bottom line' approach: economical, social, environmental.
- ❏ It is based on *ex post* evaluation and *monitoring*.
- ❏ It includes both tangible and intangible effects of the actions undertaken by the local authority.

The concept of social reporting has evolved during the past few decades from a simple act of counting, i.e. of listing information of a financial nature (one bottom line), to a more sophisticated tool which links this information to the underlying process of actions (i.e. the accounting), and finally with the 'Social reporting', comparing the required information with appropriate criteria or goals, in order to evaluate and produce evidence to the local community of the consequences of those actions (see Fig. 5.2).

The evolution of social reporting has been reflected in the legal framework of both Europe and the Member States, including Italy and the UK. Table 5.5 illustrates this framework.

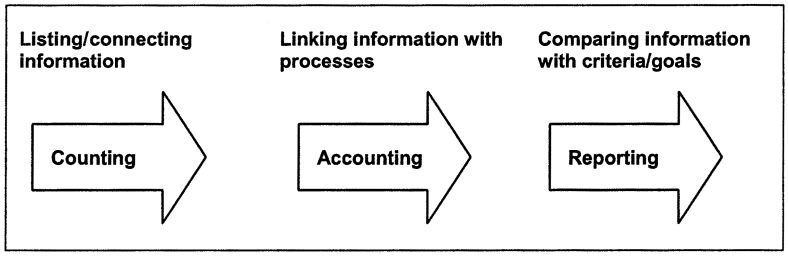

Figure 5.2 The evolution of the concept of social reporting. (*Source:* adapted from CLEAR Project, 2001.)

Table 5.5 The legal framework. (*Source:* adapted from Hinna (ed.), 2002.)

Italy		**EU**
Private sector	**Public sector**	**European Union**
Batelle Institutte, Genevra, 1975 Legge Draghi, 1998 GBS-Task-group Guidelines, 2001	L. 142/1990 Dlgs 77/1995 Dlgs 267/2000 (TUEL)	EMAS, 1993 for eco-audit Network for Building Social Responsibility in Europe, www.ebnsc.org Green Book, 2001, www.europa.eu.int/comm/off/green/index_it.htm Corporate Social responsibility, 2002

Current reporting on environmental issues (e.g. in the context of local Agenda 21) faces a number of problems related to sustainability indicators developed with the aim of identifying current urban problems in order to assist local administration decision-making processes.

Chapter 2 has already discussed the main problems associated with the current lists of indicators. Previous studies (see Lombardi & Basden, 1997; Lombardi 1998; Lombardi, 1999) have also shown that they do not put the same weight on all the sustainability aspects recognised in the literature, but mainly emphasise the issues of 'environmental sustainability' and specifically the threats to the natural environment arising from issues such as mobility, transportation and decisions related to economic appraisal. The extensive literature available in this area has confirmed this observation. In turn, this also reveals a general imbalance in the decision-making process, due to an over-emphasis on certain issues rather than others (Lombardi & Basden, 1997). The lists of sustainability indicators developed by international organisations such as the United Nations and OECD show a lack of harmonious distribution among the aspects related to an urban system. This is seen as a problem of imbalance, with more emphasis on certain issues than on others, leading to unsustainable decisions (see Lombardi & Basden, 1997; Lombardi, 1998).

More specific criticisms of social reporting are related to the availability of the information required. The reporting activity is strongly related to contingent aspects, political elections or administrative and marketing reasons. The data are often stored in different statistical data bases that are difficult to access, manipulate and compare. The lack of an available structured data base is due mainly to the fact that social reporting is not an obligatory tool. On the contrary, it is undertaken at the end of an administration process and is not linked to the forward programming stage. A major problem is the selection of the 'right' indicator which is best able to represent the urban situation.

In this case study, the selection of indicators was developed on the basis of a number of criteria largely chosen from the principal international organisations on sustainability, such as the United Nations.

These were chosen because they appeared to relate to local needs, data was available and easy to up-date, they were scientifically sound at both national and international level and they were relatively simple and easy to communicate. The social reporting process of the City of Modena was developed using a number of steps (see Comune di Modena, 2004):

(1) An identification of the main actions and programmes undertaken by the local authority (LA) during the first administrative stage of the major provisional programme and its additional administrative documentation (i.e. the Italian local 'Programma elettorale' and 'Relazioni previsionali e programmatiche').
(2) A taxonomy analysis of the actions and programmes, which are grouped in five strategic axes, or macro-programmes (packages of programmes containing groups of projects), as follows:
    (a) Strategic axe n.1: *Innovation*. This deals with economic development and technological and infrastructure endowment.
    (b) Strategic axe n.2: *Urban quality*. This deals with environmental and physical quality, parks and greenery, waste management, energy consumption, transport and mobility, and urban regeneration.
    (c) Strategic axe n.3: *Sociality*. This deals with social integration, crime, sport, culture, tourism and citizens' rights.
    (d) Strategic axe n.4: *Welfare*. This deals with education and sanitary policies (hospitals, nurseries, etc.).
    (e) Strategic axe n.5: *Administration*. This deals with an improvement in public services supplied to citizens.
(3) The selection of a number of performance indicators for each action, related to four specific measures of:
    (a) *Efficiency*. This deals with the managerial capacity of the local administration by measuring the number of projects undertaken compared with those planned, and their degree of realisation.
    (b) *Economics*. This measures the minimisation of the financial resources used for the development of the projects.
    (c) *Efficacy*. This measures the goal achievement of each project.
    (d) *Effects on the community*. This measures the benefits of each project to socio-economic sectors and to the community.
(4) A measurement of each performance indicator in terms of percentage of decrease or increase in the period of analysis (1996-2003).

Figure 5.3 provides a graphical illustration of this model (named the '4-*E* model').

This system of performance indicators provides a rich picture of the

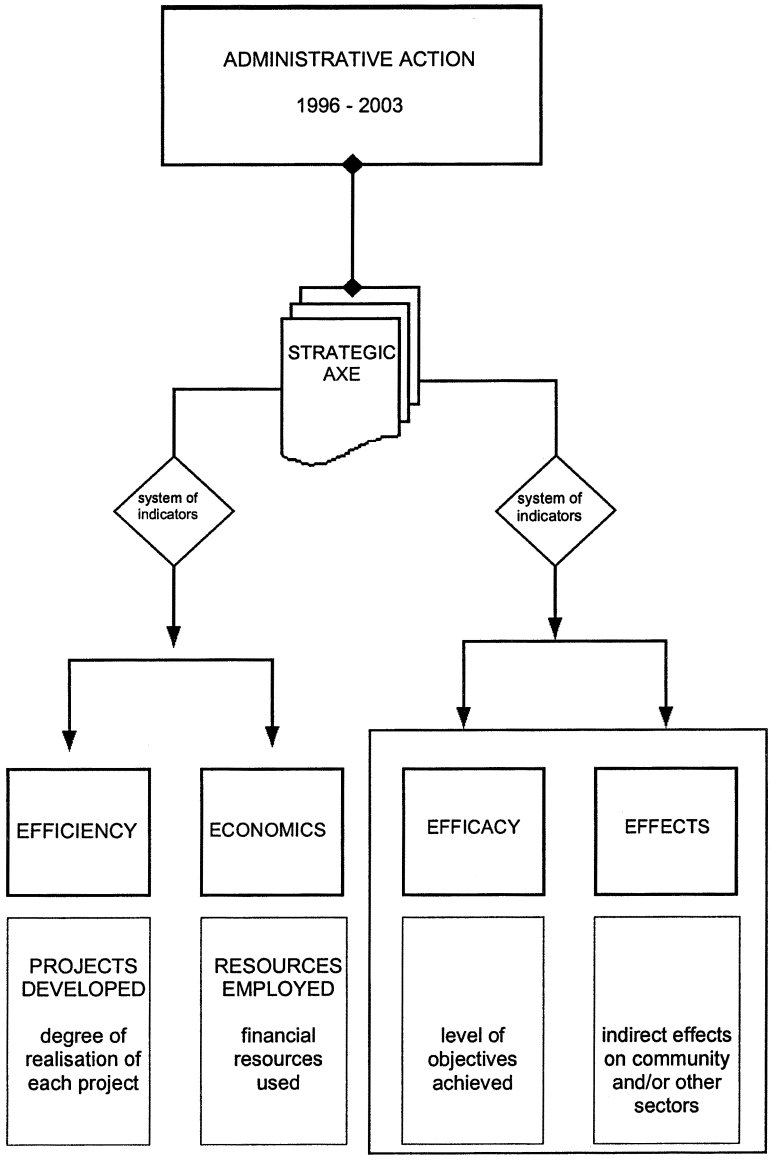

Figure 5.3 A graphical representation of the model used for each strategic axes of the social reporting of the City of Modena.

results obtained by the local administration during the years of activity, by measuring the achievement of each target declared in the Administrative Political Programme. However, it does not provide a final synthesis of the results obtained or a judgement on the sustainability of the local authority's action. The large number of indicators and measures may confuse the decision-makers who generally want an

easy measure to illustrate the sustainability of these actions. The aim of the multi-modal framework is to achieve a comprehensive and holistic view of the results.

Table 5.6 shows the re-classification of the strategic axes (and consequent actions and indicators) by using the multi-modal framework illustrated in Table 4.3. This forces the identification of a limited number of 'sound' indicators which refer to the modalities. It provides a systematic and logical design for the performance indicators to be used in the social reporting, which is comprehensive but which avoids an overload of unprocessed information. At the same time, it drives all the different measures and actions towards a restricted number of sustainable development criteria.

As illustrated in Chapter 4, the framework articulates the concept of sustainable development by using three different levels of criteria which are interlinked to each other.

The third level of criteria is represented by the fifteen modalities. The second level of criteria incorporates the five classes of urban policies:

- ❏ Urban and infrastructure development.
- ❏ Environmental and physical quality.
- ❏ Education and scientific development.
- ❏ Social and economical development.

These are reflected in the strategic axes of urban quality, welfare, sociality, innovation and administration. They are linked to the first level of sustainable development aspects named physical environment capital, human cultural capital and financial institutional capital, which in turn encapsulate the concept of sustainable development (see Chapter 2).

The key role played by an information base in decision-making within the context of sustainable development should be re-emphasised. An overflow of data may hinder a decision because it is difficult for stakeholders and decision-takers to distil the correct and appropriate information to be used in the decision-making process. The benefit of the proposed framework is to allow this selection, emphasising those indicators and/or criteria that are meaningful to citizens and stakeholders for sustainable development.

Summary and conclusion

This chapter has illustrated the application of the multi-modal framework to three case studies related to different planning contexts. In these examples, the structure has assisted in making the relevant issues of a decision-making process explicit and transparent in the context of sustainability. It is able to cover a wider range of issues which are

Table 5.6 Structuring the social reporting of Modena City according to the multi-modal framework.

Goal	Second level aspects	Strategic axes and public policies	Modalities	Examples of indicators	Decrease/increase value (1996/2003*)
Sustainable development	Urban and infrastructural development	AXE N.2: URBAN QUALITY	Numerical accounting		
			Space, shape and extension	Total built-up area	+6.3%
			Transport and mobility	Length of cycle-roads	+50%
	Environmental and physical quality	AXE N.2: URBAN QUALITY AXE N.4: WELFARE	Physical environment	Energy consumption (gas)	+5.1
			Health and ecological protection or bio-diversity	Presence of green areas	+38.4%
			Perceptions of people towards the environment	Available rooms in nurseries	+5.6%
	Education and scientific development	AXE N.1: INNOVATION AXE N.4: WELFARE	Analysis and formal knowledge	Number of registrations at university	+2.7
			Creativity and cultural development	Unemployment rate of young people	−8.8%
			Communication and the media	ICT endowment	Not found
	Social and economical development	AXE N.3: SOCIALITY	Social climate, social relationships and social cohesion	Crime rate	−4.8%
			Efficiency and economic appraisal (e.g. GNP)	Number of enterprises	+21.1%
			Visual appeal and architectural style	Number of museum visitors	+18.2%
	Governance	AXE N.5: ADMINISTRATION	Rights and responsibilities	Simplifying administrative actions	−38.7%
			Ethical issues	Number of people participating in voluntary activities	Not found
			Commitment, interest and vision	Population voting in the administrative elections	Not found

(* Note: the value of some indicators refers to a different year due to a lack of data availability.)

rarely addressed by current methods. If these can be completed with evaluation methods (see Chapter 6), a powerful approach to evaluation has been developed.

The three case studies have also shown that a great many aspects of urban sustainability for decision-making can meaningfully be checked for completeness, consistency, duplication and internal logic by deploying the three classes of sustainable urban development and the fifteen constituents (including the five main groups of urban policy actions) from the proposed structure (see also Nijkamp, 2003).

Within the extraordinary variety of planning contexts and evaluation perspectives (both retrospective and predictive), the framework provides a flexible guide that is able to identify the critical factors for sustainability and the decision-making problem, 'opening up' the field to key issues that were not previously evident. It also suggests that it is able to aid the analysis of different stakeholders' perspectives, providing useful insights for the resolution of conflicts.

As the planning process is itself a dynamic one that can change over time, the findings of the above applications support the view that the multi-modal framework can be used in different contexts, for different stakeholders and multi-objective problems. However, this framework was never intended to be in itself an alternative method for evaluation in planning and design. Rather it is proposed as a structure for all: supporting applications of multi-criteria analysis by helping the identification of a list of relevant evaluation criteria (Case study 1); for illustrating different stakeholders' views (Case study 2); and for synthesising the results of a quantitative analysis based on statistical indicators (Case study 3), widening the horizon of current practice and opening up new boundaries and directions for research work in this field.

Future, practical applications are required to test the validity of this approach in real decision-making to see whether it increases the likelihood of greater sustainable development in urban districts and cities. This is an evolutionary process which will develop in time but the structure should remain stable as the techniques and content emerge.

6 Assessment Methods

A directory of assessment/measurement tools is one of the key requirements to be considered in the development of models and processes to address the evaluation of sustainability. These are sometimes known as evaluation 'tool-kits'. In order to make progress, assessment methods must be adopted for determining whether the environmental capacity required for the city of tomorrow and its cultural heritage exists. These tools must be able to evaluate whether the forms of human settlement that surface from urban development processes are, in social terms, sustainable (Deakin, *et al*., 2002a). Evaluation methods are also required to assess whether progress has been made towards sustainable development and, finally, to justify any decision that might be made now or in the future.

'Evaluation', in this context, is generally defined as 'a technical-scientific procedure for expressing a judgement, based on values, about the impacts of a policy or of an action on the natural and built environment, or for assessing the effects of these impacts on the community' (Bentivegna, 1997, p.25). The monitoring of progress is also important because unless we can evaluate what contributes to sustainability it will be very difficult to judge whether a sustainable environment has been created (Brandon, 1998).

Recent surveys reveal that the evaluation methods currently in use are many and there is no agreement among scholars on the theoretical framework within which they can be placed (Mitchell, 1996; Bentivegna, 1997; Brandon, *et al*., 1997). Additional surveys show that opinion about the potential of environmental assessment is currently divided between those who believe it can promote sustainable development (Brandon, *et al*., 1997; Bergh, *et al*., 1997; Nijkamp & Pepping, 1998), and those who feel existing approaches, exemplified by revealed preference techniques (e.g. contingent valuation methods),

are unable to evaluate non-market goods and services and hence are inappropriate for sustainability assessment (Guy & Marvin, 1997).

According to Deakin, *et al*. (2002b) this division of opinion is important for two reasons. Firstly, it illustrates that the scientific community is divided about the quality and value of assessment methods, and second, it undermines the confidence of the professional community in the validity and usefulness of these methods (Pugh, 1996; Cooper, 1997, 1999).

The authors of this book believe that environmental assessment methods can be used to promote sustainable urban development, and that the root cause of the problem is the absence of a systematic approach towards the assessment of all the activities in the urban development cycle related to significant sustainability issues (Curwell, *et al*., 1998; Cooper & Curwell, 1998). This opinion receives support from the literature (e.g. Hardi & Zdan, 1997; Devuyst, 1999; Devuyst, *et al*., 1999; BEQUEST, 2001; Deakin, *et al*., 2001; Deakin, *et al*., 2002a).

Techniques for evaluation and monitoring are required to be fair and transparent so that the inputs and outputs are not favouring one particular view or, if they are, that all parties are aware of this limitation. There are in fact very few, if any, techniques that are completely neutral in their advice. Therefore it is important to know whether an assessment, if it takes place, is confined by the techniques employed to assess the problem. It might be confined to those aspects that are easy to measure. Measures that are easy may not produce the right result.

According to Francescato (1991), there is a distinction between *measurement* and *assessment*. Measurement involves the identification of variables related to sustainable development and the utilisation of technically appropriate data collection and data analysis methods. It mainly deals with sustainability indicators rather than with processes and methods. On the other hand, assessment involves the evaluation of performance against a criterion or a set of criteria. Both performance and criteria can only be defined by a value-based judgement. They are not empirically verifiable. Indeed the term 'performance' must denote a goal-orientated behaviour, i.e. a behaviour rendered meaningful by the existence of a criterion that specifies when a goal has been attained.

The multi-modal framework offered in this book is suggested to make the value-based judgement mentioned above intelligible in a consistent manner, and thus to explain the complexity underlying a decision. It also helps recognition of where limitations and gaps exist in current assessment methods.

As illustrated in Chapter 5, this framework is flexible and able to take into account various situations and planning and design problems; it includes an ordered list of modalities which guides the identification of relevant criteria for evaluating sustainable development in an urban context and, at the same time, is easily checked by users. It is useful as it helps decision-makers to understand, explain and communicate the

complexity of the problem to all stakeholders and to assess progress towards sustainable development.

Since different assessment techniques are required for different dimensions, and for the micro and macro scales, it is also clear that sustainability assessment of the urban environment may need to be a procedure or process that uses various techniques rather than one integrated method (Bentivegna, *et al*., 2002, BEQUEST, 2001; Deakin, *et al*., 2001; Lombardi, 2001; Mitchell, 1996). The multi-modal framework is a great assistance in linking the different assessment methods into one single procedure which may guide decision makers toward sustainable urban development even though it involves many assessment methods.

This chapter specifically focusses on the assessment methods available, and their classification and use for evaluating sustainable development in the built environment. It also addresses their limitations, which should be made clearly explicit by the multi-modal framework in order that all participants can engage properly within the process (Bentivegna, 1997). However, this chapter will not deal with the problems of sustainability indicators and their classification systems as these were discussed in Chapter 2.

A directory of assessment methods

A recent survey of the assessment methods currently in existence (Deakin, *et al*., 2001; Deakin, *et al*., 2002a, b) has identified at least 61 methods available for evaluating the planning, design, construction and operation of the sustainable urban development process (see Table 6.1) and has classified them in terms of 'pre-' and 'post-Brundtland' (see Table 6.2).

Table 6.1 List of assessment methods.

1. Analysis of Interconnected Decision Areas (AIDA)
2. Analytic Hierarchy Process (AHP)
3. ASSIPAC (Assessing the Sustainability of Societal Initiatives and Proposed Agendas for Change)
4. ATHENA (life cycle impact assessment of building components)
5. BEPAC (Building Environmental Performance Assessment Criteria)
6. BRE Environmental Assessment Method (BREEAM)
7. BRE Environmental Management Toolkits
8. Building Energy Environment (BEE 1.0)
9. Building Environmental Assessment and Rating System (BEARS)
10. Building for Economic and Environmental Sustainability (BEES 2:0)
11. Cluster Evaluation
12. Community Impact Evaluation
13. Concordance Analysis
14. Contingent Valuation Method

Continues

Table 6.1 *Contd.*

15. Cost Benefit Analysis
16. Eco-Effect
17. Eco-Indicator '95
18. Eco-Instal
19. Economic Impact Assessment
20. Ecological Footprint
21. Eco-points (a single unit measurement of environmental impact)
22. Ecopro
23. Eco-Profile (a top-down method for environmental assessment of existing office buildings)
24. EcoProP (a requirements management tool)
25. Eco-Quantum (Eco-Quantum Research and Eco-Quantum Domestic)
26. ENVEST (tool for estimating building life cycle environmental impacts from the early design stage)
27. EIA – Environmental Impact Analysis
28. Environmental Profiles (BRE Methodology for Environmental Profiles of Construction)
29. EQUER
30. ESCALE
31. Financial Evaluation of Sustainable Communities
32. Flag Model
33. Green Building Challenge
34. Hedonic analysis
35. Green Guide to Specification (Environmental Profiling System for Building Materials Components)
36. Hochbaukonstruktionen nach ökologischen Gesichtspunkten (SIA D0123)
37. INSURED
38. Leadership in Energy and Environmental Design Green Building Rating System (LEEDTM)
39. Life Cycle Analysis (LCA)
40. Mass Intensity Per Service Unit (MIPS)
41. MASTER Framework (MAnaging Speeds of Traffic on European Roads)
42. Meta Regression Analysis
43. Multi-Criteria Analysis
44. Net Annual Return Model
45. OGIP (Optimierung der Gesamtanforderungen ein Instrument für die Integrale Planung)
46. PAPOOSE
47. PIMWAQ (minimum ecological levels for buildings and ecological degree of development projects)
48. Project Impact Assessment
49. Regime Analysis
50. Quantitative City Model
51. Planning Balance Sheet Analysis
52. Risk Assessment Method(s)
53. SANDAT
54. Semantic Differential
55. Social Impact Assessment
56. SPARTACUS (System for Planning and Research in Towns and Cities for Urban Sustainability)
57. SEA (Strategic Environmental Assessment)
58. Sustainable Cities
59. Sustainable Regions
60. Transit-orientated Settlement
61. Travel Cost Theory

Table 6.2 Classification of assessment methods.

Pre-Brundtland Environment in general	**Post-Brundtland Forms of life cycle assessment**	
	Environmental Appraisal	**Environmental Impact Assessment**
Cost-benefit analysis Contingent valuation Hedonic pricing method Travel cost method Multi-criteria analysis	Compatibility matrix Eco-profiling Ecological footprint Environmental auditing Flag method Spider analysis	EIA – Environmental Impact Analysis SEA – Strategic environmental assessment Community impact evaluation ASSIPAC BEES BREEAM Eco-points Green Building Challenge MASTER Framework Meta-analysis (Pentagon method) NAR model Quantitative City model SPARTACUS Sustainable City model Sustainable communities Sustainable regions Transit-orientated settlement

(*Source:* Deakin, *et al.*, 2002a)

The pre-Brundtland directory includes most of the assessment methods in use. They can be traced back to cost-benefit analysis and the critique of the discounting principle upon which this technique of analysis is based (Pearce & Markandya, 1989; Pearce & Turner, 1990; Rydin, 1992). Their development can also be linked to the emergence of hedonic and non-market techniques of analysis such as the contingent value and travel cost method of environmental assessment described below (Brooks, *et al.*, 1997; Powell, *et al.*, 1997). The pre-Brundtland approach tends to identify impacts (using checklists or matrices, for example) and evaluates development using techniques such as logical frameworks, fiscal analyses, cost-effectiveness analysis and multi-criteria assessments. Cost-benefit analysis was also widely used to evaluate outcomes from these techniques, with environmental (non-market good) evaluations using revealed or expressed preference techniques including contingent valuation, hedonic pricing and the travel cost method (see, for example, Pearce & Markandya, 1989).

Since Brundtland, and the Agenda 21 (UNCED, 1992) call for the integration of environment and development in decision-making, the science of assessment has been placed under greater scrutiny by environmentalists and critical distinctions have been drawn between ecocentric (those focused on the concept of nature) and anthropo-

centric (those based around humankind) techniques of analysis (Rees, 1992; Pearce & Warford, 1993). The role of the natural environment as the fundamental support system for all economic and social development is now being increasingly recognised in all forms of assessment. This recognition has led to the development of many methods that focus on energy and material flows, addressing both resource usage and waste arising across a wide range of urban activities. This has in turn led to the development of multi-criteria analysis as a key method in environmental assessment. Examples include ATHENA, a tool for the life-cycle impact assessment of building components, BREEAM and BEES, which address material flows and impacts associated within individual buildings, and the ecological footprint and environmental space methods which can express consumption patterns of cities, regions or countries relative to clearly defined environmental sustainability thresholds (Breheney, 1992; Selman, 1996).

As illustrated in Table 6.2, these assessment methods may be grouped in two major classes: *environmental in general* and those augmenting into various forms of *life-cycle assessments* (Deakin, *et al*., 2002a, b). The 'environment in general' methods tend to focus on assessments of eco-system integrity. Examples of this class include cost-benefit analysis, hedonic analysis and multi-criteria analysis. The forms of 'life-cycle assessment' have been sub-classified as *environmental appraisal* and *environmental impact assessments* (complex and advanced evaluations).

The forms of environmental appraisal include the production of a compatibility matrix, the use of eco-profiling measures and environmental auditing techniques. The environmental impact assessments include project, strategic, economic, social and community evaluations, BEES, BREEAM, Eco-points and the Green Building Challenge. It also includes, the MASTER Framework, the Pentagon model, the Quantifiable City model, SPARTACUS, the Sustainable City model, sustainable region, sustainable community and Transit-orientated settlement models as advanced forms of environmental assessment.

Several of the latter are complex computer-based urban models integrating extant models of individual urban processes, often within a Geographical Information System (GIS), with other decision-making techniques (e.g. Delphi, Multi-criteria analysis) used to evaluate alternative development options within a sustainability framework. They are distinct from conventional urban models in that they are orientated towards sustainable development processes rather than having an objective to further the understanding of urban land use or demographic or transportation processes. All these methods tend to focus on building the environmental capacity needed to not only qualify the integrity of eco-systems but to evaluate the equity, participation and futurity of the economic, social and institutional issues underlying the built environment and the city of tomorrow (Deakin, *et al*., 2002a).

All these methods are used in two ways: to assess the environmental capacity of a specific stage of the urban development process (e.g. planning, design) and, in a more general way, to qualify and evaluate whether the planning and design of the urban development is sustainable. The use of the methods in this more general way illustrates the growing inter-disciplinary nature of the assessment exercise.

Methods that assess the planning policy commitment to sustainable development can be applied at the city-regional, district and neighbourhood scale. These levels of analysis are also typical of the methods adopted to assess the planning and design of major infrastructure projects. Methods that assess the design, construction and operational aspects of various buildings relate to the whole building, components and materials as major levels of analysis.

With regard to the time dimension, methods are available to assess urban activities across short, medium and long (>20 years) time periods. However, often the political pressures for urban regeneration means that decisions that reflect evaluation conducted over the short term are taken (<5 years) with little or no consideration of the long-term and particularly the inter-generational effects. Thus, as with the design, construction and operation of buildings, short-term considerations often apply and dominate the appraisal in question (see, for example, Curwell & Lombardi, 1999).

An outline summary of the main assessment methods in use

In this section a short description of the best-known assessment methods in use is given. These include examples for each of the classes suggested in Table 6.2, pre-Brundtland (or 'environment in general') and post-Brundtland (or 'life-cycle assessments'). In particular, the following methods are described:

Pre-Brundtland

CBA – Cost-benefit analysis
CVM – Contingent valuation method
HPM – Hedonic pricing method
TCM – Travel cost method
MCA – Multi-criteria analysis

Post-Brundtland

Ecological footprint
EIA – Environmental impact analysis
SEA – Strategic environmental assessment

CIE – Community impact evaluation
BREEAM – Building Research Establishment Environmental Assessment Method

The reader can find a short explanation of additional methods, among them those included in Table 6.1, at
http://research.scpm.salford.ac.uk/bqtoolkit/index2.htm.

CBA – Cost-benefit analysis

CBA is a well-known appraisal technique widely applied by both public and private organisations to aid the decision-making process in an early stage of a project's development. The main purpose of undertaking project appraisal at an early stage is to determine the viability of a project development to decide whether or not to build. Project appraisal can also help to establish cost limits or boundaries in order to determine the availability of funding and resources in undertaking the proposals (Ding, 1999).

CBA sets out to measure and compare the total costs and benefits of different projects that are competing for scarce resources by means of a market approach. It is concerned with which alternative gives the best return on capital. Thus it can be used to determine which of the possible projects to finance in order to maximise the return from a given amount of capital or public resources.

There are two types of CBA: economic and social. Economic analysis involves real cash flows that affect the investor. Social analysis involves real and theoretical cash flows that affect the overall welfare of society. Discounted cash flow analysis is used to make judgements about the timing of cash inflows and outflows on rates of return. Most experts agree that timing is fundamental to the correct evaluation of projects involving differential time periods in the payment and receipt of cash and that discounting makes allowance for the financial impact over time (Ashworth & Langston, 2000).

The main components of CBA are project costs and project benefits. Project costs are all expenditures incurred by the developer in completing the project. They are broadly divided into development and operation costs. The development costs refer to the expenditure for the construction of a project. They include land acquisition costs, relocation costs, construction costs and other statutory charges. Operation costs begin when the project finishes on site and continue up to the end of its life span. They refer to the energy consumed during the operation period, regular maintenance and repair, major repair work and regular cleaning. However, total project cost should go beyond just the cost incurred and also include costs to the public and the community in terms of environmental quality and impacts. Nevertheless, these costs are often ignored and not included in the project cash flow.

Project benefits are the revenues received from a project development and depend on the attitude of the developer towards the development. If the developer intends to use the completed project, benefits are derived from the selling of goods and services produced by it or revenue from renting out the completed project in the market place. However, the intended use of the project may be for the developer to utilise the building for his own activities, and the benefits from the development may be in terms of a better working environment and increased productivity. Nevertheless, project benefits should also go beyond the actual benefits expressed in monetary terms to take into account environmental issues such as a better living environment, leisure facilities and better traffic arrangements. From an economic point of view, project implementation may include productivity and employment opportunities in the region. However, it is difficult to place a money value on these social benefits (Ding, 1999).

The two most common capital budgeting tools used as selection criteria in CBA are net present value (NPV) and internal rate of return (IRR). Both rely on the existence of costs and benefits over a number of years, and lead to the identification and ranking of projects.

Literature on the deficiencies of CBA as a major tool in project evaluation indicates that it neither theoretically nor empirically account in a satisfactory way for ecological sustainability objectives. Alternatives have been suggested either to replace CBA completely with another technique that does not need to value environmental cost, or to supplement CBA with a technique that can measure environmental cost in other than monetary terms.

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CVM – contingent valuation method

CVM is a direct method of eliciting valuations from customers by questioning their stated willingness to pay (WTP) for an environmental

improvement, or their willingness to accept (WTA) compensation for a fall in the quality of the environment. It has been used for over 30 years in studies of recreation and the environment as a means of obtaining monetary estimates of individuals' preferences for goods, such as clear air, landscape and water quality, which are not traded in the marketplace and thus do not attract a price.

CVM is based on Hicksian measures of utility: welfare change is estimated as the money income adjustment necessary to maintain a constant level of utility before or after the change in provision of the environmental good or service being investigated. In practice, estimates are generated through the use of a questionnaire survey. Here, respondents are presented with a hypothetical scenario in which they are asked to estimate their WTP or WTA compensation for a given level of provision of environmental quality.

The construction of the hypothetical scenario and the design of the questionnaire are both critical to the successful application of the methodology. In practice, the method works best when respondents are asked about things with which they are familiar and when the valuation question is based on a payment mechanism that seems reasonable (Brooks, *et al*., 1997).

For further details

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HPM – hedonic pricing method

HPM was developed by Rosen (1974), on the earlier consumer theory of Lancaster (1966). It aims to determine the relationship between the attributes of a good and its price.

It is strongly rooted in microeconomic consumer theory and takes as its starting point that any differentiated product unit can be viewed as a bundle of characteristics, each with their own implicit or 'shadow' price. Thus the price of a given property in the built environment can be viewed as the sum of the shadow prices of its characteristics.

A large number of hedonic studies considering the effect of the environmental and neighbourhood variables (such as a forest or a site

of special scientific interest; countryside characteristics or the impact of surrounding properties; location and proximity to a high-pressure gas pipeline or aircraft flight path) on house prices have been undertaken. There also exists a significant body of research into the impact architectural style and historic sites have on property valuation. A review of these applications can be found in Bravi & Lombardi (1994), Brooks, *et al*. (1997) and Sirchia (1998).

For further details

- Rosen, S. (1974) Hedonic prices and implicit markets: production differentiation in pure competition. *Journal of Political Economy*, 82(1), 34–55.
- Lancaster, K.J. (1966) A new approach to consumer theory *Journal of Political Economy*, 84, 132–157.

TCM – travel cost method

TCM was developed by Clawson and Knetsch (1966). It is based on the assumption that the cost of travel to recreational sites can be used as a measure of visitors' willingness to pay (WTP) and thus their valuation of those sites.

The real costs of travelling to a site are taken as a proxy for the price of the product. Thus even if visitors do not pay to use the site, they may have incurred expenditure either implicitly or explicitly in travelling to it, which could be used as a measure of their valuation of that site. Time can also be perceived as an implicit cost while explicit costs are petrol or public transport fares.

For further details

- Clawson, M. & Knetsch, J.L. (1966) *The Economics of Outdoor Recreation*. John Hopkins Press, Baltimore, MD.
- Hotelling, H. (1949) *The Economics of Public Recreation*. National Park Service, US Dept of the Interior, Washington, DC.
- Pearce, D.W. & Turner, K.R. (1990) *Economics of Natural Resources and the Environment*. Harvester Wheatsheaf, Hemel Hempstead.

MCA – multi-criteria analysis

MCA attracts increasing attention from all around the world as one of the most important alternatives to CBA in decision-making. Due to the fact that environmental impacts are difficult to assess in economic terms within a market approach framework, the MCA techniques of weighting and ranking are investigated and applied to value these impacts in non-monetary terms.

In general, MCA is a technique designed to manage decisional processes typically characterised by many assessment criteria, alternatives and actions. The main advantage of MCA is that it makes it possible to consider a large number of data, relations and objectives (often in conflict) which are generally present in a specific real-world decision problem, so that the decision problem can be studied from multiple angles.

Attaining a solution in a multi-actor and multi-criteria problem is a far from easy task. The presence of several conflicting criteria excludes the existence of an 'optimum', i.e. a solution presenting the best score according to all criteria taken into account. Each alternative solution presents advantages and disadvantages, while preferences can vary according to the relative importance attributed to the various criteria in the 'ideal' solution, i.e. the alternative having the best performance for all the criteria selected is usually not feasible, and a compromise between realistic solutions is necessary.

The various multi-criteria methods aim to aid decision-makers in attaining such a compromise. These are classified as quantitative and qualitative or mixed in relation to the information-inputs they are able to handle. Examples of quantitative and qualitative or mixed methods are, respectively, 'weighted summation' and 'concordance and discordance analysis' on the one hand, and 'regime method', 'frequency analysis' and 'analytic hierarchy process' on the other.

For further details

- ❑ Hinloopen, E., Nijkamp, P. & Rietveld, P. (1983) Quantitative discrete multiple criteria choice models in regional planning. *Regional Science and Urban Economics,* 13, 77–102.
- ❑ Nijkamp, P., Rietveld, P. & Voogd, H. (1990) *Multicriteria Evaluation in Physical Planning*. Elsevier, Amsterdam.
- ❑ Roy, B. (1985) *Méthodologie multicritère d'aide à la décision*. Economica, Paris.
- ❑ Roy, B. & Bouyssou, D. (1993) *Aide multicritère à la décision: méthodes et cas*. Economica, Paris.
- ❑ Saaty, T.L. (1980) *The Analytic Hierarchy Process for Decision in a Complex World*. RWS Publications, Pittsburg.
- ❑ Saaty, T.L. (1996) *The Analytic Network Process*. RWS Publications, Pittsburg.
- ❑ Voogd, H. (1983) *Multi-Criteria Evaluation for Urban and Regional Planning*. Pion, London.

Ecological footprint

This concept is discussed in Chapter 2.

EIA – environmental impact analysis

EIA is a comprehensive procedure which involves different dimensions of a planning problem such as social, administrative and physical. It has been developed and is used as a means to identify potential damaging effects of proposed developments.

This procedure was born in the USA in 1969 under the National Environmental Policy Act (NEPA) for land use planning. Later, the EEC introduced a common directive to all Member States (85/337/CEE) which imposed the application of this EIA to all those projects having strong impacts on environmental resources. More recently, the United Nations Economic Commission for Europe has recommended the extension of EIA principles to policies, plans and programmes (see SEA, below).

More specifically, EIA is the process of assessing the physical and social impacts of projects. The main aim is to identify options in order to minimise environmental damage, for example selecting sites for project development with minimal environmental impact. The main purpose is to inform decision-makers about the environmental impacts of a proposal before a decision is made.

Sometimes vital environmental issues are valued separately by external consultants and the outcomes are included as part of an EIA submission. It may be useful for identifying environmental effects that might otherwise be totally ignored in the project evaluation process.

There are a number of methodological problems associated with non-monetary methods and, more generally, with EIA procedures, such as the following: difficulties in predicting impacts, lack of definition and measurement, monitoring of ongoing environmental change, absence of specific methods, and consultation and participation. At the moment, the analysis is usually limited to a list of environmental factors that do not take into account the complexity of interdependence with the human system.

Current research is focusing on the use of multi-criteria analysis (MCA) as an alternative to conventional economic evaluation (Ashworth & Langston, 2000).

For further details

- ❏ Department of the Environment (1993) *Environmental Appraisal of Development Plan: A Good Practice Guide*. HMSO, London.
- ❏ Warner, M.L. & Preston, E.H. (1984) *Review of Environmental Impact Assessment Methodologies*. US Environmental Protection Agency, Washington, DC.
- ❏ Zeppetella, A., Bresso, M. & Gamba, G. (1992) *Valutazione ambientale e processi decisionali*. La Nuova Italia Scientifica, Rome.
- ❏ Bettini, V. (1996) *Elementi di ecologia umana*. Einaudi, Turin.

SEA – strategic environmental assessment

SEA is an integrated assessment approach for policies, plans and programmes as it extends the process of EIA beyond specific projects. The European Commission has long espoused the desirability of extending EIA from projects to higher tiers of action and began consultations on an SEA directive in 1991. This is a consequence of the growing belief that project EIAs may occur too late in the planning process to ensure that all the relevant alternatives and impacts are adequately considered (Therivel, *et al.*, 1992; Wood, 1995). Thus when certain alternatives and significant environmental impacts cannot be adequately assessed at the project level, it may well be possible to assess them at the programme, plan or policy level (see also Directive 2001/42/CE).

In comparison with EIA, the focus of evaluation is essentially on development plans' strategies and policies. These are shaped and influenced by many driving forces such as economic, social and political priorities. Individually, or as whole, they can have a significant positive or negative impact on the environment. SEA can be seen as the process by which such impacts are identified and alternative courses of actions are proposed with the aim of considering the impacts at the earliest possible planning stage.

As with project EIA, SEA involves all screening, scoping, predicting, consulting, public participation, mitigation of impacts and monitoring (Therivel, *et al.*, 1992). The skill of the assessor comes to bear in selecting an appropriate mix from all the different approaches, tools and techniques available.

A considerable range of methods are available, including specific techniques for air quality, health risk, and tools such as the Policy Impact Matrix. This allows identification of the impact of each policy on the country's environmental stocks.

Environmental stocks, e.g. geology, soils, waste, air, energy, land, wildlife, landscape, man-made features, open space and human beings, must be chosen to reflect the themes of the environment report.

To make the appraisal more objective, a list of *indicators of positive impact* can be drawn up for each environmental stock. For each policy appraisal a *policy impact commentary* must also be provided.

For further details:

- Therivel, R, Wilson, E., Thompson, S., Heaney, D. & Pritchard, D. (1992) *Strategic Environmental Assessment*. Earthscan, London.
- Therivel, R. & Partidario, M.R. (eds) (1996) *The Practice of Strategic Environmental Assessment*. Earthscan, London.

CIE – community impact evaluation

CIE is a method that results from the adaptation of cost-benefit analysis to urban and regional planning. Its fundamental feature is that it provides the measure not only of the total costs and benefits but also of their impact on different sectors of the community, enabling the equity and social justice implications of the decisions to be taken into account (Lichfield & Prat, 1998).

The method was originally developed by Lichfield in 1956, with the name of the Planning Balance Sheet or PBS (Lichfield, 1996). PBS was explicitly devised to overcome the fact that many social costs and benefits are not easily measured in monetary terms, so that the results of any social benefit analysis was always liable to objections that some costs or benefits were incorrectly valued. Thus the approach stopped short of assigning values to many cost and benefits, simply indicating where they should be placed on the balance sheet, either as assets or liabilities. CIE further indicates which sections of the community are likely to gain or lose from planning, so taking the distribution effects into account (Brooks, *et al.*, 1997).

For further details

- Lichfield, N. (1996) *Community Impact Evaluation*. UCL Press, London.
- Lichfield, N. & Prat, A. (1998) Linking ex-ante and ex-post evaluation in British town planning. In: *Evaluation in Planning: Facing the Challenge of Complexity* (eds N. Lichfield, A. Barbanente, D. Borri, A. Kakee & A. Prat) pp. 283–298. Kluwer Academic Publishers, Dordrecht.
- Lichfield, N (1988) *Economics in Urban Conservation*. Cambridge, University Press, Cambridge.
- Lichfield, N., Hendon, M., Njikamp, P., Realfonso, A. & Rostirolla, P. (1990) *Cost-Benefit Analysis in the Conservation of Built Cultural Heritage*. Ministero dei Beni Culturali, Rome.

BREEAM – Building Research Establishment Environmental Assessment Method

BREEAM is a scheme for environmental labelling of buildings developed by the Building Research Establishment (BRE) in collaboration with a number of private sector sponsors. The basis of the scheme is a certificate awarded to individual buildings stating clearly the performance of the building against a set of defined environmental criteria. The scheme is voluntary and self-financing. Assessment is carried out by independent assessors licensed by BRE.

The first version, launched in 1990, was for new office buildings

assessed at the design scheme stage. This was updated in 1993 to reflect developing knowledge and experience gained in the operation of the scheme. Other design stage schemes have been launched for supermarkets, new houses, light industrial buildings and others.

The scheme embraces a large range of environmental issues grouped under three main headings:

(1) *Global issues*, which includes CO_2 emissions resulting from energy use, acid rain, ozone depletion due to chlorofluorocarbons/HCFCs, natural resources and recyclable materials, storage of recyclable materials and designing for longevity.
(2) *Local issues*, which includes transport and cyclists' facilities, water economy, noise, local wind effects, overshadowing of other buildings and land, reuse of derelict/contaminated land and ecological value of the site.
(3) *Indoor issues*, which includes hazardous materials, natural lighting, artificial lighting, thermal comfort and overheating, and ventilation.

Issues receive individual, discrete credits. A credit signifies that the design satisfies the criteria for the issue concerned but there is no attempt at weighting the diverse issues. A summary of the performance is included; this is expressed as a single rating of 'fair', 'good', 'very good' or 'excellent', based on a minimum level of credits achieved in each of the three classes of environmental issues. This rating is simply a measure of the balance of the design approach across the three classes. A rating of 'excellent' indicates a high standard of performance across the range of impacts, although there may still be scope for further refinement.

Similar schemes to BREEAM are the BEPAC programme in Canada and the Green Builder Program in the US.

For further details

- Birtles, T. (1997) Environmental impact evaluation of buildings and cities for sustainability. In: *Evaluation in the Built Environment for Sustainability* (eds P. Brandon, *et al.*), pp. 211–223. E&FN Spon, London.
- Prior, J. (ed.) (1993) *Building Research Establishment Environment Assessment Method (BREEAM), Version 1/93: New Offices*. Building Research Establishment Report, Second Edition.
- Cole, R.J., Rousseau, D. & Theaker, I.T. (1993) *Building Environmental Performance Assessment Criteria, Version 1: Office Buildings*. The BEPAC Foundation, Vancouver.

Linking the assessment methods to the framework

As discussed in Chapter 4, the framework provides for decision-makers a guide to comprehensive evaluation of sustainable development which includes all the appropriate levels of information.

In decision-making for sustainable development, it is important that all environmental–social–economical–institutional aspects encapsulated in the fifteen modalities of the proposed framework are covered for the true long-term sustainability of any built environment and its community.

This statement can be derived from everyday experience. If people are functioning poorly in the biotic modality, for example by inefficient handling of human waste, life functions may be threatened and sustainable development will be low. If people in an area have no vision and no commitment to the area – which are elements of the credal modality – morale is likely to be low and this will again affect all other functioning and lead to divisions in society. Again, but in a different manner, true sustainability suffers (Lombardi & Basden, 1997).

The evaluation methods previously described belong to different scientific disciplines and technical fields, such as economics, engineering, technology and planning. Most of them are able to deal with different sustainable development issues at the same time (e.g. multi-criteria analysis) but some can only deal with one or a few of them (e.g. financial appraisal). None is able to tackle all the sustainable development issues in a comprehensive manner.

Table 6.3 maps the assessment methods described above on to the fifteen modalities of the framework. This table is useful because it shows the issues of sustainable development (i.e. the modalities) tackled or involved by each method. It also indicates the different classes of 'capitals' and areas of interventions (see Table 4.3), i.e. infrastructure development, environmental development, scientific development, socio-economic development and governance, which are handled by current assessment methods.

It can be noted that the environmental dimension of sustainable development has the greatest coverage among the main assessment methods in use. Here issues such as resource consumption, pollution and impacts on bio-diversity and people's health are considered, using methods that include cost-benefit analysis and revealed/expressed preference techniques (contingent valuation, travel cost and hedonic pricing), building scale methods (BREEAM), and methods to evaluate infrastructure and particularly planning policy. The latter is addressed by EIA, community impact analysis (CIE), and the proposed EU directive on SEA.

The social and economic sustainable development elements address, respectively, considerations relating to the financing of the infrastructure and utilities required for the desired urban development,

Table 6.3 Mapping the assessment methods onto the modalities.

Capitals	**Environmental**					**Human**				**Institutional**				
Areas	**Infrastructure development**			**Environmental development**		**Scientific development**			**Socio-economic development**		**Governance**			
Modalities	**Qu**	**Sp**	**Ki**	**Ph**	**Bi**	**Se**	**An**	**Hi**	**Co**	**So**	**Ec**	**Ae**	**Ju**	**Et**	**Cr**
Pre-Brundtland methods															
CBA															
CVM															
HPM															
TCM															
MCA															
Post-Brundtland methods															
EcoFootprint															
EIA															
SEA															
CIE															
BREEAM															

(*Note:* In grey the main issues involved and in black the focusses of the evaluation.)

access to services, people's safety and security, and aesthetic issues. With the application of the pre-Brundtland 'environment in general' methods, both economic and social analyses are confined to the planning, property development and design stages (thus addressing assessment of policy, programme and infrastructure provision), and do not address the construction of projects, or the installation of operations. Conversely, the 'post Brundtland' methods attempt to address social and economic issues in addition to their environmental focus, although this treatment is piecemeal.

It is apparent that these life-cycle assessment methods often address social or economic issues using approaches from the former group. Examples can be found in the sustainable city models, in the mix of formal life-cycle assessment and CBA (e.g. Glasson, *et al*., 1994; Lichfield, 1996; Therival, 1998), in meta-analysis of policy planning and infrastructure design (Berg, *et al*., 1997), and in the transformation of multi-criteria assessments into regime analysis so as to resolve environmental problems arising from alternative economic and social structures relating to sustainable development (Bizarro & Nijkamp, 1997).

A major problem with approaches based on economic utility theory, such as cost benefit analysis, which are widely applied in spatial planning is that the long-term effects of human actions are often ignored. Opposite approaches based on argumentation and rhetoric or nominalistic theories (Zeppetella, 1997; Khakee, 1998), such as multi-criteria analysis methods avoid the dangers of reductionism by acknowledging the views and wishes of all and sundry. However, there are still some problems; for example, there is no standard by which to arrive at consensus. In addition, there is the danger, in practice, that 'those who shout loudest get heard', while less articulate groups and those who cannot represent their rights, such as animals or young children, tend to get ignored unless their cause is championed by others (Lombardi & Basden, 1997).

Table 6.3 also shows that a number of gaps exist in relation to many inter-related activities of the urban development process, such as in scientific and human development and institutional development. Perhaps the most obvious 'gap' evident is the relative absence of methods addressing institutional issues such as governance, justice and ethics with respect to development. Unfortunately, there is evidence to indicate that methods addressing these issues experience extreme difficulty in dealing with the complexity of institutional structures and the range of stakeholder interests this introduces into assessment. Thus methods to assess the capability of institutional structures to promote sustainable development remain poorly developed, despite the evident need for them (Deakin, *et al*., 2001).

Although MCA methods have often proved able to provide a guide for selecting suitable planning and design solutions in evaluation, they

lack content and a conceptual framework or theoretical guide that can help designers and decision-makers to structure the problem of sustainability in the built environment. Consequently, the selection of the most appropriate criteria to be used in the evaluation process is often developed on an intuitive basis or in a non-optimal manner (see case study n.1 in Chapter 5; also Nijkamp, 2003).

The proposed multi-modal framework should not be understood as an alternative final method for problem solving in planning and construction. Rather, it is intended to be an evaluation structure that makes available the new perspective of sustainable development in planning, integrating different approaches and methods in a structured multi-layered *tool-kit*. In other words, the framework allows a multi-disciplinary and multi-people approach to take place, enlarging and extending the horizon of current practice.

Future knowledge about sustainable development, further implementation of the information on which the framework relies and pragmatic testing in real worldwide contexts will certainly be required. Practical applications could also be improved if the model were linked to expert systems or Geographic Information Systems. At present, research findings show that the framework is reliable as a model to be used for challenging planning towards greater sustainability in the built environment.

Summary and conclusions

This chapter has examined some of the major evaluation methods currently in use for assessing the sustainable development of an urban settlement or a building. It has been noted that there are a wide variety of evaluation approaches to sustainable development in planning, design and construction but little agreement among scholars on the theoretical framework to be used. For instance, developers of assessment models for sustainability at the urban scale, such as the Quantifiable City Model by May, *et al*. (1997), mostly take into account economic-social and physical aspects of a sustainable development, while environmental assessment methods at the building scale, such as BREEAM in the UK (1993) and BEPAC in Canada (1995), concentrate on the environmental and ecological issues related to sustainability and quality of life.

All the methods are constrained and limited and take into consideration only a few of the many aspects required for developing sustainable solutions. Most evaluations are mainly technical and economic and there is not a mechanism or tool that is able to take into account all sustainability issues in a comprehensive manner.

Decision-making for sustainable development requires holistic approaches and a change from current methods both in the emphasis

and in the criteria by which development is judged. There needs to be a movement towards environmental protection and social/economic objectives. It needs to build social consensus as well as to improve technical performances. Among others, Nijkamp (1991), Brandon, *et al*. (1997) and Lichfield, *et al*. (1998) suggest that an appropriate evaluation approach should have a number of characteristics, as follows:

- *Include all the relevant effects* generated by urban projects on the environment in the long term.
- *Provide information* on the social, economic and environmental consequences of a design process through time.
- *Integrate different evaluation approaches* and scientific disciplines (a *multi-disciplinary* approach) required to verify the socio-economic and environmental compatibility of urban projects.
- *Take into account the different viewpoints*, objectives and interests of decision-makers, stakeholders and citizens within a participation process (a *pluralistic* or *multi-person* approach).

Since the time when Agenda 21 (UNCED, 1992) called for the integration of environment protection and socio-economic development in decision-making, impact assessment has advanced considerably (Deakin, *et al*., 2002b). Within the EU, EIA has been introduced as a statutory instrument (directive 85/337/EEC and amendment 97/11/EC), and the critique of EIA as solely a project-specific assessment approach (e.g. Glasson, *et al*., 1994) has led to its extension to plans and programmes under the proposed EU SEA directive. This shift in emphasis is significant as it requires the development of procedures for the procurement and assessment of plans, programmes and projects able to satisfy the policy commitment to sustainable development (O'Conner, 1998; Devuyst, 1999; Harrop & Nixon, 1999; Selman, 2000).

According to Deakin, *et al*. (2002b), a further key gain has been the evolution of methods that attempt to assess the impact of development in terms of material and energy flows, across most stages of the urban life cycle. These present opportunities to assess developments with respect to ecological limits, although in practice few are able to achieve this at present. While this suggests that much progress has been made post-Brundtland to improve the theory of assessment, it is recognised that the practice of assessment lags well behind. New methods remain largely experimental, with relatively few applications in practice. Meanwhile, many of the methods currently in widespread use fail to make assessments that adequately address the issues underlying the sustainable urban development process (Cooper, 1997; Cooper & Curwell, 1998; Cooper, 1999).

The review of assessment methods illustrated in this chapter and the mapping exercise using the multi-modal framework have pointed out several critical points, as follows.

- Firstly, those sustainability issues that are poorly addressed by available assessment techniques have been identified. Method 'gaps' are significantly evident in the social and institutional aspects of sustainable development. Method developments are required in this area, but perhaps the difficulty current methods have in dealing with the complexity of institutional structures and associated stakeholder interests presents the greatest challenge (Deakin, *et al*., 2002b).
- Developments also need to encourage the integration of assessment methods with other assessment techniques alluded to earlier as being beyond the scope of this chapter. In particular, there remains considerable scope for integration of assessment methods with sustainability indicators, and with urban sustainability models (Deakin, *et al*., 2002b). Both attempt to address the urban system holistically, but the former presents essential sustainability benchmarks while the latter presents the opportunity to seek preferred development alternatives for complex urban systems which are otherwise difficult to assess (Mitchell, 1999).
- A further aspect, which has been suggested by Mitchell (1996) and Deakin, *et al.* (2002b), is the need to ensure that the emerging sustainable development assessment techniques are applied and audited. Methods must move quickly beyond the experimental phase and be applied in practice, so that conventional techniques are replaced by those that better address sustainability concerns. This may require the application of multiple methods (conventional and experimental) in parallel to accelerate the learning process and identify how both theory and practice can be improved. Critically, such applications will require greater use of auditing and post-assessment monitoring to determine how well methods perform.
- Finally, research is required into methods of assessing the aggregate effect of policy and urban developments on urban sustainable development. This could take the form of assessment method integration as in the above-mentioned emerging models, or development of unifying frameworks and analytical procedures as argued for by Hardi and Zdan, (1997) and Devuyst (1999) and illustrated by Curwell, *et al*. (1999). However, in practice the effectiveness of both approaches will rely on the development of adaptive management structures within decision-making institutions, so that they are able understand, respond to and foster improvement of the sustainability assessment procedures (Deakin, *et al*., 2002a).

The multi-modal structure suggested in this book represents a key resource to decision-makers in this problem area. It provides a means to assist the selection of assessment techniques so as to address

sustainable urban development issues in a pragmatic and integrated manner. It also helps to address the need for a holistic approach which is needed for sustainable urban development. This means that the most significant elements and linkages in the system are addressed, and the 'technical' aspects of assessment, and the 'soft' institutional systems that direct and respond to them, evolve together.

7 Towards Management Systems and Protocols

At the heart of the sustainable development agenda is the question of management. If we take the broad definition of management as being '...the act of controlling, directing affairs to succeed, coping....' (*New* Webster's Dictionary, 1992), these are issues that are at the centre of the sustainable development agenda. We need to *control* in order to *avoid* the perceived calamities that might ensue if we do not intervene and control in some way. We need to *direct affairs* in order to take positive action that will address the agenda identified as necessary to improve the position of future generations and we need to act to *cope* with what is perceived to be a worsening environmental and social disorder.

The paradox is, of course, that it is the management actions of human beings that have resulted in the present unsatisfactory situation and are the reason why it is now thought necessary to encourage an agenda entitled 'sustainable development'. Throughout human history mankind has found it necessary to take decisions that he believed would enhance his status and position within nature. Humans strove to be *in control* of nature and, in so doing, many forgot that in fact they were part of the natural environment and part of its delicate balance. Now that we have come so far with one set of objectives, which were about controlling nature, is it possible to find a new paradigm which seeks to re-establish the position of humans *within* nature? The world is full of examples where humans have attempted to change things for the better, only to find that in a comparatively short period the results of their actions have resulted in another problem in another area which was not foreseen at the time. All technologies have the power to provide positive advantages but, if used improperly, they can often lead to

disastrous consequences. This is a warning to all of us seeking to find 'solutions' to the sustainability problem.

In past centuries, the population of the world, the level of technological sophistication and the geographical impact were all of a smaller order and, while some damage was done, it could be corrected in time and often by natural means. Now we have a different situation where, in some instances such as global warming, it requires a massive effort by all nations to solve the problem. Pollution does not recognise national boundaries, nor does it recognise human jurisdictions, nor does it have respect for culture or religion. Human development contributes to both the physical environment and also the behavioural consequences of the life in that environment. It can be beneficial or it can be harmful. The problem is that it is not always possible to tell, at the time of making the decision to develop, what the impact will be. Apart from war situations, there are very few instances where it could be said that humans have undertaken development to deliberately harm the planet or indeed its human population. It is true that sometimes decisions have been made recklessly and without regard for the consequences, often with an economic motive in mind, but, by and large, decisions were made to 'improve things'. If improvement was the aim, why do we have the problems we now face?

It is impossible to be exhaustive about the reasons why a breakdown has occurred but it must be partly due to the changing nature of the human world; see Table 7.1, for example.

Table 7.1 The changing nature of the human world.

Past generations	**Current generations**
Human settlements were bounded largely by people's ability to travel and the natural resources available.	Human settlements are engaged across the planet and wealth is the constraint not technology.
Technological development was to enhance human labour and its impact was limited to the individual or to small communities.	Technological development has moved to the wider community and global level and its impact is beyond national boundaries.
Management control was in the hands of the few.	Management control is exercised by a plethora of agencies.
Financial power was localised and within the control of the local community.	Financial power exists within a vast number of institutions, many of which are multi-national and global.
Regulation was exercised locally within the cultural context of the community.	Regulation is now exercised nationally and internationally and it reflects the demands of those with power at this level.

There is little doubt that the changes brought about by technology have made managing towards a sustainable environment much more difficult. This is coupled with a shift towards democratic processes whereby the political machines have to respond to the voice of the people. The result is a much more complex world where the institutions and mechanisms of governance can be found in a variety of different locations, where it is often the short term that is being addressed instead of the long term, and where the impacts of technologies are difficult to gauge in a holistic manner.

So how do we intervene in such an environment? It appears an impossible task. Is it realistic to expect governments to unite around a common set of principles? Can managers across the world agree on what constitutes sustainable development within their context? Can we expect a common filter on all decision-making in the future that engages with the sustainable development debate? It is unlikely.

If not we must, at least for the foreseeable future, consider what is possible at this point in time and what the conditions are that encourage good management. It would be fair to say that few would claim to have solved the problem of managing development in such a way that it is sustainable. This is not surprising since the concept of sustainability has not been adopted until comparatively recently. Many philosophers and writers have made statements over the centuries which demonstrate that wise men have understood the problem, but it was only in the latter part of the twentieth century that this became a major agenda item for the world. Good husbandry for the locality has become good stewardship for the world.

In some ways this gives us the clue for advancement because there are links between the two. The global agenda depends on a multitude of decisions at the local level. The disposal of refrigerators, the choice of energy for housing, the method of manufacturing building products and the planning framework for a local authority are all examples of the billions of small decisions that contribute to sustainable development. Thus the maxim *think global, act local* has become a motto for many within the field.

It is not difficult to see that although this may be a useful call to improve the situation, it is extremely difficult to implement in practice. A decision in one area has an impact in another which may lead to an unsustainable development. Examples abound. The method of insulating a building may save energy at the local level but the extraction process for the raw materials may require more energy than it saves and may deplete the earth of a valuable resource or at least increase its cost in a market situation. The regeneration of one urban area may lead to the decline of adjacent areas as people move to take advantage of the improvement and another community is deprived of its economic resource to maintain or improve its standards. The shift to out-of-town shopping centres can lead to deprivation in the traditional city centres, and so it goes on.

How can 'management', whatever that might be and by whoever it might be implemented, deal with such complexity? I think most people would say that at one level it cannot. We have not yet developed the tools or systems that allow us to address the issues and certainly not in a way that is understandable and actionable by all stakeholders concerned with decision-making in the built environment, or indeed elsewhere. Even if we were in favour of a totalitarian regime, which could control all inputs and outputs from the process, we do not know sufficient about the inter-relationships that exist between the various impacts of millions of decisions to *know* what the outcome would be. In fact we are not yet sure what the destination might be, if there is such a thing. Over time these relationships will change and consequently the decisions will need to respond accordingly. What is considered to be sensible now might well appear stupid to a future generation.

In a democratic society, where the will of the people determines policy, much depends on the knowledge and commitment of the people to the objective of sustainable development. This requires a high standard of education coupled with a willingness to make sacrifices now in order to allow future generations to have choice in their own futures, equal to what we enjoy now. All the constraints that politicians work with in such societies come clearly to the fore. Will this result in good economic performance, allowing the current population to achieve its present aspirations? Will it attend to the health needs of this generation? Will it resolve current difficulties in society before the next election? If this is extended to the developer, the motivation may well be even shorter term and depend on meeting the bottom-line requirements of the shareholders or investors.

This could be considered a very pessimistic scenario, and indeed would be if we thought we had to resolve everything right now. However, the nature of the management process must be to learn as we progress. This suggests that whatever system is developed must have clear and structured feedback mechanisms to allow continual review and improvement. The important question is '*Who manages?*' in order that feedback can be systematically established in such a way that there is corporate learning at all levels.

Who manages?

A simple answer to the question of who manages sustainable development would be '*Everyone*'. At least everyone has a contribution to make. On environmental issues, for example, the way each household purchases its products and disposes of waste is a management responsibility within the home. The local authority usually has responsibility for waste disposal and recycling of waste material under the auspices of a central government that provides legislation and directives as to what to do. The companies that produce the products

manage the wrapping and promotion, and transport companies deliver the products in a particular way. The list is endless but it illustrates the complexity of the management process and the complex ownership issue within the problem. In broad terms, the management of sustainable development can be categorised as follows:

- *Government:* The government has the responsibility of providing a legislative and regulatory framework within which management can operate. In addition, as a large client for many activities within most countries, it has a management responsibility to encourage and implement sustainable development within those activities and to educate the public about such issues. It is also the mechanism whereby global initiatives between nations, such as Agenda 21, are realised.
- *Local authorities:* These authorities have the responsibility of working out government policy within the context of their own jurisdiction. They too determine policy and work out their policies through actions in areas such as transport, policing, waste disposal, infrastructure works and so on. At the urban level they are the managers who set the framework within which all others have to operate.
- *Organisations and firms:* These institutions have to comply with what government and local authorities demand but they can also manage their organisations to be sensitive to sustainable development, and indeed many firms have their own policy on such issues which is available for public scrutiny. It can be complex, particularly when the organisation is a multi-national company operating across the world. The sensitivities and requirements of a country such as India or China may be quite different from those in the West.
- *Individuals:* All of us have some responsibility for managing our lives and we do this within the context provided by government and local authorities and within the constraints of those who provide goods and services for us. While we can change these 'controllers' through the election processes and through purchasing power, this is usually a long-term affair and we have to adapt accordingly.

While the above appears as a hierarchy it is really much more complex as between the levels there is interaction which changes according to the decision-making process that is adopted. It is also almost impossible to opt out from the system as many small communities have suggested they might do. They find themselves dependent at some level on others or controlled in some way, and their freedom to act is curtailed. There are also the remaining freedoms to act which individuals can exercise at will, whether within the law or outside it, and

these individual acts will have a bearing on sustainable development. Communities with high crime rates can find their position unsustainable through the actions of individuals outside the legal and regulatory framework.

The planning framework

Whatever management system is implemented for sustainable development, it has to respond to and contribute to the regulatory framework within which it must operate. One of the primary frameworks, at least for the built environment, must be that of the planning process. This is the process by which government, at all levels, exercises influence and power as to what is allowed or encouraged to be built. Usually this is defined within a process that has legal enforcement. However, there might also be a number of less formal constituents which are advisory and might be taken on board by a planning authority when it uses its discretionary powers. This can make the sources for management decision-making quite varied and complex unless these are made explicit. It also varies from region to region of each country and from country to country, making it impossible to generalise about such issues.

An international project called SUSPLAN, funded by European Union Framework Funds, involving three local government and university partnerships across Denmark, the Netherlands and the UK looked at how attitudes to sustainable development impact on urban and rural planning. One study produced a useful map of the way in which the concept of sustainable development was integrated into the planning process in the UK (Porter, 2000) as shown in Fig. 7.1. It can be seen that the local authority at the centre of the map is responding to directives and enabling planning through a variety of instruments. It responds to European, national and regional objectives and targets and initiates a complex process and system that engage sustainable development issues alongside the conventional planning criteria. In an ideal world the two would be synonymous since part of the object of planning must be the sustainability, in its widest interpretation, of the community that it serves.

In a very real sense the planning authority is managing the process of sustainable development through its planning processes. This is fine at the strategic level but at some point the more detailed aspects of sustainable development have to be owned by those who operate and develop within the framework that has been instigated. Again, regulation and legal enforcement can be used as an instrument to make sure that firms, organisations and individuals comply with what is thought to be needed in order to achieve the current view of what is sustainable. These tend to be minimum conditions as there is a sensitivity about

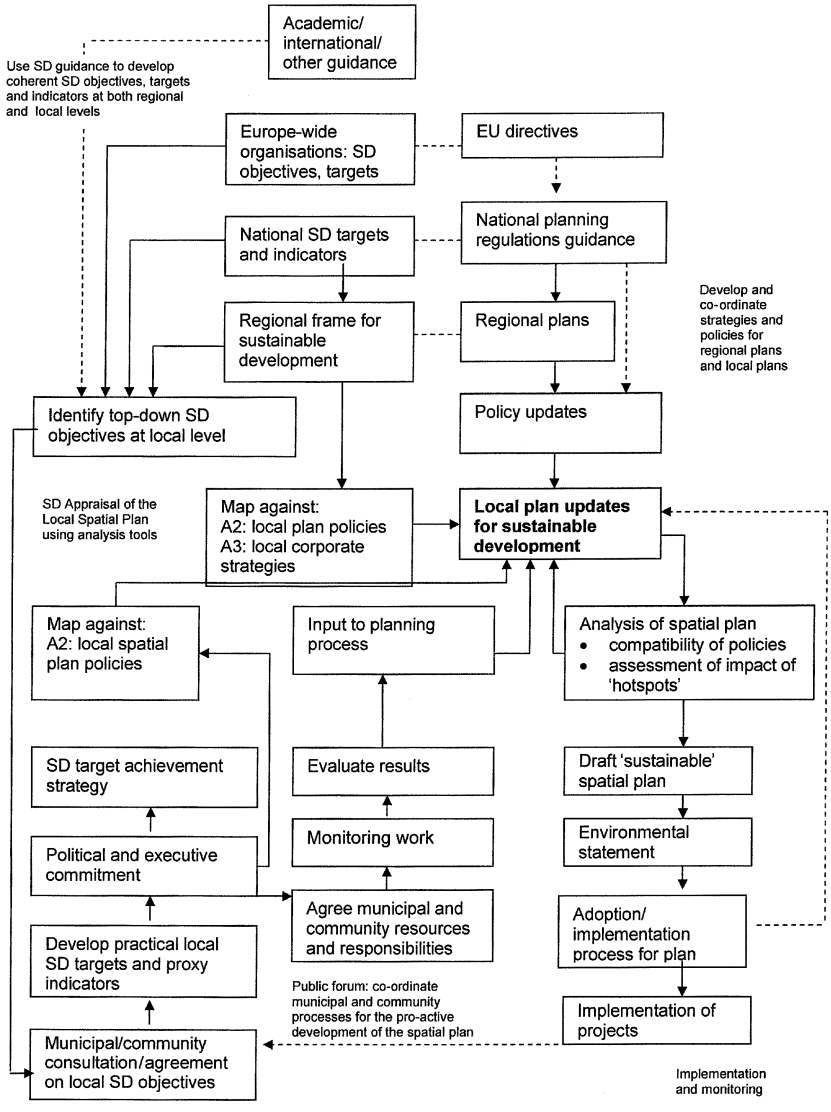


Figure 7.1 The integration of sustainable development in planning (Source: Porter, G. (2000), in Mawhinney, M. (2002) *Sustainable Development. Understanding the Green Debates*. Blackwell Publishing Ltd, Oxford.)

individual freedoms in most democratic societies. To achieve major improvements may require much more stringent discipline by all concerned and this in turn may need a greater focus on education. It is interesting to note that the Club of Rome, which did so much to bring the plight of the earth's dwindling non-renewable resources to our attention in the 1970s, is now making education its major policy driver.

The nature of the education will vary and will have to take place at

many different levels from the education of the policy makers to the education of the child, and from the education of the corporation to the education of the household. This is a long-term task and for some areas of sustainable development, where the damage to the environment is both critical and irreversible, we may not be able to wait that long.

The knowledge that needs to be imparted is evolving and emerging slowly. There is not a comprehensive body of knowledge, in an easily digestible form, which can be put before all the various stakeholders for them to implement. Indeed, in many areas there is a debate to be had as to what is sustainable and which issue takes precedence over another. This is part of the process and requires feedback and continuous learning as our knowledge is enhanced.

Management in a learning organisation

We have suggested in this book that sustainable development is a process rather than a destination. In other words, it can never be said that we have arrived at 'sustainable development' but we can say that we are striving to improve the environment within which humans live and that we are seeking to leave that environment in a better position for future generations. We are aiming not to close down their options. This is important because it means that we have to keep the trends in sustainable development under constant review and match them with our improved understanding of what is required for sustainable development. Any management system that we set up must therefore have systematic feedback as part of the process.

Pete Senge, in *The Fifth Discipline* (Senge, 1990), makes the case that the organisations that will survive in the longer term will be those that are *learning organisations.* He defines such organisations as:

> '. . . organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together.'

It would not be pushing the definition too far to say that these are the attributes of a society that wishes to take sustainable development seriously within the context of what we understand sustainable development to be. Even the definition is likely to change with time as we learn together about what sustainable development means to the current generation. Senge goes on to provide some 'thinking tools' for achieving this desirable state of affairs where we learn, provide feedback and implement, and this becomes the normal way of operating for the organisation.

In most cases it is necessary to do this activity in a systematic way.

The complexity of the interrelationships and the wide spectrum of stakeholder involvement means that anything else would be ad hoc and would eventually lead to chaos. Even today we can often see conflicts between regulatory bodies in terms of the legislation they bring forward. One piece of legislation, although well intentioned, can have the opposite effect to what was intended within another field. We need a holistic approach in which the *learning* can be shared for mutual benefit. Until quite recently the technology required to share such complex knowledge has not been available. Now, with the advent of the Internet and the concept of *knowledge grids* arriving in the near future, there is the opportunity to tap in and gain the knowledge we need quickly and, we hope, reliably. This suggests that we can move more quickly towards an understanding of what is needed, and an assessment of what the impact of our management decisions might be, fairly soon. It will not happen overnight but in time the diversity of knowledge will be available to those who want to know and it will be structured in a way that will allow people to incorporate it within their decision-making processes. Not only this, but it will be possible for the results of those decisions to be collected and fed back into the system to enhance the knowledge that will be there. In this sense it will be organic and constantly reviewing itself for the benefit of its users.

At one level this sounds useful but, like most technologies, it has the potential for harm as well as good. The way information is handled and presented affects the messages that are given. It will be based on the values of those who create the systems and, by their nature, the systems will be designed to be used frequently by the many. If they do not evolve quickly they can create a fossilised view of knowledge and an oppressive tool which will dominate thinking and not allow the expansive patterns of thinking encouraged by Senge. Even outside the wrong hands this can be dangerous but a tool of this nature in the hands of a malevolent dictator could be disastrous.

The building of such systems is also exceedingly complex and will be a learning process in its own right. It is most unlikely that a definitive system can be produced which will match the advances in communication technologies and be able to create its own brain-like tendencies to deal with these problems. In fact modelling such a system on the human brain may impart the limitations of the human brain to the machine. On the other hand, not modelling it on the brain may create problems for the human mind in comprehending what the machine is doing. These may seem fanciful scenarios but in the time frame of, say, three generations, our grandchildren may not find it so remote or so speculative. It looks as if information technology as we know it today will be an issue in sustainable development within the fairly near future (see Chapter 8).

If we accept that the process is key and that we need to systemise it in some way to make it understandable and comprehensive, we have to

consider what tools might be available. These tools have to be flexible and to be adaptable over long periods of time. They have to be forward-looking to ascertain what *might* happen in the future and prepare the ground for various possibilities. Conventional management systems are unlikely to fulfil this combination of requirements. One possibility might be *soft systems methodologies*.

Soft system methodology

The concept of soft system methodology was developed by Peter Checkland and Jim Scholes (Checkland & Scholes, 1999) to combat some of the limitations they had perceived in traditional systems engineering. Although trained as systems engineers, they found that real-world management situations were always too complicated for the straightforward application of the systems engineering approach. They said that

> '... they had to accept that in the complexity of human affairs the unequivocal pursuit of objectives which can be taken as given is very much the occasional special case: it is certainly not the norm.'
>
> (Checkland & Scholes, 1999)

In other words, the likelihood is that we will find conflicts within the operation of objectives, an inability to decide on the most appropriate objectives and consequently will have difficulty in meeting those objectives. Sustainable development has, at the moment at least, great difficulty in setting out objectives and creating harmony within the various conflicting objectives of those who participate as stakeholders over very extensive periods of time. It does not lend itself to hard systems thinking.

The initiators of soft systems identified four key thoughts which led them to develop their new approach. They suggested that all human activity was *purposeful and meaningful* to the person undertaking it. This led to the idea of modelling purposeful 'human activity systems' as a set of linked activities which together could exhibit the emergent property of purposefulness and they developed models to handle this concept.

Secondly, they realised that as you begin to develop such models several *interpretations* of any declared purpose are possible. There are a huge number of human activity models that can be built in any complex human problem and a choice has to be made between the models as to which ones are relevant. It is therefore necessary to focus on which ones are useful and which ones reflect the perspective from which the results will be built and viewed. This perspective needs to be made explicit.

Thirdly, as they moved away from an obvious problem that required a solution they moved towards the idea of a *problem situation* instead. They used the handful of models that might be produced of human activity as a source of questions to be asked of the real situation rather than as a representation of that situation.

The final shift was to argue that the learning that came out from the models of purposeful activity could provide an entry into work in information systems.

In a book of this nature it is not possible to argue the full case or to present the methodology, but the Checkland book quoted will provide the necessary knowledge in this respect. The approach is based on action learning and research where participation becomes an essential aspect of the process. It moves away from an argument about systems to a systemic approach. The methodology is systems thinking based but recast in a different form. Systemicity is shifted from modelling the world to the *process of enquiry* into the world. The system is no longer a part of the world which is to be engineered or optimised: the system is *the process of enquiry itself.* This allows reflection upon action taken, and this becomes analysable.

Such an approach may well be the appropriate one for the management of sustainable development over the longer term. It allows us to build a model, in fact several models, which we can use to enquire about the process of sustainable development and from which we can learn. It deals with the issue of purpose which underlies the need for addressing sustainable development and it provides tools for improving our understanding by reflection. The potential has not yet been harnessed because we are still in the early days of exploring the approach but there seems to be strong potential for aiding us in the decision-making process. Eventually it may be able to capture hard knowledge within tools such as knowledge-based systems and other information systems in such a way that they do not become inflexible and oppressive, but that is some way off. Information is needed for the exploratory models, but its encapsulation into knowledge arises from the reflection and perspectives given by humans and for the moment these are best dealt with through human experience.

Process protocols

It is one thing to create systems, whether for enquiry or not, and another to articulate the process of what, when, and where decisions have to be made. Developers, local authorities and individuals are having to make decisions at this point in time and these cannot be delayed until all the knowledge is available. They have a goal to achieve and for them it is a 'destination', not a 'process'. Those who wish to engage in sustainable development require guidance as to

when the principles of sustainable development should be included in the decision-making they are undertaking. This requires a protocol, i.e. a framework of rules which can be followed to achieve as far as possible the desired objective. We have already stated that it may be difficult to identify the objective but in some cases, where the goals are clear, such a protocol can be delivered.

If we observe the construction of a building we know we have to deliver accommodation of the type required by the client (and to some extent the stakeholders) within budget, of the right quality and within a certain period of time. Usually there is not much flexibility. We also know that there are activities that have to be enacted to get the building we require. We have to ascertain the client's requirements, draw up plans, tender for the construction and then build the building. It is not quite that easy, but nevertheless a process can be established which in some part can be considered generic. Researchers at the University of Salford, UK, have been exploring such a protocol for some time (Cooper, *et al*., 2004). The result is a map of the activities in a construction project which can be used to assist in determining what decisions are to be made, at what time and by whom. Figure 7.2 shows the high-level map of the process but each activity can be driven down to further levels of detail to reveal the information required and its complexity.

Upon this process can be overlaid other factors such as risk management (Ceric, 2003). Risk management is driven by many of the processes below each high-level activity. Another might well be sustainable development and the incorporation of the Sustainable Material Advice and Resource Tool (SMART) within the Process Protocol generic model as described by Gilkinson (Gilkinson, *et al*., 2002). This enables the process owners within the project life cycle to be prompted to consider a particular issue at the appropriate time in the decision-making process.

A feature of the Process Protocol is the concept of *hard* and *soft* gates. Hard gates are those where the decision maker must have the information and must make a decision before he or she moves on to the next phase. These are mandatory and must be adhered to. Soft gates, on the other hand, allow some permeability if information is not available in order that the process can progress. Such a protocol could well be an advantage in decision-making with regard to sustainable development within the construction process as it would force the manager to consider and decide on a course of action at each hard gate. At each soft gate the sustainability issue would also be raised, creating awareness of sustainable development throughout the process. This does not mean that a good decision will be made but, by pointing to key issues and possibly suggesting suitable techniques to evaluate or aid decision-making, it increases the probability of a satisfactory solution being found. Of course, as in any other situation, all such decisions are based on the information provided and the skills of the manager in using it.

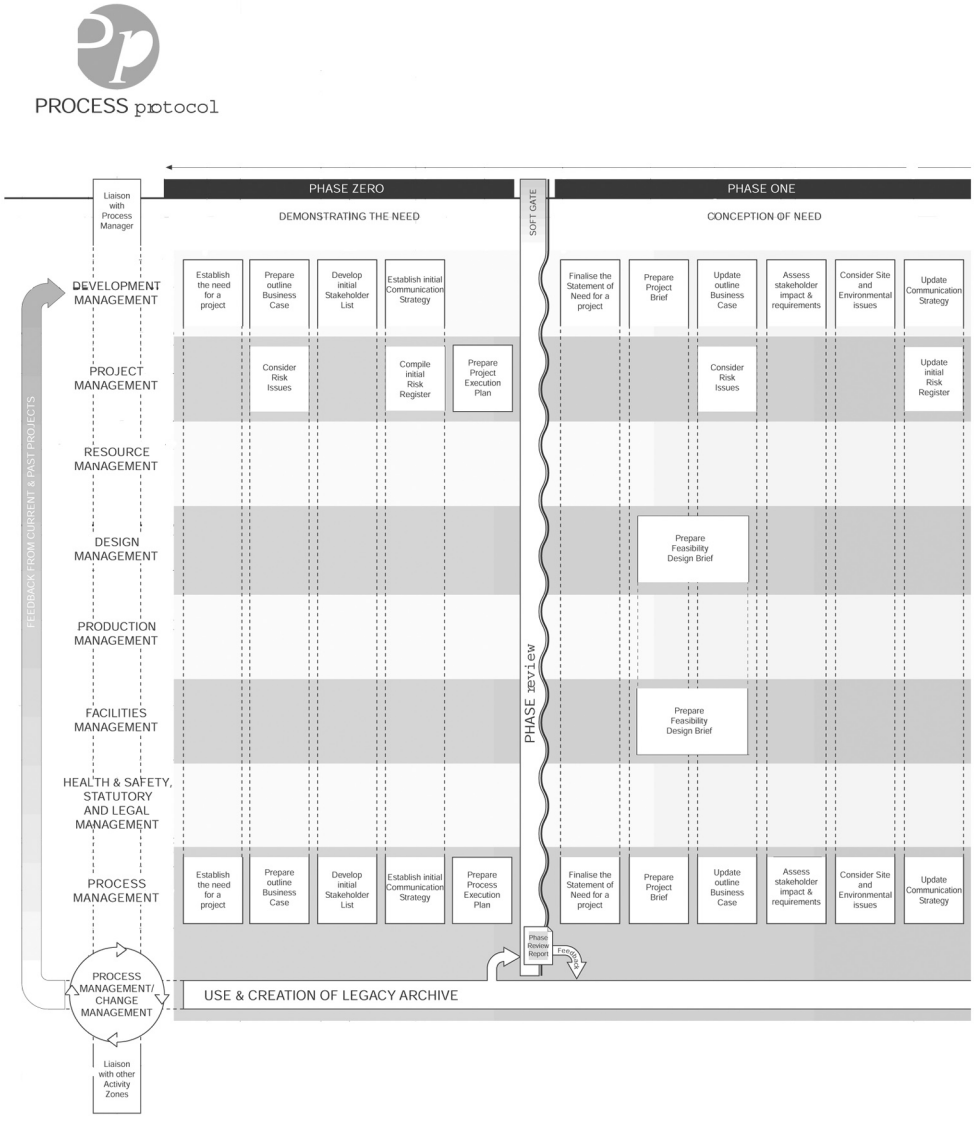
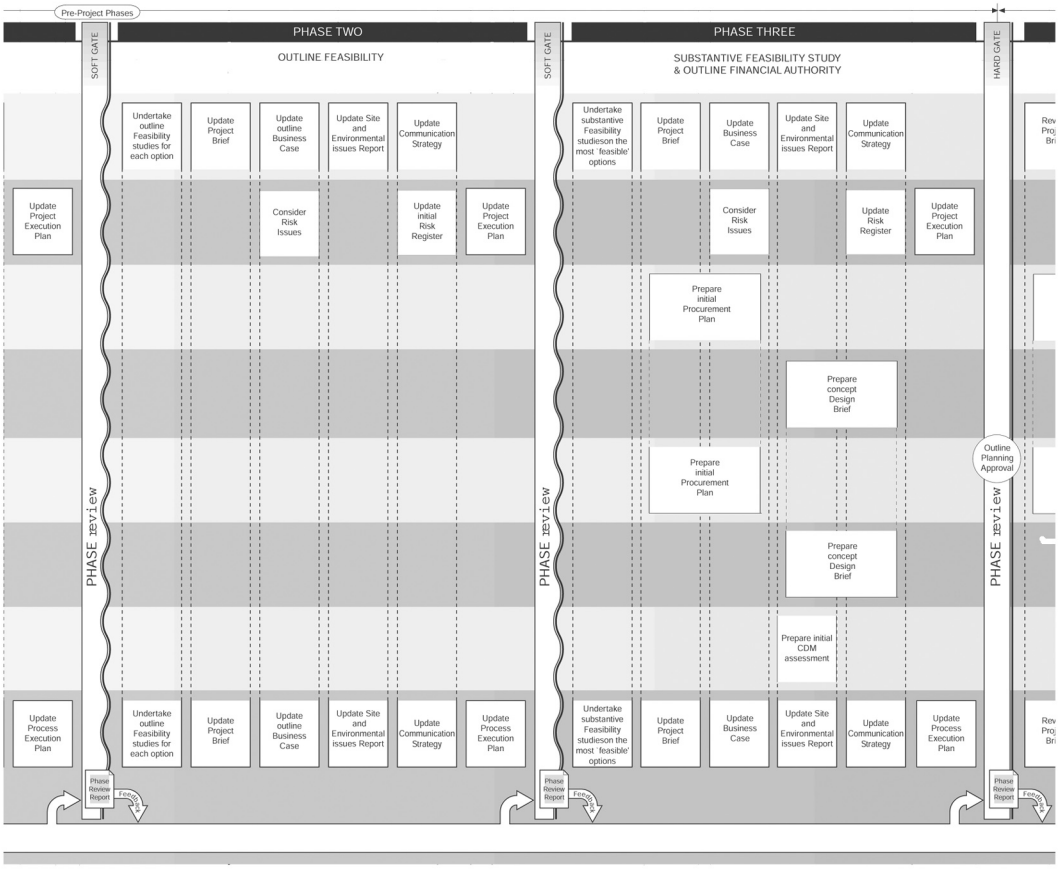


Figure 7.2 High level Process Protocol.


Pre-Project Phases
PHASE TWO
OUTLINE FEASIBILITY
SOFT GATE
PHASE TWO Review
Undertake outline Feasibility studies for each option
Update Project Brief
Update outline Business Case
Update Site and Environmental issues Report
Update Communication Strategy
Update Project Execution Plan
Consider Risk Issues
Update initial Risk Register
Update Project Execution Plan
Update Process Execution Plan
Undertake outline Feasibility studies for each option
Update Project Brief
Update outline Business Case
Update Site and Environmental issues Report
Update Communication Strategy
Update Process Execution Plan
Phase Review Report
Feedback
PHASE THREE
SUBSTANTIVE FEASIBILITY STUDY
& OUTLINE FINANCIAL AUTHORITY
SOFT GATE
PHASE THREE Review
Undertake substantive Feasibility studieson the most 'feasible' options
Update Project Brief
Update Business Case
Update Site and Environmental issues Report
Update Communication Strategy
Update Project Execution Plan
Consider Risk Issues
Update Risk Register
Prepare initial Procurement Plan
Prepare concept Design Brief
Prepare initial Procurement Plan
Prepare concept Design Brief
Prepare initial CDM assessment
Undertake substantive Feasibility studieson the most 'feasible' options
Update Project Brief
Update Business Case
Update Site and Environmental issues Report
Update Communication Strategy
Update Process Execution Plan
Phase Review Report
Feedback
HARD GATE
Outline Planning Approval
PHASE Review
Phase Review Report
Feedback

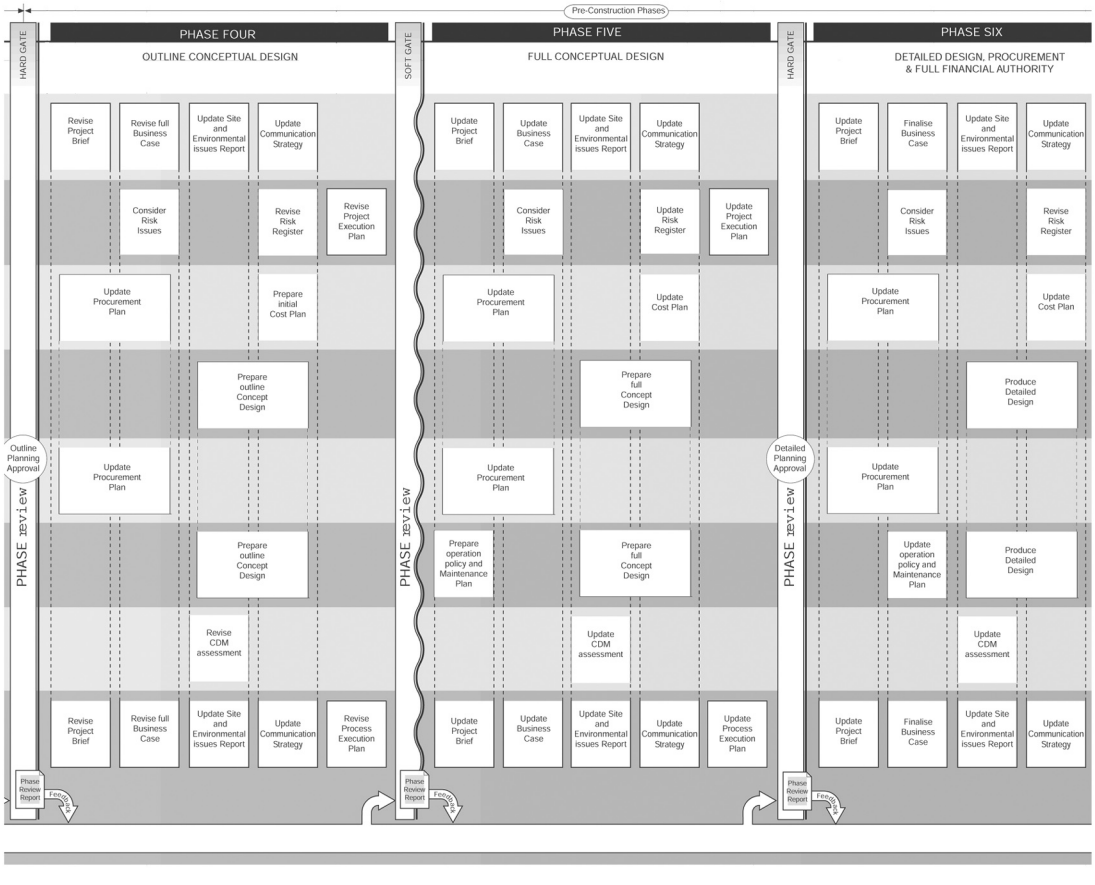
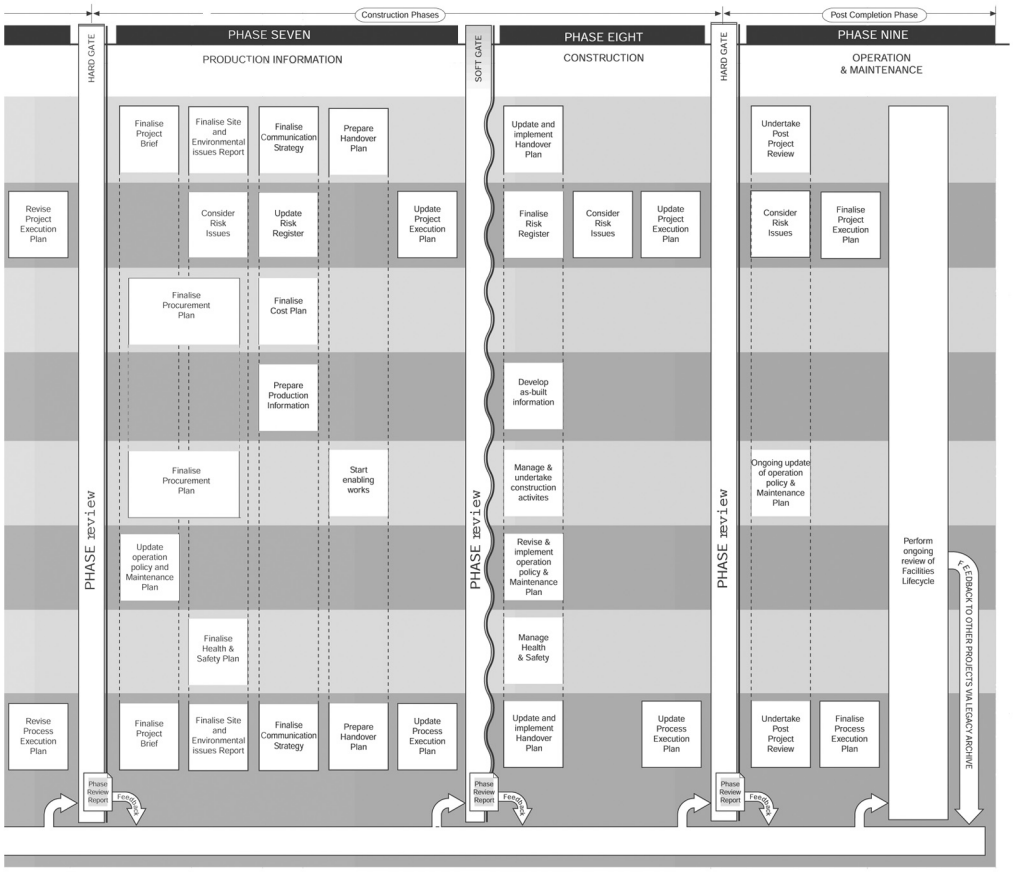
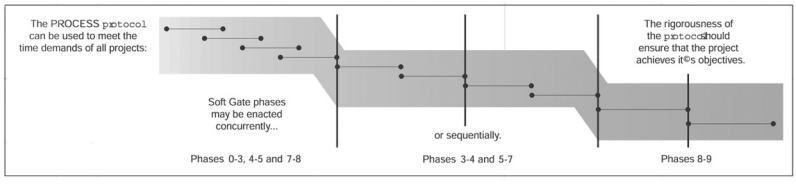


Figure 7.2 *Contd.*


Construction Phases
Post Completion Phase
PHASE SEVEN
PRODUCTION INFORMATION
PHASE EIGHT
CONSTRUCTION
PHASE NINE
OPERATION & MAINTENANCE
HARD GATE
SOFT GATE
HARD GATE
PHASE review
PHASE review
PHASE review
Finalise Project Brief
Finalise Site and Environmental issues Report
Finalise Communication Strategy
Prepare Handover Plan
Update and implement Handover Plan
Undertake Post Project Review
Revise Project Execution Plan
Consider Risk Issues
Update Risk Register
Update Project Execution Plan
Finalise Risk Register
Consider Risk Issues
Update Project Execution Plan
Consider Risk Issues
Finalise Project Execution Plan
Finalise Procurement Plan
Finalise Cost Plan
Prepare Production Information
Develop as-built information
Finalise Procurement Plan
Start enabling works
Manage & undertake construction activites
Ongoing update of operation policy & Maintenance Plan
Update operation policy and Maintenance Plan
Revise & implement operation policy & Maintenance Plan
Perform ongoing review of Facilities Lifecycle
FEEDBACK TO OTHER PROJECTS VIA LEGACY ARCHIVE
Finalise Health & Safety Plan
Manage Health & Safety
Revise Process Execution Plan
Finalise Project Brief
Finalise Site and Environmental issues Report
Finalise Communication Strategy
Prepare Handover Plan
Update Process Execution Plan
Update and implement Handover Plan
Update Process Execution Plan
Undertake Post Project Review
Finalise Process Execution Plan
Phase Review Report
Feedback
Phase Review Report
Feedback
Phase Review Report
Feedback


The PROCESS protocol can be used to meet the time demands of all projects:
Soft Gate phases may be enacted concurrently...
or sequentially.
The rigorousness of the protocol should ensure that the project achieves it©s objectives.
Phases 0-3, 4-5 and 7-8
Phases 3-4 and 5-7
Phases 8-9

It may well be possible to extend the concept into the urban planning process but then further complexity will arise due to the multiple phasing of the regeneration and renewal of a large number of properties and the infrastructure. Other techniques may be more appropriate in these circumstances.

This chapter has outlined the issues related to the management of sustainable development. In particular it has drawn attention to the complexity of the management problem. The tools identified earlier in the book are aids to those undertaking management of the built environment, but to be used effectively they must be placed within a systemic management framework that encourages good practice and a learning environment. The former can be addressed by developing 'process protocols' which identify the decisions to be made, the knowledge required and the timing of the action to be taken. The latter requires a commitment within an organisation or government department to respond to the sustainable development agenda and to change their culture to one of continuous learning. Much of this learning will come from experience and suitable 'feedback loops' will be required.

This is an area open to much wider research and development but it is an essential one if sustainable development is to have any practical benefit.

8 The Future Issues

This book has attempted to provide an introduction and overview of the key issues with regard to evaluating sustainability. It is, as was stated earlier, just a beginning. Each Chapter could be expanded into a book in its own right. The subject is evolving fast and new insights and techniques are being developed all the time. It would be unwise to assume that the subject will reach stability for some time to come. In this it is not unlike many other disciplines. In their early stages, when they are identified as a new area of study, there is an exploratory process, which is also evolutionary in nature. In this period the subject gains definition and methodologies which establish it as a bona fide area of study worthy of formal recognition in universities and in policy-making.

Some of this development has already taken place with regard to sustainable development and it is now found in many research institutions as part of the academic content. Also, in government it is found as part of the policy-making units of a large number of ministries, particularly where the government has signed one of the many sustainability protocols. However, it would also be true to say that often these policies are not carried through in practice, and only time will discover whether there is true intent. The fact that they exist must give encouragement to all who believe that this is a significant subject for future development and worthy of substantial research.

In a book such as this it is sometimes easy to give the impression that all is solved: that all we need to do is apply the knowledge and techniques and we will then have dealt with the sustainable development issues. It is not true. There is still a debate as to whether even environmental sustainability, as currently perceived, is on the right course. This is much more complex when we face the issues raised by those aspects related to sustainable communities. The world con-

gresses, such as those identified in Chapter 1, have taken this concept of sustainable development and made it high priority but the tools and policies needed to understand and exercise sustainable communities are not well established. When we address communities we are dealing with all aspects of human social and political behaviour and their impact on development. If this is coupled with environmental factors, the whole of human kind's relationship with its environment and with one another and all living species is brought into play.

It is a vast canvas on which to research and herein lies its potential downfall. There is a danger that its spectrum is too wide to be meaningful or to manage. Management must be at the root of the study of sustainable development. It is assumed that if something is going wrong we can intervene and do something about it. Our experience in the past has shown that, when humans do intervene, the full impact is often not addressed and while a problem is solved in one area another is created elsewhere. The reductionist view which deals with a highly focussed area has developed because we as human beings find it difficult to handle all the inter-relationships at once. This approach has taken us far in many areas, particularly in the physical sciences, but it can be found wanting in the social sciences, mainly because of all the interdependencies between the players and between the players and the multitude of variables.

We do not know what will happen in the future that may enable us to explore issues at a global level. It is difficult, even in economic or financial investment forecasting, to know what will happen next. The models used are based on previous experience, and who knows what new features are on the horizon? The number of interrelationships is so huge that it only needs a small change from previous experience for us to find that a domino effect has been created and a totally new paradigm with which the model cannot cope. Models are by nature simplifications of the real world and are myopic. If they were perfect, those in the know would all be millionaires as we could presumably play the stock exchange to our advantage. This does not happen.

In some ways this can be depressing and can send rather negative vibrations around the world. How do we take this very important matter forward? What is there that may help us? This book has tried to lay down some parameters within which we can work. It has outlined the key areas for investigation. It has provided a comprehensive structure which goes beyond mere lists of indicators to approach the subject. It has provided a list of the more common techniques that can be applied to measure events and enable informed decision-making (even though it recognises their shortcomings) and it has suggested ways in which management may address the issue. Each of these matters requires substantial further investigation and there are many researchers across the world who are undertaking such studies. Is this enough?

Of course these studies are of benefit and will contribute significantly to what might evolve in the future. Scenario planning will also help 'try out', albeit in a limited way, what the future might be like. Foresight studies may help prepare for or influence the future and all models of all types may warn of us of future impending problems. There are some technologies that will influence us in a way that we will not have seen before. It could be argued that a zero carbon energy policy might change many things. The types of energy source would change, creating a whole new infrastructure of manufacture and delivery. Fuel cell technology, thought to offer enormous potential, is still in its comparative infancy and we do not know whether it will be applicable beyond the local environment. Using existing technologies, the Three Gorges Dam in China is a new infrastructure designed to supply a large proportion of China's future energy need as the country continues with its economic growth. However, up to two million people have been 'displaced' in order for the dam to be built, creating a reservoir 450 miles long. For those dependent on the technologies, they will have a major impact on the way they behave and their built environment. They may make them more or less vulnerable in the future, which in turn may instigate social behaviour related to self-protection. Will another country use the vulnerability of the dam, for example, to attack or place pressure on the country and its policies? The 'community' may well change its behaviour to make it less sustainable in the long term from the perspective of most sustainability models.

Perhaps the biggest unknown is the influence of information technology on the way we behave. We have never faced such an information explosion before. We do not know how we will react in the long term and we do not know what the increased connectivity between humans, and between humans and machines, will do to what humans expect from the built environment. At the moment there is some evidence that those engaged in providing information technologies and their content are binding themselves together in conclaves around the world such as Seattle or Dubai. This is counter-intuitive as most predictions have suggested that geography is no longer a barrier for work, but here we see the big players apparently reaping major benefits from being geographically close to each other while encouraging the rest of us to work apart! This may be a temporary situation, but who knows?

So what are the trends in information technology that may have an impact on sustainable development? Broadly they are as follows:

- *Convergence:* The concept of convergence is at two levels. At one level the technologies themselves are converging together through digital processes so that they can interact in a way that has not happened before. Television, audio, telephone, camera, music can now be transmitted and received by a single source machine. It

allows all media to be incorporated together. The second is convergence of content. The Internet even as currently operated has few boundaries and knowledge is passed seamlessly around the world. Those who own the distribution of such knowledge may find themselves in a strong strategic position. It is a way of influencing values, sometimes intentionally and sometimes not. All knowledge has a filter which is provided by the authors or disseminators and this can be for good or ill. It provides bias which in the normal course of events is subject to debate and criticism. This provides checks and balances. But what happens when a piece of knowledge is used repeatedly for convenience and expediency? It can establish a 'conventional wisdom' in which thinking can be fossilised and an oppressive tool can emerge. The benefits then depend on the benign or malign nature of the knowledge. The new technologies are designed to be repeated to aid the less informed. Who will provide the checks to take on the large-scale providers? For those opposed to a particular filter on knowledge it represents a threat which can lead to an undermining of their perceived value system and in extreme cases to acts of terror as the only way out.

- *Connectivity:* Alongside convergence we need connections to be made so that we can realise the potential of sharing these different media. The last decade has seen a massive increase in the penetration of computers per head of population in the developed world coupled with access to a wide variety of devices to transmit and receive the information. Mobile phones are now pivotal points for the exchange of music, knowledge, visuals, games and many other things, in addition to the use for which they were originally developed. We are now moving towards 'knowledge grids' where computers act together and become more powerful and their knowledge more accessible. This opens avenues for sharing information in ways we have never seen before. These machines can also act as the repositories for data collected by sensors and it may be that the kind of knowledge capture required for complex domains such as sustainable development becomes available without the enormous expense of manual labour.
- *Culture:* As technology becomes more user-friendly and education on how to use it becomes more widespread, the patterns of behaviour among human beings will adapt to the new environment. The computer games industry has changed the nature of leisure time, the the Internet has changed the way students access knowledge as well as having led to the development of on-line shopping. These are all indicators of behaviour change and it is difficult to know where these developments will end. Will there be a reaction to them reversing current extrapolations or will they continue to a point where an outside observer might see the human race as an interconnected whole, entirely inter-dependent and able

to be manipulated at will? Extreme scenarios these may be, but it could happen. What is clear is that at the moment the way we live our lives has changed dramatically in one generation.

- *Creativity:* For many years computers have been seen as machines that constrain creativity. The rules which have to be obeyed to operate them have been seen as limiting what can be done. This is changing, and increasingly, as the technology mimics the real world and the degrees of freedom we experience in the real world become available in the virtual environment. In fact they may well go further because the things at which human beings are not good may well be the things at which machines excel, and the combination could lead to real breakthroughs in creativity. The boundaries may well disappear and already technologists are talking about enhancing human performance by 'jacking in' the machine to the brain. At present it is to enhance the brain where there is impairment, but in the future it could be used for overcoming natural human constraints and providing life enhancement.
- *Content:* It is the content of these knowledge networks that is critical to their take-up and the way they are used, and what actions follow from this increase in knowledge. The knowledge has the power to bind people together by dispelling ignorance and allowing free communication. On the other hand, it has the power to divide and reinforce prejudice. It remains to be seen what this will do to make communities more sustainable. Will they come together or will they fight? Already tensions can be seen between communities where there is strong religious belief that divides them. Does one group's value system, as conveyed by the technology, lead to the undermining of the other? Is it a tool for harmonisation or dissent? It is likely to be both, but which will prevail at a particular point in time we just do not know.
- *Collaborative working:* Despite the clustering of those engaged in IT in certain parts of the world, there is also a development in collaborative working across normal geographic boundaries. Aeroplanes are designed and constructed with design and subassembly plants thousands of miles apart. Supply chains for industry are linked through the Internet, and can act on-line and monitor easily the performance of their teams. Many firms encourage their personnel to work at home for part of the week to avoid paying for large buildings and to assist performance. What does this do for the concept of a sustainable community? Does it enrich or destroy?

The above list gives an indication of some of the issues related to perhaps the biggest technological driver the world has ever seen. Its effect is being debated throughout the world and arguments will continue for many years to come. It is possible to paint a very positive

scenario in which information technology may well be a player in providing a solution to many of the sustainable development problems. We may be able to avoid people travelling as much, we may be able to break down ignorance and improve understanding, we may be able to engage the Third World and assist in the education it needs but can ill afford. On the other hand, the technology can be seen as an oppressive tool by which the poor are excluded, human beings are manipulated, privacy is jeopardised and values drop to the lowest common denominator.

The future is in our hands, or at least in the hands of those who control the technology. It is here that governments have a part to play. If we wish to have a benign technology that will help sustainable development, what aspects should we be encouraging? This is an issue which all governments need to address in terms of policy, but at what level can it be implemented? This raises the whole question of long-term strategies for sustainable development. Who *does* own the problem and who can implement them?

This is an interesting question. Figure 8.1 shows where we might see decisions being made with some examples. It is applicable to a wide variety of decisions and not just information technology. It demonstrates where we can expect responsibility to lie. However, in terms of policy it is the top four layers that have most impact and the bottom three where this policy is implemented. In fact the 'city' is at the pivotal point between policy and implementation as it both makes and implements policy.

This is made clear in Fig. 8.2 where it can be seen that the city plays a very significant role at the interface between policy and enabling

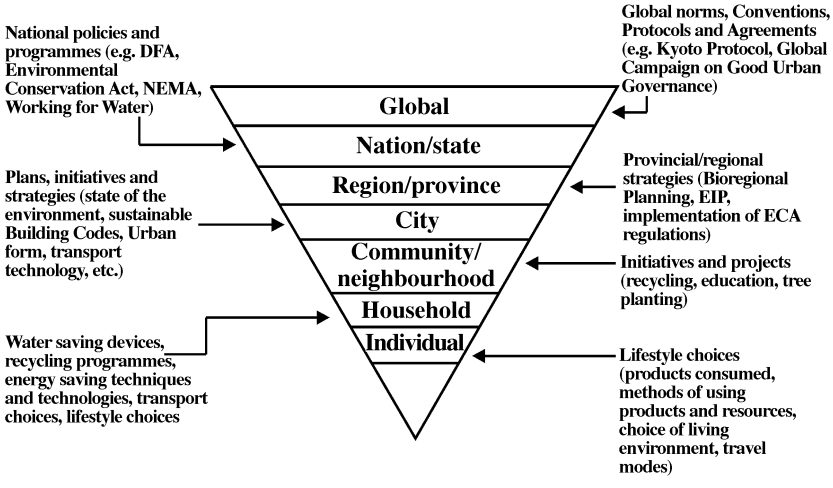


Figure 8.1 The sustainability complex. (*Source*: Mathew Cullinan: MCA Planners, South Africa, 2003.)

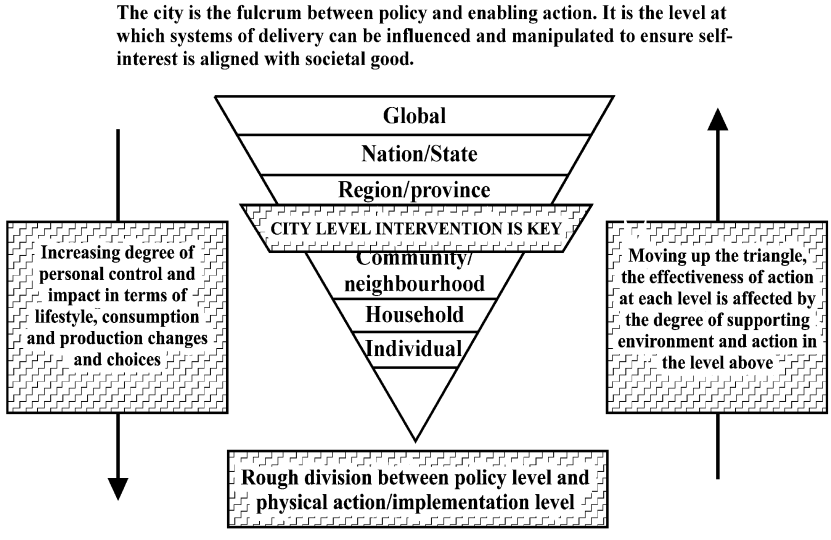


Figure 8.2 What is the significance of the city? (*Source*: Mathew Cullinan: MCA Planners, South Africa, 2003.)

action. While we need to act in each layer of the triangle, a useful focus for sustainable development in the first instant could well be the city and its environs. This would combine policy with action and is likely to have the greatest impact.

If cities do provide this useful interface, it is worth considering 'how' cities might address a long-term policy and action agenda. There are very few examples of where this is happening at the present time. Most cities have to consider relatively short-term perspectives on the future because of a number of factors which impact upon their decision-makers. A major factor for the politicians might be the length of time until the next election.

The Vancouver study

There have, however, been some examples of a long-term view which provide an insight into the approach that could be taken. One of the most interesting is the International Gas Union competition to determine a sustainable city in 100 years' time. It was set appropriately in the millennium year of 2000 and nine cities were invited to compete. The winner was Vancouver in Canada and it is worth looking at the approach that was taken and which impressed the judges. It is not usual for a city to look as far ahead as 100 years and it requires an approach that can engage as many stakeholders as possible.

What the Vancouver study showed was that once the timescale

moved beyond 20 years or so, the baggage of the present is left behind. People become much more open about what they think is really needed for a sustainable future, and begin to build a consensus. This allows strategies to develop which can be translated into policy and into programmes of long-term action. One hundred years, or approximately three generations, is probably a sensible time to expect cities to plan ahead provided it is recognised that any plan will need to be kept under review and updated at regular intervals. None of us can forecast too far into the future but we can put in place systems that will act as reference points which can be modified as our knowledge increases and as we see events unfolding.

'Cities PLUS' (PLUS standing for Planning for Long-term Urban Sustainability) was the term used by the Vancouver study and was undertaken over a period of eighteen months with around 500 people, representing major stakeholders, involved. These people spent that period in 'thinking, dreaming, talking, drawing, assessing and most importantly, committing themselves to a process and plan'. This is an extraordinary achievement in the time and one of which many other cities would be envious. The full plan can be obtained from Sheltair Group Inc, 2-3661 West 4th Avenue, Vancouver BC, V6R 1P2 (web site: www.sheltair.com or email: info@sheltair.com) and the authors are indebted to the members of Sheltair for their assistance in providing this resumé. The brief description that follows cannot do justice to the considerable amount of work and thought put into the full report. The report does provide an outline plan for the Greater Vancouver Region but, more importantly for the rest of the world, it provides a suggested process which could be adopted by many even if the plan itself is focussed on Vancouver. It did this by focussing on three main stages.

Stage one: defining the context

The first stage of the process was to identify the context for the 'vision' of what forces might be acting upon the city over the specified period. These included the following:

- *Technological transformations* including movement of information, improvement in machine energy efficiency, economies of scope rather than economies of scale, progressive lightening of structures/components, progressive miniaturisation, discontinuity in manufacturing technique and transition from carbon to hydrogen content fuels.
- *Climate change* which for Vancouver included an expected temperature increase of 3° to 4°C, average precipitation increase of 5% to 20% in winter and average precipitation decrease of up to 20% in summer.

- *Demographic change* which demographers are suggesting could peak at nine billion globally and then decrease to six billion in 2100. For Vancouver lower fertility rates and increased longevity will result in a proportionately smaller working population, causing labour shortages and higher dependency rates within the first two decades of the twenty-first century and suggesting the encouragement of further immigration.
- *Resource scarcity* with the accompanying disturbance of the global marketplace may lead to Vancouver facing food shortages, increased demand on water supply, land shortages around the city and timber loss through deforestation and disease, and to non-renewable energy sources being affected.
- *Globalisation* will dissolve national and cultural boundaries and may result in a new economy based on emerging technologies with a 'world city' at its centre and hinterland cities at the perimeter.
- *Worldview shifts* away from the view that nature was to be exploited to one where our physical and spiritual connections to the biosphere are rediscovered and we respect the ecological limits of our planet.

The report goes on to look at the specific forces related to the context for Vancouver which included its place, people, economy and infrastructure.

The report then describes three challenges that arise from these studies:

- First, the need for a move from urban planning viewing cities as a series of discrete components, to finding common solutions which would cut across urban planning disciplines and jurisdictions. In other words, a holistic rather than a reductionist model.
- Secondly, the challenge of how to deal with the uncertainty inherent in planning 100 years ahead.
- Thirdly, the challenge of how to think globally while acting locally. The team rejected any view that there was a correct development pathway generic to all situations and decided that they must find local solutions to local problems.

Stage two: developing the long-term plan

Having set out the context, the team then moved to developing the long-term plan. This adopted the following three phases:

- *Phase one: envisioning our future*: This involved defining Vancouver region as 'one system' where the people, the place, the infrastructure and governance are in constant interaction; identifying core themes underlying the vision ('sustainability, resilience and

liveability' were chosen); determining the constraints to be faced; building on assets and past successes as the 'seeds of sustainability'; and determining one broad vision and then specific visions and end-state goals for each of the individual components of the urban system.

- *Phase two: exploring the options*: Forecasting techniques were used to determine the impact of the forces shaping the next century and then measurable 100-year targets were set for each component of the urban system together with an assessment of their current status to determine the critical path towards achievement. The magnitude of change required to achieve the critical path was evaluated and where it was possible to achieve the target earlier (the preferred path) the 'solution space' was established. Then best practices were found and used to suggest the best path, and backcasting methods were used to develop staged scenarios for getting into the solution space.
- *Phase three: implementing the plan*: A long-term plan of 100 years involves great uncertainty so the team focussed on finding integrated strategies that would guide implementation plans (rather than the traditional reductionist approach). They identified eight catalyst strategies to stimulate movement in the right direction and used an integrated design workshop to visualise the transformation. Finally, they identified a series of implementation measures that could be taken in the short run using a suite of policy tools to set the wheels of change in motion and then they defined key roles for a broad range of actors.

The above description is inadequate for the amount of thinking and preparation that went into the effort. To determine such a plan for a city region is a daunting task and it is also extremely ambitious. It is to the credit of the team that they managed to provide such a high-level proposal in the time available.

Stage three: the legacy of the endowment

The legacies of cities include the long-term plan for the city/region along with a transferable process and networks of people. Without this legacy the exercise would be almost worthless. There must be 'follow through' and this requires current and future generations to 'buy in' to the process and own its operation. This means that there must be a network of people able and willing to work together to achieve the aims of the plan who are also willing to educate and inform future members of the network about the whole process, not only of planning but of implementation. There needs to be an agenda to which all stakeholders can subscribe in such a way that it affects their present day decision-making and their future priorities.

In the case of Greater Vancouver, the long-term plan has sparked a process of integrated comprehensive planning. All urban components have been examined or re-examined and then transformed in accordance with a shared set of visions, goals, targets, scenarios and strategies. It has engaged a broad cross-section of actors in a collaborative process based on significant communication and trust-building. It is an interesting experiment and it will be interesting to see whether it can stand the test of time. In particular, it will be interesting to see whether shared values can be maintained when some of the global changes mentioned earlier place pressure on the system.

The networks play a key role in this exercise and the Vancouver team has established networks at different scales. There was the regional network in the first instance and then this was extended to a national network engaging other cities and organisations. An international network has now been established bringing together over 30 like-minded cities willing to share experiences, tools and talents. The aim will be to share these experiences with the world at the 2006 World Urban Forum.

The conclusions of the Vancouver study

The process of undertaking the study seems to have given unexpected 'added value' to the issue of sustainable development as viewed from the city level. It has allowed the Vancouver team to forge new partnerships, to clarify and galvanise a commitment to sustainability and to establish new and extensive networks for the future. The team's conclusions are appropriate for a book of this nature and they include the following:

- ❏ Forecasting scenarios emphasised that major change was needed if the region was to remain liveable and secure. Backcasting scenarios showed that it was possible to 'close the loop' over the century ahead and reduce the ecological footprint to become a region that lives comfortably within the carrying capacity of its resource base.
- ❏ Sustainable development is both a goal and a process and they achieved useful results whenever they combined a clear understanding of the goal with participatory processes involving government, private and civil sectors.
- ❏ The 100-year time horizon enabled all parties to look beyond immediate pre-occupations and vested interests, discover powerful unifying ideas and consider responsibilities to future generations.
- ❏ Integration is the key to sustainable development. It requires determination to focus simultaneously on all dimensions, i.e. social, economic, environmental; short-, medium- and long-term; from the local to the global levels.

- The future of a particular city is intimately connected with the wellbeing of other cities. The flows of materials, resources, finance and information have impacts well beyond the city under examination. Responsible planning involves dialogue and alignment with the interests of other urban and rural areas.
- Planning a large urban region is much more complex than planning for a neighbourhood or city. The challenge is to find common ground and move beyond abstract generalisations.
- The adaptive management framework and integrated design process provides a transferable model for long-term planning.
- It is important to create opportunities for big thoughts that can produce big plans. Taking the long view and imagining one urban system has changed the way the participants see their city/region and the way they see themselves.
- Competition with others brought out the best. As Ron Clark, President and CEO of SaskEnergy, said of the Vancouver study:

> 'The Process generates informed choices. It is not about seeing the future, and it's certainly not about guaranteeing an outcome, but it is about defining a rich and intellectually robust and defensible process. Win, lose or draw, we've already gained immensely.'

There is much in this case study from which we can learn and in investigating such approaches it may be possible to develop generic and yet flexible methodologies which will allow comparisons and evaluations to be made across national and international boundaries. In turn this will allow the body of knowledge regarding sustainable development to build into a robust source of information which will benefit countries and communities around the world.

A research agenda

This book has provided an overview of the current state of knowledge with regard to the evaluation of sustainable development. It cannot be exhaustive as the potential spectrum of activity that falls under the heading of sustainable development is enormous. Evaluation methods in practically every aspect of social, economic, political and technological behaviour can be brought to bear on the subject. It is practically impossible for a single individual to have the knowledge and skills required to undertake such exercises in a complete way. It has to be a corporate effort and projects such as the Vancouver study provide pointers to the way this can be handled. We are in the middle of an action learning process whereby we all bring our knowledge gained formally and informally to the issue and we endeavour to find an

improvement in the way we can evaluate and manage sustainable development.

In this book we have tried to provide an outline of the scale of the task that has to be faced but at the same time we have tried to suggest ways in which this can be addressed. At the root is a structure which is robust and which can be used for all such studies. The Dooyeveerd structure (see Chapter 4) is the closest we have found to answering some of the questions we have posed about integrating information and providing meaning to the subject. Sustainable development can 'mean all things to all people' but by providing structure it gives the opportunity to rigorously address the subject and establish 'building blocks' of knowledge. However it does not answer questions about process and this is where the Vancouver study may provide assistance. The process adopted by the Vancouver team echoes some of the issues raised by Dooyeweerd in terms of a holistic approach and goes on to establish how this might be implemented.

It would be true to say that there are no right or wrong answers to methods and processes of evaluation. More standardised approaches would have advantages in terms of knowledge-building and making comparisons. However, meeting the needs of today without jeopardising the opportunities for future generations to meet their own needs means that a flexible and adaptive system is required. Whether this can be done within a framework to which all can bring their understanding and sets of values is not yet proven. The following is a suggested research agenda (one of many, we are sure) which could help in understanding this complex issue:

- Develop, test and assess a framework for addressing sustainable development in which various value systems can be represented in such a way that it does not produce a prescribed solution. Dooyeweerd's 'Theory of the Cosmos' as adapted by Lombardi and Brandon (see Chapter 4) might be a good starting point for such a study.
- Test the above framework across international boundaries and develop an adaptive, generic process which can form the basis of international comparison and policy-making, always realising that new technologies and events will occur which may change the processes and evaluations involved.
- Place evaluation methods within the framework and investigate how these might act together to aid the achievement of consensus on action. The evaluation methods should not dominate the result but merely be aids to educating stakeholders as to the implications of their actions. Where there is a shortfall in evaluation methods, new approaches should be sought.
- Provide a manual that gives guidance to all concerned with the subject at various levels (e.g. building, district, city, region) and

provides a coherent and robust approach to a holistic approach to the evaluation of sustainable development.

In conclusion

Readers will no doubt be aware of the complexity of the subject now if they were not before. The authors have attempted to give an overview that provides pointers to the future based on their experience and the literature in the field. It is not possible to cover in every detail the requirements of a full system for sustainable development, and indeed no such system exists. Those engaged in sustainable development are acting rather like the learning organisation suggested by Peter Senge (Senge, 1990) in *The Fifth Discipline*. He starts his book by saying:

> 'From an early age , we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price. We can no longer see the consequences of our actions; we lose our intrinsic sense of connection to a larger whole. When we try to see the ''big picture'' we try to reassemble the fragments in our minds, to list and organise the pieces. But, as physicist David Bohm says, the task is futile – similar to trying to re-assemble the fragments of a broken mirror to see a true reflection. Thus, after a while we give up trying to see the whole altogether.'

He then goes on to say that:

> 'When we give up this illusion – we can build ''learning organisations'', organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together.'

Sustainable development demands this corporate enlightenment and commitment. It also requires an acknowledgement that there is not one solution but many and that our understanding will emerge in an evolutionary way in a continual process of improvement over time.

At the start we said that this book was just a beginning, and so it is. There is still much to do and much to learn. We hope that the content provides further insight to the reader and encourages him or her to engage in the 'learning together' process for the benefit of all those who engage with the built environment … and that is practically all of us!

Appendix A: The Philosophy of the 'Cosmonomic Idea of Reality'

Note: The following text provides an outline summary of the very extensive philosophical underpinning of the 'Cosmonomic Idea of Reality'. It cannot be comprehensive but for those who wish to know more it may provide additional insight which will lead to further study of the subject. However, the reader should be warned that this is not an easy exercise to be undertaken.

The proposed framework is based on the 'Cosmonomic Idea of Reality' theory of Herman Dooyeweerd (1955), which underlies the systemic approach named multi-modal system thinking (de Raadt, 1991, 1994, 1997). The multi-modal system thinking approach aims to make complex systems intelligible by escaping from the traditional Cartesian approach by means of comprehensive philosophical studies of multi-level perspectives.

Compared with previous system schools, such as the open system theory proposed by L. von Bertalanffy (1971) and later developed by Le Moigne (1994), the multi-modal system thinking approach maps systems according to two axes, a multi-modal one (vertical) and a systemic one (horizontal). Specifically, this approach is based on the Cosmonomic Idea philosophy of Dooyeweerd and cybernetics as developed by Ashby (1956, 1976) and Beer (1967, 1981). Adapting and modifying these two foundations, multi-modal system thinking has shifted the focus of systems design and usage onto a number of levels of functioning (named *modalities*) in which systems operate, instead of being on the systems themselves.

The main similarities and differences between the two systemic schools of le Moigne and de Raadt are shown in Table A1.

Table A.1 Comparison between systemic schools of thinking.

Common ground	Systemic approach (Le Moigne)	Multi-modal system (De Raadt)
Both promote a reconception of science in a personal relation denying the objective, independent notion. Both consider the loop of information and organisation as fundamental in making social sciences intelligible as distinct from the traditional energetic notion of natural sciences. Both oppose the popular notion that social science is less exact or more fuzzy. Both try to find alternatives to the cybernetic paradigm, which is considered to be insufficient. Both admit that ultimately faith is the last criterion of choice, or the last station on a multi-modal stair.	Emphasis on the inadequacy of the analytical paradigm in understanding complexity. Constructivism makes how we construct knowledge intelligent. This is received neither through senses nor by way of communication but is actively built up by a cognisant subject. The function of cognition is adaptive and serves the subjects' organisation of the experimental world, not the discovery of an objective ontological reality. This does not tell us what kind of knowledge is constructed. It may fall into relativism.	Emphasis on the inadequacy of isolation of normative and determinative orders. The assumption is that there is an absolute truth and ordered reality independent of human beings. It escapes relativism by focusing on a priori knowledge, which is justified by faith. Our knowledge is limited. However, it uses the cybernetic paradigm as an attempt to make social systems intelligible.

(*Source:* based on Eriksson, 1996)

As said above, the groundwork of the multi-modal system thinking is the scientific methodology of Dutch philosopher Herman Dooyeweerd (1894–1975), known as the 'Cosmonomic Idea of Reality'. It is based on the fundamental notion that nothing, not even theoretical thought, is absolute: all is relative to the Creator God who, by the act of creation, gave everything meaning.

In the words of Basden (www.basden. demon.co.uk/Dooy/summary.html):

> '...the main motivation behind Dooyeweerd's work was to form a philosophical framework that did not make God-avoiding assumptions right from the start, and one that was self-consistent. He wanted it to account for the unity and diversity that we experience. Dooyeweerd was troubled by the fact that Biblical ideas do not seem to fit ''comfortably'' with most theoretical thinking, yet he was not satisfied with the explanation given by both secularists and fundamentalists that religion has nothing to do with this world of science, technology, business and, in particular, thinking.'

For a general description of Dooyeweerd's work see Clouser (1991) and Kalsbeek (1975), and for full theoretical treatment see Dooyeweerd (1955) and Hart (1984). The present illustration makes copious refer-

ences to the expositions of de Raadt (1991, 1994, 1997) and Basden (1994, 1996).

The theory of the 'Cosmonomic Idea' acknowledges an external reality that is independent of the acting and knowing subject (hence the term '*Cosmonomic*'). We are affected by it but also affect it and have views and desires concerning it. In particular, the theory claims there are two 'sides' to reality as we know it: a *law side* and an *entity side*.

The entity side concerns things, systems and, in fact, anything that does something: e.g. a person, a flower, a house, a town, a government, a symphony. The law side concerns *modalities* in which entities operate: e.g. physical, social, biotic, ethical, technical.

A modality can be defined as an irreducible area of the functioning of a system. It is characterised by a nucleus of meaning which provides it with an internal order named *sphere sovereignty* and has its own order, or set of laws, by which it is governed (hence the alternative name *law sphere* given by Dooyeweerd), e.g. the laws of arithmetic, the laws of physics, the laws of aesthetics, the laws of ethics. These not only guide but also enable entities (people, animals, etc.) to function in a variety of ways.

The law and entity sides can be seen as orthogonal: an entity crosses several modalities. For instance, an entity such as a tree is characterised by a number of modalities, including the spatial (it occupies a limited space) and the physical (it is made of materials), up to the biological (it is alive!) but, compared with a person, it has a more limited range in which it actively functions. It is unable to learn or to speak, and it does not have social interactions or financial businesses. On the contrary, it can be used (as an object) for learning, can be given as a present to a friend, or can be sold or bought (see Figure A1).

In everyday living the entities stand to the fore, as it were, and the law side recedes into the background, but in science the law side comes to the fore while the entities recede. So when we analyse reality we should study the law side, not the behaviour of entities. It is the law side (i.e. the modalities) that expresses the fundamental *meaning*, and it is the law side that enables entities to 'exist'.

Modal laws – or orders – are fulfilled in two different ways. In the earlier (or lower or 'hard') modalities, such as numerical and spatial, and their equivalents in the scientific disciplines, mathematics and geometry, the orders, or set of laws, that govern these modalities are more determinative, i.e. 'the law always exerts its own fulfilment'. For example, within the physical modality the law of gravity is always obeyed; it is a law of spatial aspect that nothing can be both round and square. However, in the later (or higher or 'soft') modalities, such as the ethical and the juridical, the laws are more normative since their fulfilment is contingent on people's inclination to follow these laws and they cannot be described through the harder modalities' determinative rules.

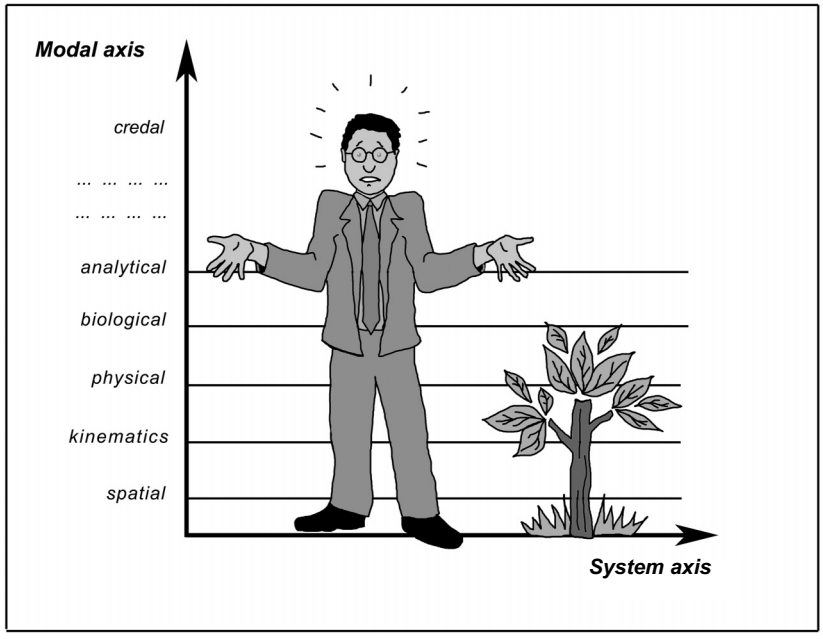


Figure A.1 Two-dimensional representation (modality/system axes) of entities (a man and a tree) crossing different modalities.

The laws are unique and irreducible, differing from modality to modality, so that it is not possible to entirely understand the behaviour of one modality on the basis of the laws of another modality (sphere sovereignty). However, there are definite relationships between them which allow an entity to function in a coherent rather than fragmented manner. These relationships between modalities are of three kinds.

(1) *Dependency*: The laws of later aspects depend on and require those of earlier ones. Thus biotic laws require those of physics, which require those of movement, and so on. The philosophy of the 'Cosmonomic Idea' has not placed the fifteen modalities in an arbitrary order and the earlier aspects serve as foundations for the later (Dooyeweerd calls this 'the cosmic order of time').
(2) *Functioning*: An individual structure (entities and systems) functions in each aspect either as subject or object. While human beings can act as subject in all aspects, animals have a more limited range in which they can function as subject. A sheep might act as an economic object, for instance, but not an economic subject, i.e. it can be used as exchange but it cannot itself do an exchange. This functioning individuality structure serves as an integration point for the aspects.
(3) *Analogy*: Components of each aspect are mirrored or echoed in

> others. Such an analogy is the basis for the symbolic representation of knowledge on a computer. The correspondence between the orders of different modalities allows one modality (named the *source*) to be used as a metaphoric representation of another or several other modalities (named *idioms*). For example, social scientists often express aspects of social behaviour (operating in the social modality) in terms of quantitative measures (operating in the numeric modality). They can then use the laws of mathematics to manipulate aspects of behaviour in the social modality and derive conclusions that have been difficult to arrive at without the aid of these laws. In the words of de Raadt (1991), it is important to note that '. . . these conclusions rest upon the laws of the numeric modality and not on the basis of the social modality. Therefore, while they may be mathematically valid, they need not be necessarily valid in the social sphere'.

Although every modality can be an 'idiom' for another, its effectiveness as an idiom varies and the degree of correspondence declines as the distance between one modality and another increases. For example, the numeric modality is not a very suitable idiom for the juridical modality and it would be better to use a closer modality such as the ethical modality. In the words of de Raadt (1991), the softness of the normative order is not due to any indefiniteness, but due to the lower homomorphism that exists between the soft modalities and the logical and numerical modalities (these latter being the idioms employed by much of the hardest science) when compared with the homomorphism that exists between the hard modalities themselves.

Dooyeweerd illustrates a 'working' list of fifteen modalities whose properties are exhibited by the objects of people's experience. These fifteen aspects and their meaning-nuclei (in brackets) are as follows: numerical (quantity); spatial (continuous extension); kinematics (movement); physical (energy, mass); biological (life function); sensitive (senses, feeling); analytic (discerning of entities, logic); historical (formative power); communicative (informatory, symbolic representation); social (social intercourse, social exchange); economic (frugality, handling limited resources); aesthetic (harmony, beauty); juridical (retribution, fairness, rights); ethical (love, moral); and credal (faith, commitment, trustworthiness). They were derived by taking every large-scale kind of property that has been distinguished in the history of philosophy and science.

In identifying the modalities and their order, however, not all authors are in accord. Hart (1984) identifies only fourteen modalities, as she does not include aesthetic. In addition, she places the analytic modality between the historical and the communicative modalities. De Raadt (1997) adds two new aspects: epistemic (whose essence is wisdom) and operational (whose essence is production). These are placed,

respectively, next to the communicative modality and the social modality. Kalsbeek (1975) discusses the meaningfulness of including kinematics within physical as part of it.

The framework developed in this study keeps the original number and order of the modalities given by Dooyeweerd as a consistent list for interpreting sustainable development processes of the built environment. The aim was not to rethink reality, but rather to provide a useful tool for aiding decision-making in planning.

Appendix B: Commission of the European Communities

COMMUNICATION FROM THE COMMISSION

Structural indicators

Brussels, 16.10.2002
COM(2002) 551 final

Executive summary

This Communication presents the Commission's proposal for the list of indicators to be used in the Spring Report 2003.

This Communication presents the Commission's proposal for the list of indicators whose main purpose is to support the key messages of the Spring Report 2003. The Communication also describes the progress the Commission services have made over the last year in developing new indicators, improving the quality of last year's list of structural indicators and integrating the candidate countries into the structural indicators process.

The new list comprises a high degree of stability and allows for some flexibility.

This is the third year in which the Commission has chosen a set of structural indicators. There have been limited changes to the list to ensure a high degree of *stability*. This is important for assessing progress in the achievement of objectives from one year to the next, and

it allows the reliability and the quality of the indicators to continue to be improved. However there has also been some *flexibility* in the list to incorporate indicators reflecting new political priorities or when better indicators have become available.

The list remains short and balanced between the domains.

The list of indicators has also been kept *short* with no increase in the number from the 42 indicators used in last year's Spring Report. A shorter list allows one to better focus the policy messages drawn from the indicators. The *balance* between the domains has been retained with seven indicators for each of the domains.

The main change is the inclusion of the candidate countries.

In response to the request from the Gothenburg European Council all 13 candidate countries will be integrated into the structural indicators this year so that they can be assessed in the Commission's Spring Report. The Communication presents the expected availability of data for the candidate countries at the time of the next Spring Report.

Much progress has been made on developing and improving indicators.

The Commission services have made good progress on developing new indicators and improving the quality and presentation of the existing indicators. Progress has been made in developing indicators in several areas: composite indicators, potential output, marginal (and average) effective tax rate, childcare facilities, e-commerce, e-government, business demography, company registration, financial integration, recycling rate of selected materials and hazardous waste. From this work two new indicators have been added to the list. The Commission services will continue to develop indicators across a wide range of areas over the next year. Two composite indicators on the knowledge-based economy have been developed and will be used in relevant policy discussions and Communications. The Commission continues to reflect on the use of composite indicators within the framework of the structural indicators.

Structural indicators

I Background

(1) The Lisbon European Council conclusions (paragraph 36) asked for an agreed set of structural indicators to be used to underpin

the analysis in the Commission's annual Spring Report to the Spring European Council. The role of the structural indicators is to allow for an objective assessment of the progress made towards the Lisbon European Council objectives, expanded at Gothenburg and refined at Stockholm and Barcelona.

(2) In each of the last two years the Commission prepared a list of structural indicators and agreed it with the Council. These indicators cover six areas: general economic background, employment, innovation and research, economic reform, social cohesion and the environment. The indicators proved useful in the Spring Report for illustrating areas where more policy action was needed and for measuring the progress made towards the Lisbon goals.

(3) This Communication presents the Commission's recommendation for the list of structural indicators which are a key element of the Spring Report 2003. The final list of structural indicators, agreed with the Council, will be adopted at the Copenhagen European Council in December 2002.

II Work in progress

(4) The Commission services' work on structural indicators since last year's Communication has been directed to four areas:
   (i) to continue to improve the quality of the indicators in the list used for the Spring Report 2002;
   (ii) to integrate the candidate countries into the structural indicators, following the request of the Gothenburg European Council;
   (iii) to produce precise definitions and data for the agreed list of indicators to be developed; and
   (iv) to assess whether there is a need to modify the list of indicators taking into account the progress made on the indicators to be developed and the policy priorities identified at recent European Councils.

(5) Eurostat has been working with the other Commission services and with Member States' national statistical institutes to improve the quality of the structural indicators. Over the last year Eurostat has improved the country coverage, time series and quality of the data for many of the existing structural indicators. In particular, considerable progress has been made with regard to providing official data for structural indicators which have previously been based on unofficial sources. Moreover, Eurostat has continued to improve its publicly accessible internet site[1] which now contains detailed methodological information as well

[1] www.europa.eu.int/comm/eurostat/structuralindicators

as the data for all the structural indicators. Improving the quality of the indicators improves the robustness of the policy conclusions drawn in the Spring Report.

(6) This Communication represents the main outcome of the Commission's work on structural indicators over the last year. Section III sets out the main principles for the new list of indicators. Section IV presents the new list of structural indicators and explains why new indicators have been included in this year's list and why certain indicators have had to be dropped. Section V sets out how the candidate countries are being integrated into the structural indicators this year. Finally section VI describes the progress made by the Commission services in developing new indicators since last year, with more details and the new list of indicators to be developed presented in annex 1.

III Principles for the new list of indicators

(7) This is the third year in which the Commission has chosen a set of structural indicators whose main purpose is to support the key messages of the Spring Report 2003. There is a high degree of *stability* in the list of indicators in order to allow for the measurement of progress over time as requested by the Council. This stability is also appropriate as most structural problems usually show considerable persistence. At the same time this allows for a process of continuous improvement of the indicators in terms of reliability and quality. Changing the indicators from year to year would render this task much more difficult for both Eurostat and national statistical institutes.

(8) There has also been *flexibility* in the list of indicators as new priorities have been identified and improved indicators have become available. However, this has been balanced by the need for a sufficient degree of stability to ensure that a consistent and well-founded assessment of the progress towards the Lisbon and subsequent European Councils' objectives can be made in each year's Spring Report.

(9) The list of indicators should be kept *short* in order to send clear, simple and focussed policy messages but it should also be *balanced* to reflect the equal importance that Lisbon and Gothenburg placed on the domains of (1) employment, (2) innovation and research, (3) economic reform, (4) social cohesion and (5) the environment. In addition, some general economic background indicators are included to illustrate the economic context in which the structural reforms are taking place. To that end, this Communication presents 42 indicators, a number which is unchanged from the Spring Report 2002. There are seven

indicators in each domain to ensure that each policy domain can be covered in equal depth.

(10) In principle any new indicators should be taken from the set of indicators which the Commission services have been developing since last year's Communication, or should be justified in the light of a new major objective set by the European Council. In addition, these new indicators should be drawn from the different indicator and benchmarking processes going on at the sectoral level where they have already been tested. It is important to ensure the consistency between these sectoral processes and the overarching structural indicators.

(11) Any new indicators should also meet the criteria used for the original choice of indicators. The indicators should be: (1) easy to read and understand; (2) policy relevant; (3) mutually consistent; (4) available in a timely fashion; (5) comparable across Member States, the candidate countries and as far as possible with other countries; (6) selected from reliable sources; and (7) should not impose too large a burden on Member States and respondents.

(12) The main change to the structural indicators this year is that their coverage will be expanded to all 13 *candidate countries*, as requested by the Gothenburg European Council. This will allow the candidate countries to be included step by step into the Lisbon strategy starting with the Spring Report 2003. Eurostat has been working in conjunction with the statistical institutes in the candidate countries to improve the availability and quality of the structural indicators for these countries. More details are given in section V.

IV The new list of indicators

(13) The new list of indicators has been drawn up in accordance with the principles set out above. In total three indicators have been added to the list and three indicators dropped out of the 42 indicators.

(14) The list includes new indicators where there has been sufficient progress on developing the data such as the 'effective average exit age', 'company registration' and 'financial integration'. New political priorities are also reflected in the list. For example 'R&D expenditure' is now disaggregated by 'R&D financed by industry' rather than by 'Business R&D expenditure' to reflect the objective set by the Barcelona European Council. The inclusion of the 'effective average exit age' also reflects the importance attached to this issue at the Barcelona European Council. Whenever new indicators have been added to the list they have had to fulfil the quality criteria set out in section III above.

(15) With the inclusion of new indicators it has been necessary to drop some indicators from last year's list. This is an increasingly difficult process as more and better indicators become available. New indicators were included when they were more politically relevant compared to the previous indicator, when the quality of the data for the new indicators was better and when the previous indicator duplicated to some extent another indicator in the list.

(16) The *disaggregation by gender* is a general principle of the structural indicators. This disaggregation has been extended this year, where good-quality data are available and where a gender disaggregation is meaningful. It is expected that data by gender will be available for 'effective average exit age', 'life-long learning', 'accidents at work' (serious, but not fatal accidents)', 'risk-of-poverty rate', 'persistent-risk-of-poverty rate', 'dispersion of regional employment rates', 'long-term unemployment', 'science and technology graduates' and 'early school leavers' by the Spring Report 2003.

General economic background

(17) The general economic background indicators illustrate the overall economic context in which the structural reforms are taking place. No changes have been made to the indicators in this domain. A new indicator has been developed to measure increases in potential output, which is the ultimate objective of structural reform. However, it has been decided not to include potential output growth in the list this year to allow time to resolve any issues which may arise from the indicator's use.

Employment

(18) The employment indicators address several of the key aims of the Lisbon European Council namely: to strengthen employment in the Union; the importance of equal employment opportunities for men and women; and the importance of an 'Active Employment policy' such as focussing on life-long learning. It is important to note that the Barcelona European Council refined the Lisbon objectives concerning employment and social cohesion.

(19) An indicator on the *average effective exit age* has been included in the list of structural indicators to monitor the Barcelona European Council's objective of a progressive increase of about five years in the effective average age at which people stop working in the European Union by 2010. This indicator replaces the *employment rate of older workers* which will now be included as part of the employment rate indicator.

Innovation and research

(20) The innovation and research indicators measure Lisbon's emphasis on the transition to a knowledge-based economy through better policies for R&D, education and the information society. No changes are being proposed to the indicators in this domain. However the indicator *R&D expenditure* will now be disaggregated by source of finance rather than the sector carrying out the R&D expenditure. This reflects the objective set at the Barcelona European Council to raise overall spending in the Union on R&D with the aim of approaching 3% of GDP by 2010 and increase efficiency of R&D. Two-thirds of this investment should come from the private sector. The composite indicators developed in this area will be used in the first stage in the sectoral policy processes.

Economic reform

(21) The indicators on economic reform respond to the Lisbon European Council's emphasis on product and capital market reform. They look at market integration, progress in liberalising the network industries and possible distortions in the functioning of product markets caused by public intervention.

(22) The indicator *convergence of interest rates* has been included in the list of structural indicators to replace *capital raised on stockmarkets*. The new indicator allows to better measure progress in financial market integration. Compared to capital raised on stockmarkets, convergence of interest rates is less narrowly focussed as it covers several financial markets and it is not distorted by privatisation programmes or cyclical fluctuations in stock markets. In addition, data are available with a short time lag and convergence of interest rates is a well-established and easy to interpret indicator.

(23) An indicator on *company registration* has been added to the list of structural indicators reflecting the Lisbon European Council's request that the time and cost involved in setting up a company be monitored. The total number of procedures required for registering a new company and the average period of time needed for going through this process are good indicators of progress made in economic reform. This indicator replaces *business investment* which is a less precise measure of progress in economic reform.

Social cohesion

(24) The social cohesion indicators provide measures of the degree and the persistence of the risk of poverty, income dispersion and the associated risk of social exclusion in accordance with the Lisbon European Council's high priority on social cohesion. The

open method of co-ordination in the field of social inclusion was endorsed at the Laeken European Council. Seven of the ten primary indicators agreed in Laeken for this process have been included in the list. Others, such as 'life expectancy' at birth are used in the sectoral processes.

(25) In the social cohesion domain some changes have been made to the definitions of *inequality of income distribution*, *risk-of-poverty rate*, *persistent-risk-of-poverty rate*, and *population living in jobless households*. The definition of *regional cohesion* has been changed from the variation in regional unemployment rates to the variation in regional employment rates and the name has been changed to *dispersion of regional employment rates*.

Environment

(26) The environment indicators reflect the Gothenburg European Council's integration of sustainable development issues into the Lisbon process. The indicators cover the four main areas identified by the Gothenburg European Council: climate change, sustainable transport, threats to public health and managing natural resources.

(27) No changes are proposed to the environment indicators this year. However the indicator *greenhouse gases emissions* has been modified by including the policy targets set by the Kyoto protocol and the EU Burden Sharing Agreement. These targets require certain Member States to reduce their emission while others are permitted to increase their emissions in comparison to 1990 levels. Comparing the difference between present emissions and the individual target values for each Member State is an effective way of assessing the effects of climate change policies.

V Inclusion of the candidate countries in the structural indicators

(28) As requested by the Gothenburg European Council the 13 candidate countries (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia and Turkey) will be included in the structural indicators exercise step by step starting this year. Preference will be given to a wide country-coverage of a sub-set of the structural indicators which will permit an appropriate comparison with and between the candidate countries. Any proposals for new structural indicators should take into account the need for data on the candidate countries.

(29) Eurostat has been working in conjunction with the statistical institutes in the candidate countries to improve the availability

and quality of the structural indicators for these countries. Considerable progress has been made in this work. Eurostat has based its work on the deadline of the Spring Report and at present most data for the structural indicators for the candidate countries are still being collected and quality-assessed. Data for the candidate countries are therefore not included in the statistical annex of graphs attached to this Communication.

(30) The expected availability of data for the candidate countries is set out in Table 1. At this stage it is difficult to provide precise details on which countries and which years will be available for the Spring Report 2003 because Eurostat and the candidate countries' national statistical institutes are working hard to ensure as wide a coverage as possible, taking into the account the need for good-quality data while respecting the foreseen development plans of the statistical system of the country concerned. Inclusion of the candidate countries in the structural indicators exercise should not result in placing a heavy burden on them.

(31) Table 1 shows that, in general, some information on most of the indicators is expected to be available in time for the Spring Report 2003 at least for a majority of candidate countries, although data coverage is poorest for the economic reform domain. In some cases, when data are available they will need to be interpreted with care given the recent collection of the data and the specific characteristics of the candidate countries. For some of the structural indicators covering the candidate countries more fully is likely to be a lengthy process but one which has a high priority.

(32) It should also be noted that the *EEA/EFTA countries* (Iceland, Liechtenstein and Norway) will be included in the statistical annex of the Spring Report 2003, where data are available.

VI Indicators under development

(33) Twenty-one indicators to be developed were presented in last year's Commission Communication on structural indicators. Since the last Communication was published in October 2001 the Commission services have made a lot of progress in developing indicators. In particular progress has been made with regard to the following indicators: potential output, marginal (and average) effective tax rate, childcare facilities, e-commerce, e-government, business demography, company registration, financial integration, consumption of toxic chemicals, resource productivity, recycling rate of selected materials and hazardous waste. A summary of the progress made in each of the areas is provided in annex 1.

Table 1 Expected data coverage of the candidate countries for the Spring Report 2003.

Indicator	Coverage	Indicator	Coverage
General economic background		III Economic reform	
(a) GDP per capita and GDP growth	Yes	(1) Relative price levels	Yes
		(2) Prices in the network industries	No
(b) Labour productivity (per person only)	Yes	(3) Market structure in the network industries (electricity)	*
(c) Employment growth	Yes	(4) Public procurement	No
(d) Inflation rate	Yes	(5) Sectoral and ad hoc State aid	*
(e) Unit labour cost growth	Yes	(6) Convergence of interest rates	Yes
(f) Public balance	Yes	(7) Company registration	No
(g) General government debt	Yes		
I Employment		IV Social cohesion	
(1) Employment rate	Yes	(1) Inequality of income distribution	Yes
(2) Effective average exit age	Yes		
(3) Gender pay gap	No	(2) Risk-of-poverty rate	Yes
(4) Tax rate on low-wage earners	Yes	(3) Persistent-risk-of-poverty rate	No
(5) Life-long learning	Yes	(4) Dispersion of regional employment rates	Yes
(6) Accidents at work	Yes		
(7) Unemployment rate	Yes	(5) Early school-leavers	Yes
		(6) Long-term unemployment	Yes
		(7) Population living in jobless households	Yes
II Innovation and research		V Environment	
(1) Spending on human resources	Yes	(1) Greenhouse gases emissions including targets (CO_2 only)	Yes
(2) R&D expenditure	Yes		
(3) Level of Internet access (households only)	Yes	(2) Energy intensity of the economy	Yes
(4) S&T graduates	Yes	(3) Volume of transport (freight only)	Yes
(5) Patents (EPO only)	Yes		
(6) Venture capital	No	(4) Modal split of transport (freight only)	Yes
(7) ICT expenditure	Yes		
		(5) Urban air quality	No
		(6) Municipal waste	Yes
		(7) Share of renewables	Yes

Key: Yes = Data available for all or a high proportion of candidate countries.
No = Data available for none or very few candidate countries.
* = Pending. Decision to be taken during the autumn on basis of data coverage and quality.

(34) The Commission services have made considerable progress in developing composite indicators, particularly in areas such as the knowledge-based economy, entrepreneurship and the Internal Market. Composite indicators are calculated by weighting together a set of well-chosen sub-indicators to provide a summary of each Member State's progress in a particular policy area. Composite indicators would have the advantage of providing a broader coverage of information than can be

Table 2 The 42 structural indicators proposed for the Spring Report 2003.

General economic background
(a) GDP per capita (in PPS) and real GDP growth rate
(b) Labour productivity
(c) Employment growth*
(d) Inflation rate
(e) Unit labour cost growth
(f) Public balance
(g) General government debt
I Employment
(1) Employment rate*
(2) Effective average exit age*
(3) Gender pay gap
(4) Tax rate on low-wage earners
(5) Life-long learning
(6) Accidents at work*
(7) Unemployment rate*
II Innovation and research
(1) Spending on human resources (public expenditure on education)
(2) R&D expenditure (**by source of finance**)
(3) Level of Internet access
(4) Science and technology graduates*
(5) Patents
(6) Venture capital
(7) ICT expenditure
III Economic reform
(1) Relative price levels and price convergence
(2) Prices in the network industries
(3) Market structure in the network industries
(4) Public procurement
(5) Sectoral and ad hoc State aid
(6) **Convergence of interest rates**
(7) **Company registration**
IV Social cohesion
(1) Inequality of income distribution
(2) Risk-of-poverty rate*
(3) Persistent-risk-of-poverty rate*
(4) Dispersion of regional **employment** rates*
(5) Early school-leavers not in further education or training*
(6) Long term unemployment*
(7) Population living in jobless households
V Environment
(1) Greenhouse gases emissions (including targets)
(2) Energy intensity of the economy
(3) Volume of transport (tonne- and passenger-km) relative to GDP
(4) Modal split of transport
(5) Urban air quality
(6) Municipal waste
(7) Share of renewables

Changes are marked in **bold**. * Denotes indicators which are disaggregated by gender.

Table 3 Changes to the list of structural indicators*.

General economic background No change.
I Employment 'Effective average exit age' has replaced 'employment rate of older workers'. The latter is now included as a part of the 'employment rate' indicator.
II Innovation and research 'R&D expenditure' is now disaggregated by source of finance rather than by the sector carrying out the R&D.
III Economic reform 'Convergence of interest rates' has replaced 'Capital raised on stockmarkets'. 'Company registration' has replaced 'Business investment'.
IV Social cohesion 'Regional cohesion' is now defined as the variation in regional employment rates, rather than unemployment rates and has been renamed 'Dispersion of regional employment rates'. Changes have been made to the definitions of 'inequality of income distribution' and 'population living in jobless households'.
V Environment 'Greenhouse gases emissions' now includes the agreed policy targets.

* In comparison with the list adopted by the Laeken European Council.

included in the current list of structural indicators and they would also allow for a reduction in the number of indicators presented in the list. However, because composite indicators invite strong policy messages to be concluded they need to be robust and based on a sound methodology.

(35) The Commission has therefore worked on the basis that composite indicators should be assessed on a case by case basis and should meet the following quality criteria. The composite indicators should: add value compared to the use of simpler indicators; include only sub-indicators which are relevant to the phenomenon to be measured; be based on high-quality data for all the sub-indicators; the intercorrelation between the sub-indicators should be investigated; the method for weighting the sub-indicators should be transparent, simple and statistically sound; and the composite indicators should be tested for robustness and sensitivity.

(36) Over the last year two composite indicators on 'investment in the knowledge-based economy' and 'performance in the transition towards the knowledge-based economy' have been developed. These composite indicators have been assessed by external experts and have undergone a detailed review and sensitivity

analysis[2]. The Commission now proposes to use these composite indicators in the relevant policy discussions and Communications. This will also be the case for other composite indicators being developed by the Commission services. For example, an indicator to measure the e-business readiness of European enterprises is under development while composite indicators are already used to measure progress made in the area of the Internal Market and innovation. In order to improve the quality of the synthesis brought forward, the Commission could consider the inclusion of composite indicators within the framework of the structural indicators on the basis of the assessment of their use in the sectoral processes.

Annex 1: Indicators under development

(1) Since last year's Communication on structural indicators was published in October 2001 the Commission services have made considerable progress in developing indicators. This annex describes where progress has been made. It also presents the new list of indicators to be developed.

Composite indicators

(2) The Commission services have made considerable progress in the development of composite indicators since last year, as explained above[3]. In particular, two composite indicators, 'investment in the knowledge-based economy', and 'performance in the transition towards the knowledge-based economy' have been developed. The Commission now proposes to use these composite indicators in relevant policy discussions and Communications. This will allow further progress in capturing the various dimensions of the knowledge-based economy.

(3) The composite indicator 'investment in the knowledge-based economy' captures the two main aspects of knowledge investment: creation and diffusion. The composite indicator is constructed from sub-indicators on R&D expenditure, science and technology doctorates, researchers, gross fixed capital formation, e-government, education spending and life-long learning.

(4) The composite indicator 'performance in the transition to the knowledge-based economy' captures four important elements of performance: labour productivity, scientific and technological

[2] *State-of-the-art Report on Current Methodologies and Practices for Composite Indicator Development*. Joint Research Centre – Applied Statistics Group, Ispra, June 2002 (www.jrc.cec.eu.int/uasa/prj-comp-ind. asp)

[3] These composite indicators will be assessed through their use in the sectoral processes.

performance, use of the information infrastructure and the effectiveness of the education system. The composite indicator is constructed from sub-indicators on labour productivity, patents, publications, e-commerce and the schooling success rate.

General economic background

(5) The Commission services in co-operation with the Council have now produced an indicator of *potential output* using a production function approach. As stated above it has been decided not to include this indicator in the list this year to allow time to resolve any issues which may arise from the indicator's use.

Employment

(6) The Commission services are analysing the main factors contributing to the *gender pay gap* with a view to obtaining further information for analysing pay differentials between men and women. A Commission policy paper is under preparation.

(7) Development of indicators on the *marginal effective tax rate* and the average effective tax rate has continued with the OECD. These indicators provide a measure of poverty and unemployment traps respectively. However, the data are not expected to be delivered in time for the Spring Report 2003.

(8) The Barcelona European Council established targets for *childcare facilities*. Some data are now available from Member States' National Action Plans on employment. 3 These composite indicators will be assessed through their use in the sectoral processes. At present data are available from 11 Member States but not in full compliance with the agreed definition. The Commission services are working with Eurostat and the Member States to improve the coverage of the data. Given the political importance attached to this indicator Member States should redouble their efforts to provide data on childcare facilities.

Innovation and research

(9) Eurostat carried out a pilot survey for *e-commerce* in 2001 and 2002. At present the survey does not cover all 15 Member States. In the meantime, the Commission services have collected data via a Eurobarometer survey on the percentage of companies selling on-line and the percentage of companies buying on-line. Data from the 2001 survey are already available and data from the 2002 survey are expected in November 2002. From 2003 onwards data on e-commerce will be provided from the Eurostat survey. As the Eurostat data do not yet cover all the Member States this indicator remains under development.

(10) The indicator *e-government* is defined as the average percentage use of 20 basic public services available on-line. The first results

for this indicator became available in 2001 and they have been used successfully in the e-Europe benchmarking process. Whilst the data are available the Commission has decided not to include e-government in the structural indicators due to the constraint of keeping the list short. E-government is retained in the list of indicators to be developed as it may be considered for future inclusion in the list of structural indicators.

Economic reform

(11) Progress has continued in collecting data on *business demography*. Harmonised data on 'enterprise births', 'survival rates of newly born enterprises' and 'enterprise deaths' covering most Member States should be available by late 2002, with the aim of covering all Member States by 2003.

(12) Indicators on *company registration* have now been published as part of the Best procedure under the Multi-annual Programme for Enterprise and Entrepreneurship. Data on 'the time required to register a private limited company' and 'the cost of registering a private limited company' have therefore been included in the structural indicators (as explained above).

(13) The Commission services have developed three indicators on *financial integration* following a request from the Ecofin Council in July 2000. One of these indicators, convergence of interest rates, has therefore been included in the list of structural indicators (as explained above). Work is continuing on other indicators of financial integration such as the degree of bias towards domestic assets in banks' or pension funds' portfolio allocations.

Social cohesion

(14) The Employment and Social Affairs Council adopted the Social Protection Committee's 'Report on Indicators in the field of poverty and social exclusion' on 3 December 2001. Following from this work, indicators are being developed on, for instance, health and socio-economic status, housing and living conditions. For the Spring Report 2003 data for most of the social cohesion indicators are expected to be available from the European Community Household Panel. In the future, such indicators will be based on the new 'Statistics on Income and Living Conditions' (EU-SILC) which is expected to provide data with a shorter (two year) lag. In addition, Eurostat will reflect on the development of regional GDP per capita data based on regional price level data.

Environment

(15) Six indicators to be developed on the environment were included in last year's Communication. More detailed information on these indicators, and other environment indicators under

development, are included in Eurostat's forthcoming report to the Environment Council.

(16) As regards *consumption of toxic chemicals* considerable methodological and development work is still required. Eurostat has launched a project to develop a set of indicators that takes account of the most common toxicological effects on humans and the effects on the ecosystem.

(17) Data on *resource productivity* for electricity generation are already available, but data for apparent consumption of mineral ores still need improvement to fill gaps and to improve the quality and the timeliness of the data.

(18) As regards both *the recycling rate of selected materials and generation of hazardous waste* the forthcoming European Regulation on Waste Statistics is expected to provide harmonised statistics with improved country coverage, timeliness and quality.

New list of indicators to be developed

(19) The new list of indicators to be developed includes indicators retained from last year's list which have not yet been fully developed or which would still benefit from use in sectoral policy processes. This is the case for composite indicators, potential output, marginal (and average) effective tax rate, childcare facilities, e-commerce, e-government, business demography, recycling rate of selected materials and hazardous waste. Other indicators have been retained because little progress was made, due to the fact that the Commission services had to restrict their attention to developing a manageable number of indicators. In the same context, further reflection should be given to the relationship between the indicator to be developed 'healthy life years' and the indicator 'life expectancy at birth'.

(20) GDP per capita at regional level has been added to the list of indicators to be developed. This indicator, which plays a central role in the definition of economic and social cohesion policy, had been proposed by the Commission in previous years for the list of structural indicators but it had not been retained by the Council. As a result, the Commission services will continue their efforts to develop this indicator and in particular to express this indicator using purchasing power parities measured at regional level.

(21) No other new indicators have been added this year to the list of indicators to be developed. Developing indicators is a long process and therefore the Commission has decided to focus its attention on those indicators already earmarked for development. The only other change from last year's list is that company registration has been removed because it is now included in the structural indicators.

Table 4 List of indicators to be developed.

Composite indicators
General economic background (1) *Potential output* (2) Total factor productivity
I Employment (3) Vacancies (4) *Quality of work* (5) *Marginal (and average) effective tax rate* (6) *Childcare facilities*
II Innovation and research (7) *Composite indicators on the knowledge-based economy* (8) Public and private expenditure on human capital (9) *E-commerce* (10) *E-government* (11) ICT investment
III Economic reform (12) *Business demography* (13) Cost of capital (14) *Financial integration*
IV Social cohesion (15) Regional GDP per capita in PPS Indicators will continue to be developed by the Social Protection Committee and the Commission services.
V Environment (16) *Consumption of toxic chemicals* (17) Healthy life years (18) Biodiversity (19) *Resource productivity* (20) *Recycling rate of selected materials* (21) *Generation of hazardous waste*

Indicators where progress has already been made are marked in *italics*.

Annex 2: Definition, source, availability and policy objective behind the selected indicators

General economic background indicators

Indicator	Definition	Source	Availability*	Overall policy objective
(a) GDP per capita in PPS and real GDP growth rate	GDP per capita in Purchasing Power Standards (PPS). Growth rate of GDP at constant prices (base year 1995).	Eurostat; National Accounts.	*Coverage*: All MS, US and Japan. *Time series*: 1991–2001.	Growth performance, standard of living.
(b) Labour productivity	GDP per person employed. GDP per hour worked relative to the EU15 (EU15= 100).	Eurostat; National Accounts and OECD.	*Coverage*: All MS, US and Japan. *Time series*: 1991–2001.	Overall efficiency of the economy.
(c) Employment growth	Annual percentage change in total employed population. (Total and by gender).	Eurostat; National Accounts and OECD.	*Coverage*: All MS, US and Japan. *Time series*: 1991–2001.	Progress towards full employment.
(d) Inflation rate	Harmonised indices of consumer prices (HICPs). Annual average rate of change.	Eurostat; Price Statistics.	*Coverage*: HICP for all MS. US and Japan data are not strictly comparable. *Time series*: 1991–2001.	Sound macroeconomic environment.
(e) Unit labour cost growth	Growth rate of the ratio: compensation per employee in current prices divided by GDP in current prices per total employment.	Eurostat; National Accounts.	*Coverage*: All MS, US and Japan. *Time series*: 1991-2001.	Sound macroeconomic environment.
(f) Public balance	Net borrowing/lending of consolidated general government sector as a percentage of GDP.	Eurostat, OECD.	*Coverage*: All MS, US and Japan. *Time series*: 1991–2001.	Sound macroeconomic environment.
(g) General government debt	General government consolidated gross debt as a percentage of GDP.	Eurostat, OECD.	*Coverage*: All MS, US and Japan. *Time series*: 1991-2001.	Sound macroeconomic environment.

* 'Time series' describes those years for which data are available in most of the Member States.

I Employment

Indicator	Definition	Source	Availability	Overall policy objective
(1) Employment rate	Employed persons aged 15–64 as a share of the total population aged 15–64. Also employed persons aged 55–64 as a share of total population aged 55–64. (Total and by gender for both age groups.)	Eurostat; Labour Force Survey.	*Coverage*: All MS. Comparable data not available for the US and Japan. *Time series*: 1991 –2001.	Full employment.
(2) Effective average exit age	Average exit age, weighted by the probability of withdrawal from the labour market. (Total and by gender.)	Eurostat; Labour Force Survey.	*Coverage*: All MS. Comparable data not available for the US and Japan. *Time series*: 2001.	Full employment. Combating social exclusion.
(3) Gender pay gap	Average gross hourly earnings of females as a percentage of average gross hourly earnings of males.	Eurostat; European Community Household Panel (ECHP).	*Coverage*: All MS except L, FIN and UK. No data for US or Japan. *Time series*: 1995–1998.	Combating gender discrimination.
(4) Tax rate on low-wage earners	Income tax plus employee and employer contributions less cash benefits as a percentage of labour costs for a low-wage earner (single person without children with a wage of 67% of the average production worker's wage).	OECD; Fiscal Affairs Statistics (for the APW work).	*Coverage*: All MS, US and Japan. *Time series*: 1996–2000, estimates for 2001.	To measure the tax pressure on labour, especially the low-paid and the relatively unskilled.
(5) Lifelong learning	Percentage of population aged 25–64, participating in education and training in the four weeks prior to the survey. (Total and by gender.)	Eurostat; Labour Force Survey.	*Coverage*: All MS. Comparable data not available for the US and Japan. F uses non-harmonised methodology. *Time series*: 1992–2001.	Full employment. More and better jobs.
(6) Accidents at work (quality of work)	Index of the number of accidents at work (serious and fatal) per 100 000 persons in employment (1998=100). (Total, and by gender for serious accidents but not fatal accidents.)	Eurostat; European Statistics on Accidents at Work (ESAW).	*Coverage*: All MS, US but not Japan. *Time series*: 1994–2000.	Quality of work.
(7) Unemployment rate	Total unemployed individuals as a share of the total active population. Harmonised series. (Total and by gender.)	Eurostat; Unemployment Statistics.	*Coverage*: All MS, US and Japan. *Time series*: 1991–2001.	Full employment. Combating social exclusion.

II Innovation and research

Indicator	Definition	Source	Availability	Overall policy objective
(1) Spending on human resources (public expenditure on education)	Total public expenditure on education as a percentage of GDP.	Joint Unesco/OECD/ Eurostat questionnaire.	*Coverage*: All MS, US and Japan. *Time series*: 1995–99 (2000 and 2001 data available for some Member States, time series start in 1992 for several MS).	Quality of human resources.
(2) R& D expenditure (by source of finance)	Total R& D expenditure, broken down by source of finance (industry, public or abroad).	Eurostat, OECD.	*Coverage*: All MS (except Luxembourg), US and Japan. *Time series*: 1991–99 (2000 for some MS).	R& D effort.
(3) Level of Internet access	Percentage of households who have Internet access at home. Percentage of enterprises who have access to the Internet (web).	Eurobarometer Survey and Eurostat (households). Eurostat (enterprises).	*Coverage*: All MS, US and Japan. No US data for enterprises. *Time series*: 1998–2002 for households, 2000–01 for enterprises.	Information society.
(4) Science and technology graduates	Tertiary graduates in science and technology per 1000 of population aged 20–29 years. (Total and by gender.)	Joint Unesco/OECD/ Eurostat questionnaire.	*Coverage*: All MS (except EL), US and Japan. *Time series*: 1993–2000.	Quality of human resources.
(5) Patents	Number of European and US patents per million inhabitants (EPO and USPTO patents).	European Patent Office (EPO) and US Patent Office (USPTO).	*Coverage*: All MS, US and Japan. *Time series*: 1991–99 (provisional data for 2000).	Innovation capacity.
(6) Venture capital	Venture capital investments relative to GDP. Breakdown by investment stages (early stage and expansion).	European Venture Capital Association (for EU), Price Waterhouse Coopers (for US).	*Coverage*: All MS (except Luxembourg), US but not Japan. *Time series*: 1991–2001.	Access to finance, in particular for start-ups.
(7) ICT expenditure	ICT expenditure as a percentage of GDP. Disaggregated into IT and telecommunications expenditure.	European Information Technology Observatory (EITO).	*Coverage*: All MS, US and Japan. *Time series*: 1991–2000.	Diffusion of ICT.

III Economic reform

Indicator	Definition	Source	Availability	Overall policy objective
(1) Relative price levels and price convergence	Relative price levels of private final consumption including indirect taxes (EU=100) and their coefficient of variation.	Eurostat/OECD (price statistics: PPP indicators).	*Coverage*: All MS, US and Japan. *Times series*: 1991–99 for MS. Estimates for 2000. 1993 and 1996 for US and Japan plus estimates for other years.	Product market integration. Market efficiency.
(2) Prices in the network industries	Price level and evolution in the telecommunications, electricity and gas markets.	Eurostat; Energy statistics. DG INFSO for telecommunications data.	*Coverage*: All MS. US and Japan data for telecommunications. *Time series*: 1992–2002 for electricity and gas. 1997–2001 for telecommunications.	Market efficiency.
(3) Market structure in the network industries	Market share of the incumbent in the fixed and mobile telecommunications markets. Market share of the largest generator in the electricity market.	DG INFSO for telecommunications data. Eurostat for electricity data.	*Coverage*: All MS, except Lux for electricity. No US or Japan data. *Time series*: 1999–2000 for fixed telecoms. 2001 for mobile telecoms. 1999–2000 for electricity.	Market efficiency.
(4) Public procurement	Value of public procurement which is openly advertised as a percentage of GDP.	DG MARKT; Eurostat.	*Coverage*: All MS. No US or Japan data. *Time series*: 1993–2000.	Product market integration.
(5) Sectoral and ad hoc State aid	State aid (sectoral and ad hoc) as a percentage of GDP.	DG COMP.	*Coverage*: All MS. No US or Japan data. *Time series*: 3-year averages from 1990–92 to 1998–2000.	Distortions in the single market.
(6) Convergence of interest rates	Convergence of annual percentage interest rates. Calculated for interest rates charged on mortgages, short-term corporate debt and medium- to long-term corporate debt.	DG MARKT based on European Central Bank data.	*Coverage*: All MS for mortgage rates. 12/13 MS for corporate loan rates. *Time series*: 1995–2002.	Financial market integration.
(7) Company registration	The average time and financial cost for complying with the mandatory procedures required for company registration.	Study conducted for DG ENTR.	*Coverage*: All MS. No US or Japan data. *Time series*: 2001.	Promoting entrepreneurship.

IV Social cohesion

Indicator	Definition	Source	Availability	Overall policy objective
(1) Inequality of income distribution	Ratio of total income received by the 20% of the country's population with the highest income (top quintile) to that received by the 20% of the country's population with the lowest income (lowest quintile). Income should be understood as equivalised disposable income.	Eurostat; European Community Household Panel (ECHP).	*Coverage*: All MS except L, FIN and UK. No data on US or Japan. *Time series*: 1995–98.	Combating poverty and social exclusion.
(2) Risk-of-poverty rate	Share of persons with an equivalised disposable income below the risk-of-poverty threshold before and after social transfers. The threshold is set at 60% of the national median equivalised disposable income (after social transfers). (Total and by gender.)	Eurostat; European Community Household Panel (ECHP).	*Coverage*: All MS except L, FIN and UK. No data on US or Japan. *Time series*: 1995–98.	Combating poverty and social exclusion.
(3) Persistent-risk-of-poverty rate	Share of persons with an equivalised disposable income below the risk-of-poverty threshold in the current year and in at least two of the preceding three years. The threshold is set at 60% of the national median equivalised disposable income (after social transfers). (Total and by gender.)	Eurostat; European Community Household Panel (ECHP).	*Coverage*: All MS except L, FIN, S and UK. No data for US or Japan. *Time series*: 1997–98.	Combating poverty and social exclusion.
(4) Dispersion of regional employment rates	Coefficient of variation of employment rates across regions (NUTS 2 level) within countries. (Total and by gender.)	Eurostat; Regional Statistics.	*Coverage*: All MS except DK, IRL and L. No data for French DOM. No US or Japan data. *Time series*: 1991–2000.	Cohesion.

(5) Early school-leavers not in further education or training	Share of the population aged 18–24 with only lower secondary education and not in education or training. (Total and by gender.)	Eurostat; Labour Force Survey.	*Coverage*: All MS except UK. Comparable data not available for the US and Japan. *Time series*: 1992–2001.	Investing in people. Combating social exclusion.
(6) Long-term unemployment rate	Total long-term unemployed (over twelve months) as a percentage of total active population – harmonised series. (Total and by gender.)	Eurostat; based on Labour Force Survey.	*Coverage*: All MS except EL. Comparable data not available for the US and Japan. *Time series*: 1991–2001.	Full employment. Combating social exclusion.
(7) Population living in jobless households	Persons aged 0–65 (and additionally 0–60) living in households with no member in employment as a percentage of all persons living in eligible households. Eligible households are all except those where everyone falls into any one of these categories: (1) aged less than 18; (2) aged 18–24 in education and inactive; (3) aged 65 (60) and over and not working. (Total and by gender.)	Eurostat; Labour Force Survey.	*Coverage*: All MS except DK, FIN and S. Comparable data not available for the US and Japan. *Time series*: 1991–2001.	Combating poverty and social exclusion.

V Environment

Indicator	Definition	Source	Availability	Overall policy objective
(1) Greenhouse gases emissions (including targets)	Progress in emissions control relative to targets. Aggregated emissions of six main greenhouse gases (CO_2 , CH_4 , N_2O, HFCs, PFCs and SF_6) expressed in CO_2-equivalents.	European Environment Agency.	*Coverage*: All MS, US and Japan. *Time series*: 1991–99.	Limit the climate change and implement the Kyoto Protocol.
(2) Energy intensity of the economy	Gross inland consumption of energy divided by GDP.	Eurostat; Energy Statistics.	*Coverage*: All MS, US and Japan. *Time series*: 1991–99.	Use energy more efficiently.
(3) Volume of transport relative to GDP (tonne- and passenger-km)	Index of (freight and passenger) transport volume relative to GDP. Measured in tonne-km/GDP and passenger-km/GDP and indexed on 1995.	Eurostat/DG TREN/US Bureau of Transportation Statistics.	*Coverage*: All MS, US and Japan. *Time series*: Freight 1991–96; Passenger 1991–99.	Decouple transport growth from economic growth.
(4) Modal split of transport	Modal split of freight transport (percentage share of road in total inland freight transport) and passenger transport (percentage share of car transport in total inland passenger transport).	Eurostat/DG TREN/US Bureau of Transportation Statistics.	*Coverage*: All MS, US and Japan. *Time series*: Freight 1991–96; Passenger 1991–99.	Progress towards more environmentally friendly transport modes.
(5) Urban air quality	Indicators based on the concentrations of ozone and particulates in urban areas (number of days of pollution exceeding standards for each of the two selected air pollutants).	European Topic Centre/Air Quality.	*Coverage*: All MS, except Lux and S for ozone; except DK, EL, F, Lux, A and S for particulates. No data for US or Japan. *Time series*: 1991–99 (gaps are present).	Improve urban air quality.
(6) Municipal waste	Municipal waste (collected, landfilled and incinerated). Measured in kg per person per year	Eurostat; Environment Statistics.	*Coverage*: All MS except A for collected; except EL and IRL for incinerated. No data for US or Japan. Data for all MS expected by end of 2001. *Time series*: 1991–99 (gaps are present).	Decrease waste generation and harmful disposal.
(7) Share of renewables	Contribution of electricity from renewables to total electricity consumption.	Eurostat; Energy Statistics.	*Coverage*: All MS. No data for US or Japan. *Time series*: 1991–99.	Sustainable production of energy.

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The authors

Though the book is the integrated result of a joint effort by the two authors, Peter Brandon is mainly responsible for Chapters 1, 3, 7 and 8 and Patrizia Lombardi has written Chapters 4, 5, 6 and Appendix A. Chapter 2 they have developed together.

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